Work-related ill-health as determined in General Practice

A thesis submitted to The University of Manchester for the degree of Doctor of Philosophy in the Faculty of Medical and Human Sciences

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Glossary

Active reporter – A reporter who submits cases or declares 'I have nothing to report' during their reporting month

AFOM – Associate of Faculty of Occupational Medicine

Agent coding - A coding system to classify suspected chemical and physical agents attributed to skin and respiratory disease reported to THOR

BEACH – Bettering the Evaluation and Care of Health

CAS code – Chemical Abstract Service registry number

CBI – Confederation of British Industry

COEH – Centre for Occupational and Environmental Health, The University of Manchester

Core reporter – A reporter who reports to a THOR scheme on a continual basis, submitting a return every month of the year

CTS – Carpal Tunnel Syndrome

Denominator – Bottom half of a fraction; in terms of calculating incidence rates the denominator is the population from which incident cases are derived

Diplomates – Alumni of the Diploma in Occupational Medicine course at COEH

DOccMed – Diploma in Occupational Medicine as set by the Faculty of Occupational Medicine, UK

DWP – Department of Work and Pensions

Economically active - A person of working age and in employment

EPIDERM – Occupational Skin Surveillance

Event code – A coding system for classifying events that are reported to THOR as precipitating work-related mental ill-health

FFOM – Fellow of the Faculty of Occupational Medicine

GB – Great Britain

GPRD – General Practice Research Database

GROS – General Registry Office for Scotland

Harvesting – Reporting cases from outside the allocated reporting period

HSE – Health and Safety Executive

Https - Hypertext Transfer Protocol Secure

ICD 10 – International Classification of Diseases version 10

IIDB - Industrial Injuries Disablement Benefit

Incidence rate – The risk of population developing a disease within a specified period of time

LFS – Labour Force Survey

LR – Likelihood Ratio

Med 3 – Sickness certification certificate used in order to claim Statutory Sick Pay after more than 7 days sick leave. The doctor is required to have seen the patient on the day of issue or the previous day

Med 5 - Sickness certification certificate used in order to claim Statutory Sick Pay after more than 7 days sick leave. Issued on occasions when the doctor wishes to supply evidence of incapacity for work for an earlier period

MFOM - Member of the Faculty of Occupational Medicine

MOSS – Musculoskeletal Occupational Surveillance Scheme

NICE – National Institute for Health and Clinical Excellence

Non-responder – A THOR reporter who does not return a case of a 'zero return'

Numerator – The top half of a fraction. In the calculation of incidence rates this is the number of incident cases that needs to be divided by an appropriate denominator

OH – Occupational Health

ONS – Office for National Statistics

OP – Occupational Physician

OPRA - Occupational Physicians Reporting Activity

OSSA – Occupational Surveillance Scheme for Audiological physicians

Prevalence – The number of cases of disease present in a population at any given time

PTSD – Post Traumatic Stress Disorder

QOF – Quality Outcomes Framework

READ codes – A clinical coding system used in General Practice in the UK

Red card – Term used to describe when a persistent non-responding reporter is withdrawn from THOR-GP after 6 months of non-response

Reporter fatigue – The reduction in an individual's reporting activity after a length of time participating in a reporting scheme

RIDDOR - Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995

ROI – Republic of Ireland

Sample reporter – A reporter who reports to a THOR scheme one randomly assigned month a year

SIC 2003 – UK Standard Industrial Classification of Economic Activities 2003

SIDAW – Surveillance of Infectious Disease At Work

SOC 2000 - Standard Occupational Classification 2000

SOSMI – Surveillance of Occupational Stress and Mental Illness

SPSS – Statistical Package for Social Sciences

SSL/TLS protocols - Secure Sockets Layer and Transport Layer Security. Cryptographic protocols that provide communication security via the internet

SWI – Self-reported work-related illness

SWORD – Surveillance of Work-related and Occupational Respiratory Disease

Task/movement codes – A coding system to code tasks and movements attributed to musculoskeletal disorders reported to THOR

THOR - The Health and Occupation Reporting network

THOR-GP - The Health and Occupation Reporting network in General Practice

UK – United Kingdom

Yellow card - Term used to describe when a persistent non-responding reporter is contacted to inform them that, should there be no further response, they will be withdrawn from THOR-GP after 6 months of non-response

Zero return – A report of ‘I have nothing to report’ during a THOR participant’s reporting month

Abstract

Introduction Work-related ill-health and resulting sickness absence is detrimental to the employees themselves, the employer and the national economy as a whole. To reduce the risk of work on health, information about causal factors and sectors at risk must first be gathered. General practice had been referred to as the ‘blind spot’ in occupational health as so little was known about work-related ill-health seen by GPs. The principal aim of this thesis was to estimate the incidence of work-related ill-health in the UK/GB as determined in general practice, to critically compare general practice reporting with other data sources and to evaluate the incidence and sickness absence burden of work-related ill-health.

Methods Data on incident cases of work-related ill-health and sickness absence were collected from GPs reporting to a UK-wide surveillance scheme (The Health and Occupation Reporting network in General Practice (THOR-GP)), and compared to information from other sources. To enable the calculation of incidence rates, THOR-GP population denominator information was gathered and characterised using Census information based on patient and practice postcode. Results were presented as a series of four peer-reviewed published papers and an additional chapter exploring the calculation of incidence rates.

Results The work-related ill-health diagnoses reported by GPs were mainly musculoskeletal (53%) and mental ill-health (30%). Overall, half the cases were issued with sickness certification. The proportion of cases issued with sickness certification differed by diagnosis; 79% of psychological cases had certified time away from work and these conditions were responsible for the majority of sickness absence days certified (56%) however these cases were rarely referred to secondary care (1%). Industries operating within the public and financial sectors had the highest incidence rates of work-related mental ill-health and correspondingly the highest rates of sickness absence. Industries with the highest proportions of self-employment had the lowest rates of sickness absence. When compared to reports from occupational physicians (OPs), GP information was more representative of the employed population of the UK, whereas OP data concentrated on industries covered by occupational health services. Incidence rates based on clinical specialists’ reports were much smaller than GP rates and biased by severity and referral patterns. Rates based on self-reported (SWI) data were higher than GP rates due to greater inclusivity; however diagnoses were unsubstantiated by medical opinion. The THOR-GP population denominator was characterised using approximately a million patient postcodes (and linking these to Census data) from over a hundred GPs. These population estimates compared well with those based on the practice postcode and enabled the calculation of incidence rates of work-related ill-health for this and (with weighting methods) the GB population. Rates of work-related ill-health were highest for those employed within construction and agriculture.

Conclusion This thesis has shown how the systematic collection of work-related ill-health data from GPs adds to the knowledge base about the distribution and determinants of work-related ill-health (and sickness absence) within the UK/GB workforce. This work also contributes to knowledge relating to the ‘primary care denominator problem’ in calculating rates of incidence from general practice.

Declaration

No portion of the work referred to in this thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

Copyright Statement

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Chapter One: Introduction

1.1 A brief history

An individual spends a large proportion of time at work; therefore a person's occupation has the potential to have a significant effect on health. In 2009/2010 an estimated 1.5 million people become ill, or were injured through their work activities, resulting in 28.5 million workdays lost due to work-related ill-health and injury (1).

Effects of work on health have long been apparent, with adverse effects of dust from mining and working with metals noted in Greek and Roman times, and documentation of work-related ill-health described in detailed texts from the 15th century onwards. During the Renaissance, Georg Agricola was appointed as a town physician at the centre of the metal mines of Bohemia; he studied mines and mine workers, and wrote comprehensive works on mining and metallurgy. These texts gave emphasis to injuries and diseases associated with mining, and their prevention through ventilation, protective clothing and engineering. In 1700 Bernardino Ramazzini wrote 'De Morbis Artificum Diatriba' ('An Account of the Diseases of Work'), the first book exclusively devoted to occupational medicine, and led him to be described as the 'father of occupational health'. His most important instruction to physicians was that, upon examination of the patient, they should always enquire about the individual's employment.

In the United Kingdom (UK) the effects of work on health could not have been more apparent than during the Industrial Revolution. The invention of the steam engine gave rise to the mass mechanisation of sectors such as the cotton industry. Not only did the Industrial Revolution result in an increased incidence of infectious diseases such as typhus (factory fever), resulting from overcrowding following the movement of populations from rural to industrialised areas, but diseases caused by the work itself also became apparent. For example, work in cotton mills involved exposure to many health risks; byssinosis and emphysema through inhalation of cotton dust, and cancer of the lips and mouth due to 'kissing the shuttle' (which involved sucking the cotton to rethread the shuttle). Long serving mule spinners risked cancer of the scrotum due to exposure to mineral lubricating oils that is if they had not already retired with deterioration in their health as a result of other exposures and working practices. Workers in the weaving rooms frequently sustained noise induced hearing loss, along with injuries as a result of operating fast moving machinery. The first Factory Act was brought about by a small group of employers, doctors and reformers in 1833. This applied to all textile mills and addressed minimum working age, hours of work, cleanliness and education. Since then, further legislation has been introduced in the form of Acts of Parliament, resulting in the Health & Safety at Work Act (1974), which is the basis of Health & Safety Law in the UK.

1.2 Current situation

Implementation of regulations is not necessarily an act of altruism by employers, as this affects the two main aspects of occupational medicine; the effects that work has on an individual and the effects of ill-health on the ability to work. Improving working conditions should improve the health of an employer's workforce, enable a greater proportion of the workforce to remain in work, and enable them to work well.

In the UK, the Health & Safety at Work Act (1974) created a different approach to health and safety, and it also had a substantial effect on influencing health and safety legislation further afield (in Europe for example). In more recent years, the UK implements health and safety legislation based on European directives and regulations. In 1989, the first (and probably the most important) directive providing for minimum requirements concerning health and safety at work was adopted. This was introduced to encourage improvements in the safety and health of workers. The aim of the directive is to protect workers through the implementation of preventive measures to guard against accidents at work and occupational diseases. The directive was primarily implemented in Great Britain (GB) by the Management of Health and Safety at Work Regulations (in 1999) which established obligations for employers to evaluate, avoid and reduce workplace risks (2). Despite these EU-wide legislations, international policies differ not only in the implementation of health and safety law, but also in the data collected on incidence of occupationally related ill-health. Some countries (such as Finland) have policies where employers are obliged by law to report cases of ill-health caused by the working environment (3). Inconsistencies in reporting may also occur between countries e.g. in Germany physicians are motivated to report cases by remuneration (4), while other countries have no such legal requirements, and information on occupational ill-health is gathered by surveillance and research studies. The Dutch and the Scandinavians are thought of as the fore-runners of occupational health care in Europe (5;6). In 1998, new legislation was introduced to ensure all Dutch workers have access to an occupational physician (7;8). In comparison, the UK has been estimated to have only 12% of its working population served by occupational physicians (9).

People continue to become ill as a result of workplace exposures. However legislation and changes in the type of work, and the way this work is done over time (amongst other social and cultural factors) have resulted in changes in the type of hazards affecting working populations. Some occupational diseases, such as poisonings and certain cancers (e.g. scrotal cancer), have been all but eliminated (in developed countries) due to the recognition of causal hazards and the introduction of interventions to prevent or restrict exposures. Asbestos is one such substance which was used extensively for its fire-retardant properties as a building material from the 1950’s to the mid 1980’s. Many construction (and other) workers were exposed to asbestos during this time, and its causal link to mesothelioma is well recognised. As a result, the use of, and exposure to, asbestos is now highly controlled. However, mesothelioma has a disease latency of more than 15 to 20 years and mortality is on the increase, with deaths from the disease rising from 153 in 1968 to 2249 in 2008 and expected to peak in 2016 (10).

Apart from asbestos related diagnoses, in recent years, an individual with work-related ill-health is less likely to be suffering from diseases such as asthma or dermatitis which result from exposure to allergenic or irritant substances (11;12). Work-related musculoskeletal disorders and mental ill-health have been more frequently reported, and make up the majority of cases in surveillance studies (1;13). There are likely to be many reasons for this change in the relationship between work and health effects in the UK, such as a reduction in manufacturing industries, technological advances (a lot of work is now computer based), health & safety legislation and policies and mental ill-health issues becoming less stigmatised. Sickness absence policies may also have an impact on patterns of work-related ill-health, especially as these have been amended/updated in line with governmental campaigns.

1.2.1 Sickness absence

Sickness absence is detrimental to the employee themselves, the employer and the national economy as a whole. There is a raised awareness of costs to employers and to the UK economy (estimated at £17 billion in 2009) (14;15), and as a result of greater understanding of the relationship between work and health. There is also increasing evidence that work is good for physical and mental well-being. A report ‘Is work good for your health and well-being’ commissioned by the Department of Work and Pensions in 2005 (16), found that employment is not only the most important means of obtaining economic resources, but that it also meets important psychosocial needs, and is essential to an individual’s identity and social role. Conversely, the report found evidence that unemployment is generally harmful to health, giving rise to higher mortality, poorer general and mental health and resulted in higher medical consultations and hospital admissions. One of the obstacles to early return to work is unnecessary or prolonged sickness certification (17). This may be as a result of a lack of training in issues surrounding work and health (18), as research has shown that GPs as certifiers of sickness who also work part-time in occupational medicine practice certified shorter periods of absence (19).

Studies found that each week one million people report sick, and 3000 of these employees will still be away from work six months later. Also, only 20% of people receiving incapacity benefit longer than six months will return to work in the following five years (20;21). In 2008, issues surrounding work and health were highlighted in a review of the health of Britain’s working age population (22). This review recommended the introduction of a ‘fit note’, whereby a general practitioner (GP) may recommend which work tasks a patient is able to undertake, rather than signing them off work as simply ‘unfit’.

Sickness absence from work can result from all categories of ill-health; however research based on GP records (23;24) has shown that mental ill-health and musculoskeletal disorders are responsible for the highest rates of sickness absence. A study based on industry human resources records stated that a large proportion (26%) of absence from work was due to work-related illness or injury (25). It is clear that work-related sickness absence is caused or aggravated by working conditions, be they physical of psychological; however sickness absence can also result from the effect of non work-related conditions on the ability to work which can also be influenced by working conditions. The loss of the ability to work and be productive influences the economic wellbeing of individuals, families and communities and has a detrimental effect on self-esteem, health and wellbeing. This relationship of health with working conditions has been illustrated in a theoretical model published by Benavides (Figure 1.1) (26)

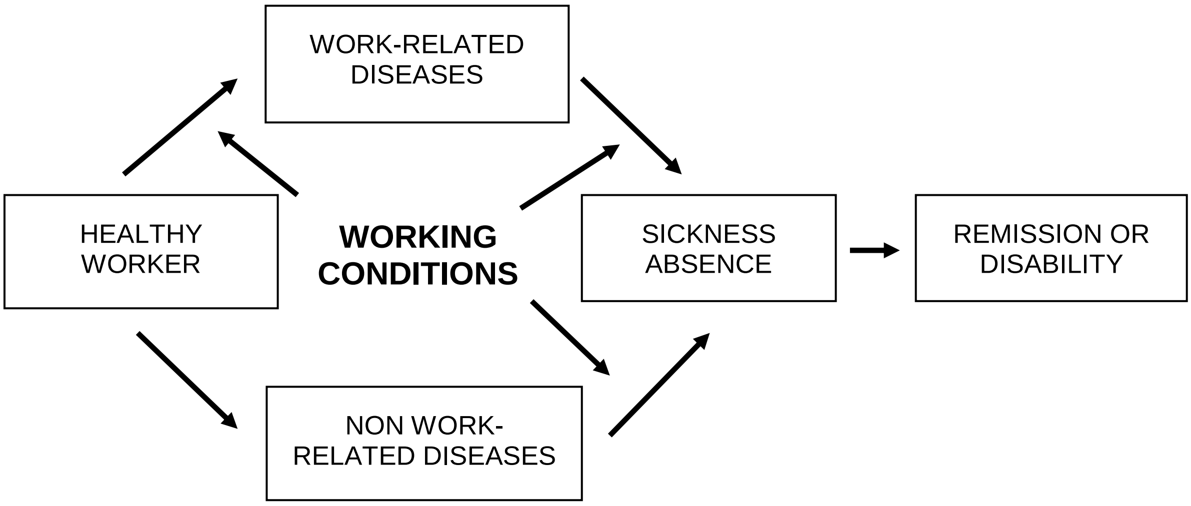

Figure 1.1 Theoretical model of the natural history of sickness absence adapted from a publication by Benavides (26)

In order to reduce the rates of sickness absence it is necessary to gather information on factors within the workplace that influence rates of sickness absence to help inform prevention policy.

1.3 Sources of information of work-related ill-health

In order to produce, develop, and monitor policies on work, well-being, health & safety issues, information about causal factors and employment sectors at risk (e.g. work-related ill-health) must be gathered. Calculating incidence rates gives information on the risk of a population (e.g. employees within a specific industrial sector) of becoming ill over a specified period of time. It is therefore an extremely useful epidemiological measure to identify which populations are more at risk of becoming ill through their work, and how these may change over time. Currently in the UK, the Health & Safety Executive (HSE) collects information on work-related ill-health from a variety of sources, all of which have their advantages and disadvantages.

1.3.1 Surveys of self-reported Work-related Ill-health (SWI)

The Self Reported Work Related Illness (SWI) and Workplace Injury Surveys have been conducted annually since 2003 by HSE as part of the Labour Force Survey (LFS) (27). The surveys collect data on individually reported work-related illness and workplace injuries as a module of the LFS, which is a survey of a sample of UK households collecting data on the UK labour market (28). The injury data becomes part of the Workplace Injuries Survey, while the illness data are used to produce the SWI. The aim of these surveys is to provide the HSE with an indication of the prevalence and incidence of self-reported work-related ill-health and injury, and the resulting working days lost by individuals in the UK. The module is conducted (via face-to-face or telephone interviews) with individuals sampled in the LFS who are aged 16 or over and who are currently employed, or who had been employed in the previous year. These individuals are then asked the following screening question:

Within the last 12 months have you suffered from any illness, disability or other physical or mental problem that was caused or made worse by your job or by work you have done in the past?

Individuals who respond positively to this screening question are asked further questions, focusing on the number of episodes of work-related ill-health that they have experienced in the last 12 months. Up to eight episodes of work-related ill-health can be provided, and the responder is asked to describe the ill-health. Their response is fitted into one of the following diagnostic categories by the interviewer: musculoskeletal; breathing / lung; skin; hearing; stress, depression or anxiety; headache / eye strain; heart disease / attack / circulatory problem; infectious; other. Responders are then asked to state which of the episodes they consider to be the most serious, and it is this (most serious) episode *only* that the following questions relate to: first awareness of episode of ill-health; whether the responder has had any time off work for ill-health, how many working days lost; any action their employer / organisation had taken in response to the ill-health; job title; qualifications and training required for the job (29). Data on work-related ill-health are made available via the HSE website as estimated incidence rates of the number of people who have conditions that they self report (as being caused or made worse by their occupation), and the work-days lost resulting from these conditions (30). Estimates are provided by diagnostic types (including musculoskeletal; stress; skin; respiratory; hearing problems; heart disease / attacks; infectious disease), and by industrial and occupational groupings. Musculoskeletal and stress are the most prevalent (Figure 1.2).

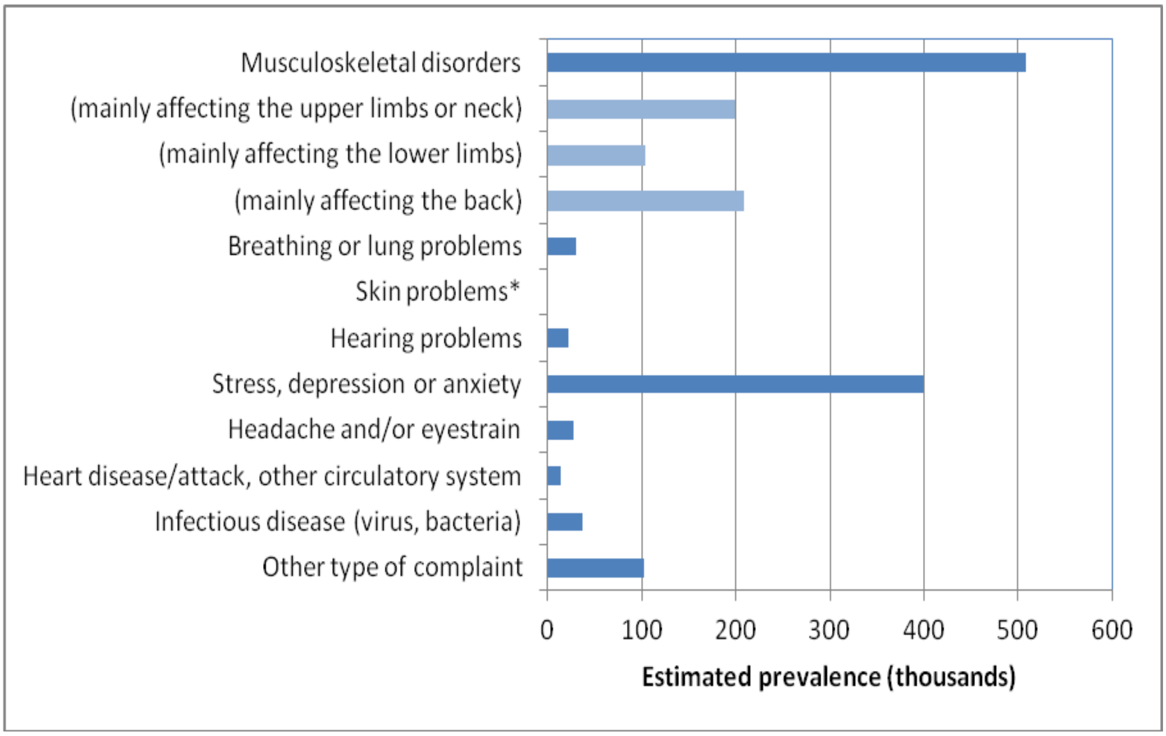

Figure 1.2. Estimated 2010/2011 prevalence of self-reported work-related illness, by type of complaint, for people working in the last 12 months (31)

*Sample numbers too small to provide reliable estimates

Statistics from the SWI are often widely quoted as evidence of the burden/scale of work-related ill-health in the UK. However, there are a number of well established difficulties/limitations associated with the data that are acknowledged by researchers (29;30) and by HSE (32). The main limitation of the SWI data comes from a concern that it is an individual's (and most likely non-medical) perception of work-related attribution to ill-health, rather than one made after assessment by a medical practitioner (29;33).

1.3.2 Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR)

RIDDOR is a statutory reporting scheme for employers and other specified duty holders to report workplace incidents to HSE or other enforcing authorities (34). Incidents reportable to RIDDOR include fatal and non-fatal injuries, occupational diseases and dangerous occurrences, and aggregated statistics from RIDDOR reports are published on the HSE website. There are three categories of reportable injury to workers that are defined under the regulations: fatal, major (e.g. fractures and amputations) and over-three-day injury (other injuries that result in a worker with an inability to do their job for three or more days). Enforcing authorities are informed about almost all fatal workplace injuries; however non-fatal injuries are known to be substantially under-reported, with less than half of all such injuries actually reported, particularly in sectors of high self-employment.

1.3.3 Industrial Injuries Disablement Benefit (IIDB) Scheme

The Industrial Injuries Scheme which is administered by the Department for Work and Pensions (DWP) (35), compensates workers who have been disabled by an occupational disease. Diseases compensatable under the scheme include defined occupations and diagnoses where the occupational cause is well established. Importantly for cases of long latency, it may be difficult to identify and prove occupational cause. Additionally the number of eligible cases is likely to underestimate disease incidence, because individuals may be unaware of the possible occupational origin of their disease and the scheme requires an individual to actively claim IIDB. Figures are published on a calendar year basis, and care needs to be taken in interpreting the annual totals for all prescribed diseases and their trend, as prescribed diseases do not represent the full spectrum of work-related illness. Data are likely to be biased towards industries (such as construction) and diseases (such as lung diseases, vibration white finger, and deafness) where the availability of compensation is well known. Many such cases are a legacy of past working conditions, which would not be acceptable today (e.g. asbestos related diagnoses).

1.3.4 Other UK data sources

HSE also uses information originating from schemes collecting information on specific diseases and exposures (36). These include the mesothelioma and asbestos registers, which collate death certificate information from the Office of National Statistics (ONS) and the General Register Office for Scotland (GROS), a surveillance scheme collecting information on incidence of radiological exposure (OTHEA) (37) and the surveillance scheme for workers exposed to lead. Under the Control of Lead at Work Regulations (CLAW) 2002 (and earlier 1980 and 1998 Regulations), all workers with significant exposure to lead are required to have medical surveillance, including workers having their 'blood-lead level' monitored. Annual returns give summary statistics for each workplace based on the maximum blood-lead level recorded for each worker under surveillance.

1.3.5 European data sources

Eurostat provides statistical information (economic, employment, population etc.) on the European Union. Data collated includes information on fatal and non-fatal accidents at work (38). Despite recognised issues with comparability, information is as standardised as possible. Fatalities in the workplace cover eight industry groups. These are not only standardised by working populations but also for other issues such as the removal of road traffic accident fatalities in GB and Ireland where these data are not included as work-related fatalities. Similarly to RIDDOR, information on non-fatal injuries is thought to be subject to under-reporting. Differences between countries arise as in some member states such as GB, Ireland and Denmark, accidents are reported to a national inspectorate (such as HSE) whereas in countries such as Germany or Spain, reports are made through insurance systems where reporting is incentivised. Due to these differences HSE do not use the non-fatal accident information to draw comparisons across Europe but use the European Union Labour Force Survey (EU LFS) (39). This is a household survey carried out in the 27 Member States of the European Union, three candidate countries and three countries of the European Free Trade Association (EFTA). Similarly to the GB based SWI, in 2007, the EU-LFS included a module asking about accidents at work, work-related health problems, and exposure to factors that can adversely affect mental well-being or physical health in the previous 12 months.

1.4 The Health & Occupation Reporting network (THOR)

Another major source of national statistics on work-related ill-health is The Health & Occupation Reporting network (THOR) (13;40-47). THOR is a network of surveillance schemes run by the Centre for Occupational & Environmental Health (COEH) at the University of Manchester, collecting data on work-related ill-health from clinical specialists from a number of medical specialties throughout the UK. The first of these schemes collected information of occupational respiratory disease and was set up in 1989. The schemes that make up THOR are shown in Table 1.1:

Table 1.1. THOR reporting schemes

SCHEME NAME	NAME IN FULL	REPORTING PHYSICANS	YEARS IN OPERATION
SWORD (41)	Surveillance Of Work-related Respiratory Disease	Chest physicians	1989 to present
EPIDERM (40)	Occupational Skin Surveillance	Dermatologists	1993 to present
OPRA (13)	Occupational Physicians Reporting Activity	Occupational physicians	1996 to present
SIDAW (46)	Surveillance of Infectious Disease At Work	Consultants in Communicable Disease Control (CCDCs)	1996 to present
OSSA (45)	Occupational Surveillance Scheme for Audiological physicians	Audiological physicians	1997 to 2006
MOSS (42)	Musculoskeletal Occupational Surveillance Scheme	Rheumatologists	1997 to 2009
SOSMI (43)	Surveillance of Work-related Stress and Mental Illness	Psychiatrists	1999 to 2009

For all these schemes, physicians report on a voluntary basis and submit anonymised information on cases presenting in their clinic when they believe the ill-health has been caused or aggravated by work. When all schemes were in operation, there were over 2,000 physicians participating in THOR. Each case must be a new (incident) case of work-related ill-health, seen in their clinical practice. Although the reporter is given guidance on what (and how) to report (48), the cases submitted are based on the physician's own opinion of the diagnoses and work-relatedness. Doctors provide demographic information (age, gender and postcode district), details on the type of employment (occupation and industry) and the agent/task/event suspected of causing/aggravating the ill-health. The physicians report continuously (i.e. every month) as 'core' reporters, or as 'sample' reporters who submit a return for a randomly assigned month each year, via a postal report card or an on-line web form located on the THOR website (44). If the reporter does not see any relevant cases in a reporting month they submit a 'zero return’. The data reported to THOR are used to calculate incidence rates, to study trends and to identify new and emerging causes of work-related ill-health (11;49). THOR schemes have a good UK coverage, however not all eligible physicians participate in the schemes. Carder *et al* (49) carried out an exercise to estimate the proportion of the GB cases included in SWORD and EPIDERM (during 2005 to 2007). The researchers found that 62% of GB work-related skin cases and 60% of respiratory cases were likely to have been captured by these THOR schemes. In order to calculate incidence rates the cases reported are adjusted by reporter response rate and those estimated to be missed due to non-participation and divided by the number of persons employed in the UK according to LFS data.

THOR is a valuable source of information, and benefits from medical specialists’ opinions of diagnosis and the relationship with work and exposures. However THOR collects data from clinical specialists, and therefore only provides estimates of the incidence of the cases referred to secondary care, or (for OPRA) employees that have access to occupational health services. Many patients and those with less severe diagnoses will fall outside the catchment areas of these schemes. In comparisons, the SWI collects data from individuals, so a case does not need to be seen by a medical practitioner to be included in the survey; SWI data therefore originate from the lowest level of the ‘work-related health surveillance pyramid’ (Figure 1.3). This is a model adapted from the public health ‘Burden of illness pyramid’ (50). Although the SWI benefits from being more inclusive (as described earlier) the diagnosis and assessment of work-relatedness is not based on medical opinion.

Collection of data on work-related ill-health as seen by general practitioners would potentially bridge this gap in the knowledge, and be an important addition when investigating the relationship between work and health.

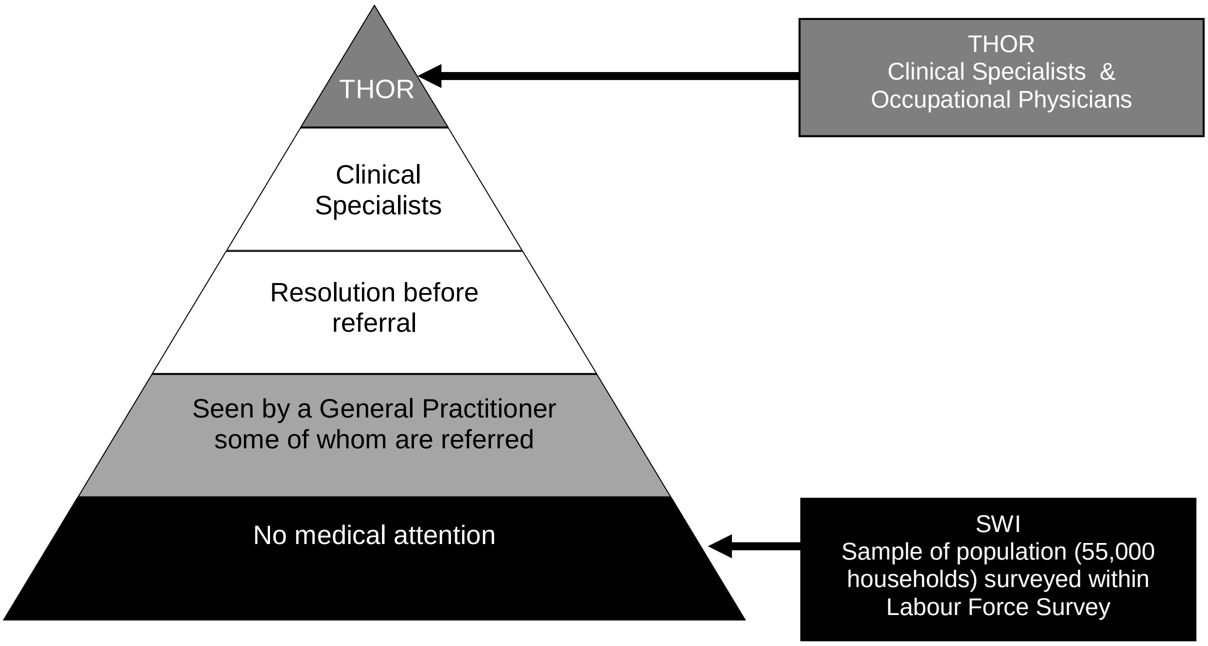

Figure 1.3. Work-related health surveillance pyramid

1.5 Work-related ill-health in general practice

General Practitioners (GPs) are usually a patient's first port of call for ill-health problems, including those of occupational cause. Estimates suggest that more than 90% of patients consult their GP within a five-year period (51). Little is known about the incidence of work-related ill-health that is seen in general practice, and often the occupational associations with diseases are unrecorded by GPs (52). General practice has often been referred to as the 'blind spot' in occupational health as so little is known about occupational health seen by GPs (53;54). Some diseases should always have occupational factors explored, and GPs often represent the first opportunity to establish a link between a disease and workplace exposures, however GPs may often fail to explore this (55). This may be associated with a lack of training and experience in occupational medicine in general practitioners, due to curriculum overload, or a lack of communication with local occupational physicians (56). Data from general practice would supplement information from other sources, and improve knowledge about work-related diseases and minor work-related injuries (57).

1.5.1 Previous knowledge on work-related ill-health in general practice

A search of the published literature was conducted using search terms associated with work (i.e. occupation, work-related and work) and combined with terms to specify the primary care (i.e. general practice (and practitioner), GP, family practice, primary care and family physician). Very few papers described the type of work-related ill-health that was determined by GPs, or gave measurement of incidence.

Publications resulting from this search included those that were not relevant because they were studies describing the health of the general practitioner and general practice staff (and also general dental practitioners), rather than the work-related ill-health seen by the physician in his/her clinical general practice sessions (58-61). Although some researchers studied aspects of occupational ill-health seen in general practice, there was very little information to enable accurate estimates of incidence to be calculated. Some of the studies based on general practice data were on specific diseases seen in particular industries, making it difficult for results to be applied to the wider population. For example, studies included one on asthma and heart disease in transport workers (62), and another of dermatitis in an electronics store (63).

The search also identified publications based on data from a range of countries which differed in GPs' education, legal regulations and policies, and social or economic situations. Additionally, some of the publications selected were not necessarily relevant to the subject under review; for example, the terms, 'family physicians' and 'general practitioners' have different meanings in different countries; in an American publication orthopaedists and neurologists were termed as 'primary care physicians' (64), while in the UK these practitioners would be classed as providing secondary care.

The search terms included in the literature review also included 'population based' studies. These were included in the search results because general practice lists (of patients) may be used as a study population, for example where participants are sent questionnaires about certain aspects of work-related ill-health. Some of these ‘population based studies’ are not directly relevant to this study, as cases were not necessarily seen by a general practitioner (65;66).

However, despite the lack of publications with direct relevance to this thesis, there was a number of studies giving an insight into work-related ill-health and sickness absence seen by general practitioners, including estimates of the incidence and prevalence of specific diseases, the type of work-related ill-health seen in general practice and GPs’ recognition and knowledge of issues surrounding work and health.

1.5.1.1 The incidence and prevalence of work-related ill-health in general practice (Table 1.2)

Publications giving estimates of incidence and prevalence of ill-health related to work seen in general practice clinics, all concentrated on specific diseases (as opposed to comparing rates of different categories of disease within the same study), including asthma (52;62) lower back pain (67-69), work-related stress (70), dermatitis (63;71) and carpal tunnel syndrome (72).

One of these studies ‘Occupational asthma: a community based study’ by de Bono *et al* (52) assessed the overall load of occupational asthma within a general practice. The study population comprised 182 patients with adult onset asthma, as selected from patient records. These were studied for a diagnosis of occupational asthma, or for evidence that information about the patient’s occupation was recorded at the time of diagnosis of asthma, with any association noted between work and asthmatic symptoms. Of all the patients with adult onset asthma, 157 (86%) had at least one occupation recorded; 50 (32%) of these were in jobs involving potential exposure to known asthmagens but only 18% (9/50) had a potential link between diagnosis and occupation recorded. Overall 7 (4%) of those with adult onset asthma had been diagnosed with occupational asthma; nearly half of these occupational cases had been diagnosed by the GP, the others were diagnosed after referral to a chest or occupational physician. It was concluded that although only 4% of the study population had a diagnosis of occupational asthma, it was likely that in a substantial number of cases the diagnosis had been missed or not considered, and therefore the 4% figure was likely to be an underestimate.

Insufficient history taking was noted, and better occupational medicine education and training for GPs was recommended.

This study not only gives an assessment of the proportion of asthma cases seen by general practitioners that are considered occupational, but it also raises the lack of training in issues surrounding work and health amongst GPs. Of note, only one practice was studied, and regional variations due to local employment are likely. This work was also only based on case notes from four GPs, who may have different educational backgrounds and interests (so diagnosis and history taking would vary) therefore there may be issues in applying the results to the wider UK population.

The study also highlighted the possible extent of underestimates from clinical specialist reporting schemes, with just under half the cases of occupational asthma being diagnosed by the GP rather than a clinical specialist (albeit based on small numbers). The authors recommended a prospective GP based study assessing all new presentations of asthma for occupational aetiology.

A report was commissioned by the HSE to examine the feasibility of assembling national information on the frequencies and distribution of ill-health presenting to general practitioners in relation to their occupation (73). The report 'Frequencies of diseases presenting to General Practitioners according to patients' occupation', examined existing schemes (such as the General Practice Research Database (GPRD) (74)) using electronic Read coding methods from various information technology (IT) systems, and found that none of these schemes routinely collected information on occupation. The report concluded that if the different IT systems were to be used for the purpose of collecting information on the relationship between work and health, this would require additional procedures not routinely carried out by GPs.

Two of the papers (68;69) found in the literature search studied lower back pain, and involved the same population as that used in the 'South Manchester back pain study' (75). This research aimed to determine the one-month period prevalence of low back pain (not solely work-related) in an adult population, using individuals registered with two general practices in South Manchester. The aim for both of these studies was to establish an employed 'lower back pain free' cohort; this was achieved by questionnaire and produced a population of 1412 adults. The spin-off studies recorded the reason for each consultation in the following 12 months, and those visiting the GP with lower back pain were investigated further. Only 63/1412 (4.5%) patients consulted for lower back pain, and of those who didn't (but responded to a questionnaire), 32% reported they had experienced low back pain during the 12 month follow-up period. Although these cases were not specifically work-related, one spin-off study investigated the employment and physical work activities associated with the cases (68), and the other concentrated on psychosocial factors in the workplace (69). An increased risk of lower back pain was found in individuals whose job involved lifting/pulling/pushing objects of 25 lbs or more, or in workers who had jobs that involved prolonged periods of standing or walking. Psychosocial factors found to be associated with lower back pain consultations were a perceived inadequacy of income and lower social status (although these factors are related).

Another publication 'Epidemiologic studies in Low-Back Pain' (67) also found significant associations with occupational factors such as lifting, carrying, pulling and pushing. Researchers examined the records of 3920 patients in a family practice in Vermont, and found that 10.2% of patients had consulted for low back pain in a three year period. As in the 'South Manchester back pain study', these findings were not specifically related to work-related low back pain, although associations with factors in the workplace were investigated. However, the risk factors associated with the condition were decided by researchers, based on the occupations recorded in the patients' notes rather than from a specific assessment of the exposures involved in the individuals work tasks.

Moving away from musculoskeletal diagnoses, a study investigating psychosocial problems presented by patients with somatic reasons for encounter in Norway was relevant, but again this research was not specifically designed to study work-related problems seen in general practice (70). The researchers investigated whether a GP may overlook a psychological problem if not presented directly, by studying 1110 patients with somatic problems visiting 89 GPs in one day. The patients returned a questionnaire about their reasons for consulting their GP on that particular day, while the GP also completed a questionnaire about the consultation. A third (354/1110; 32%) of the patients recorded psychological reasons that they felt were affecting their health on that day. Less than half (43%) of these patients discussed these psychological problems with the GP. Occupational stress was the most frequent psychosocial problem disclosed to the GP (59% of patients reporting this in the consultation). Multiple regression was used to analyse which variables (e.g. reason for encounter, gender of GP, patient age and income level) influenced the patients to communicate their psychological problems to the GP. Results showed that reason for encounter was significantly associated with disclosure of these problems with disorders of the musculoskeletal system the strongest predictor.

One study that was highly relevant, was by *Keegel et al* entitled 'Incidence and prevalence rates for occupational contact dermatitis in an Australian suburban area' (71). This study aimed to collect and verify reports of occupational contact dermatitis in order to generate disease estimates in a defined area in Melbourne. Cases were found using two methods; in the first method, 30 GPs, two dermatologists and one dermatology outpatient clinic used a reporting form in their routine clinics to record cases suspected of having occupational contact dermatitis, while the second method identified workers who were referred to an Occupational Dermatology Clinic by physicians outside the study area. Using these two methods combined, resulted in 182 reports/referrals of suspected occupational contact dermatitis. Cases were confirmed by patch testing and as incident (as opposed to prevalent), by asking if patients had experienced symptoms for less than three months. This resulted in 41 confirmed incident cases of occupational contact dermatitis (48 cases were lost to follow-up). These numerator cases were divided by the working population of the study area (200,000 workers) to give an incidence rate of 20.5 per 100,000 persons employed. This incidence rate is based on the multiple sources used in the two methods, however, the paper tabulates these sources individually, therefore it is possible to calculate the incidence rate according to GP reports (i.e. 12/200,000 which is an incidence rate of six per 100,000 persons employed). The paper discusses the benefits of including reports from GPs, as this includes less severe cases that would have been solely managed in the general practice setting (and not referred to clinical specialists). The study also benefits from the fact that cases were confirmed by 'gold standard clinical tests', namely patch testing. The authors acknowledge the study's limitations; in particular there was poor GP participation (only 63/700 (9%) of eligible GPs enrolled in the study) and low attendance by workers at patch testing appointments (38% did not attend). Despite this poor rate of participation, the employed population of the study area was still used as a denominator by which to divide the numerator (incident cases reported) even though the majority of the population would have been seen by GPs not participating in the study. As a result incidence rates calculated from GP reports would be severely underestimated. The researchers state that the study provides more extensive disease estimates for occupational contact dermatitis in an Australian setting than had been previously available (such as from workers compensation schemes), and it contributes to a better understanding of the epidemiology of occupational contact dermatitis through a process of triangulation with other datasets.

Although not solely work-related, a study based in the Netherlands aimed to estimate incidence rates of carpal tunnel syndrome (CTS) using general practice data (72). The study is introduced by stating that most studies on carpal tunnel syndrome are population based, and that the incidence of CTS in general practice is rarely studied. The authors continue by saying that incidence rates from general practice are different to population based studies, where patients with symptoms are actively sought. In GP based studies rates are representative of patients with more severe symptoms, prompting them to seek medical advice. The authors argue that CTS is often linked to occupation, and they aimed to investigate the role of work-related and other factors in the condition. Researchers analysed data from the first and second Dutch National Survey of General Practice, which were conducted in 1987 and 2001 respectively. The base population of these national surveys were patients registered with participating practices. Information about occupation was sought by mailing a questionnaire to all registered patients. Incidence rates were calculated for all new episodes classified by GPs, after consultation with the patient. Incidence rates for 1987 and 2001 were 1.3 and 1.8 per 1000 respectively. Rates for females were three times higher than males in both study periods. For females, incidence rates were higher in unskilled and semi-skilled workers than rates found in skilled and higher-skilled professional job categories. The authors concluded that occupational skill level is associated with CTS in women, but not in men.

This study benefits from the fact that the rates are derived from a large population of general practice patients, from over 100 GP practices. Practices were selected by stratification by region, urbanisation level and deprivation status. The GPs and the study population was considered representative of the Dutch population as a whole (76). The authors conclude that incidence and prevalence rates from general practice are more than 10 times lower than those found in community based studies, therefore it appears that a large proportion of people with CTS do not consult their GP. Although the paper aimed to investigate the occupational factors associated with the CTS, results were only published comparing two groups (unskilled and semi-skilled vs skilled and higher-skilled professional occupations). As results showed rates between these groups only varied in females the authors hypothesise that this may be due to hand-intensive work carried out in the home (and therefore not work-related) or that unskilled and semi-skilled work may be more strenuous on the wrist than for men employed in similarly categorised occupations.

Table 1.2. The incidence and prevalence of work-related ill-health in general practice - Literature review summary table

Name, Year, Country of Study	Title	Aims	Methods	Key findings	Conclusions and results relevant to thesis	Strengths/Limitations
De Bono et al, 1999, UK (52)	Occupational asthma: a community based study	To examine the prevalence, aetiology and mode of diagnosis of occupational asthma in general practice by examining asthma patient records.	Patients with adult onset asthma were identified from an Oxfordshire practice. Notes were made on the date of diagnosis, any occupations recorded, any comments on the link between work and asthma and if a formal diagnosis of occupational asthma was present.	86% of patients with asthma had at least one occupation recorded, 32% of these were in jobs associated with exposure to known asthmagens; only 18% of these had a link between occupation and symptoms recorded. Overall just 4% had the diagnosis of occupational asthma.	In many cases a diagnosis of occupational asthma is missed with GPs taking inadequate or no occupational histories. Improved training for GPs and a prospective GP based study was recommended.	The study was based on a single practice of four GPs in one particular part of the country therefore possible problems with external validity.
Macfarlane et al, 1997, UK (68)	Employment and physical work activities as predictors of future low back pain (LBP)	To determine physical factors related to employment that predict a new episode of LBP.	1412 adults registered with two general practices in Manchester were identified as a back pain free cohort. Occupational histories were taken and data on consultations for LBP were collected through computerised records in a one-year follow up. One year incidence calculated for occupational groups. Cumulative exposure in years to particular tasks calculated and modelled using logistic regression.	63 (4.3%) cohort members consulted with LBP during one-year follow up. 247 (32%) of non-consulters reported experiencing LBP, therefore results were based on 310 patients with LBP with 537 known (as they returned questionnaire) to be back pain free. Increased risk of new episode of LBP in individuals with jobs involving lifting/pushing/pulling objects over 25lbs or in those jobs with prolonged standing or walking. Risks were in general greater in women.	Calculation of incidence rates amongst a population derived prospectively from general practice lists. Occupational activities correlated with incidence of LBP. Captures LBP not seen by GPs.	Incidence rates use the denominator of those who answered questionnaire (59% of practices' population). Non responders to 1-year follow were presumed the same as responders. Study based in Manchester only, therefore possible problems with external validity. The LBP experienced by the cohort members is not necessarily attributed to work-related factors. Possible response bias to questionnaire, maybe more likely to respond if experienced LBP. Study benefits from being a large cohort with good information derived from the prospective follow up.
Papageorgiou, 1997, UK (69)	Psychological factors in the workplace - do they predict new episodes of low back pain?: Evidence from the South Manchester back pain study	To determine whether work-related psychological factors and social status predict the occurrence of new episodes of LBP and influence consultation behaviour.	Using the same cohort of 1412 back pain free adults above, this study obtained baseline information on work-related psychosocial factors and psychological distress using three questions regarding job satisfaction and a general health questionnaire (GHQ). Social class was derived from patients' occupation. Relative risk of LBP associated with these psychosocial factors were calculated.	310 patients (as above) experienced LBP during the one-year follow up. At baseline, significant associations were found with LBP and perceived inadequacy of income, work dissatisfaction and social class. In the one-year follow up inadequacy of income and social class were associated with consultation for LBP.	Calculation of relative risks of psychosocial factors related to LBP amongst a population derived prospectively from general practice lists. Captures LBP not seen by GP.	Non responders to 1-year follow were presumed the same as responders, possibility of non-response bias. Study based in Manchester only, therefore possible problems with external validity. The LBP experienced by the cohort members is not necessarily attributed to work-related factors. Possible response bias to questionnaire, maybe more likely to respond if experienced LBP. Some of the association are based on small numbers. Study benefits from being a large cohort with good information derived from the prospective follow up.

Name, Year, Country of Study	Title	Aims	Methods	Key findings	Conclusions and results relevant to thesis	Strengths/Limitations
Frymoyer et al, 1980, Canada (67)	Epidemiologic studies of low-back pain	To define the multiple risk factors of LBP.	Researchers examined records of the patient (aged 18 to 55) population of a practice in Vermont. Records were made for a 3 year period of variables including occupation, episode of LBP, anxiety, depression, smoking and pregnancy. Occupations were assigned possible risk factors.	11% of males and 9.5% of females reported an episode of LBP. LBP was significantly related to truck driving, lifting, carrying, pushing, pulling and twisting. Patients with LBP also reported more episodes of anxiety and depression.	Incidence rates of LBP in a practice population associated with occupational risk factors.	Study based in Vermont only, therefore possible problems with external validity to the wider Canadian and UK populations. The LBP recorded in patients' notes was not necessarily attributed to work-related factors. Work-related risk factors associated with patients' occupations was decided by researchers. The information from patient records in this selected university practice was more complete than would be expected of other practices, due to systems implemented to gain patient information upon registration.
Gulbrandsen et al, 1998, Norway (70)	Psychosocial problems presented by patients with somatic reasons for encounter: tip of the iceberg?	To describe the frequency of psychosocial problems presenting to a GP with somatic reasons and explore whether factors such as GP or patient characteristics and their relationship influence the presentation of problems.	A questionnaire survey of 1401 patients visiting 89 GPs during a single day in a county of Norway. Patients and GPs were asked about the reason for consultation, asked if it included problems from a list of nine psychosocial factors and whether they had been mentioned during the consultation.	Of the 1401 patients, 1217 (87%) returned the questionnaire and of these gave 1110 somatic reasons for encounter. 354 (32%) of these patients' recorded at least one psychological problem that they felt was affecting their health. Less than half of these disclosed these to their GP. Occupational stress was more often communicated than any other kind of problem. Female patients disclose non-occupational problems more often than males. Musculoskeletal problems are the reason for encounter proceeding disclosure of psychological problems.	Occupational stressors are common in patients in GP consultations, often associated with musculoskeletal problems. Patients more often communicated psychosocial problems when they knew their doctor well; this is more likely the case with a GP than with other types of physicians.	Occupational stress could be more frequently reported due to a patient's demand for sickness certification, rather than more patients experiencing these problems. Survey of a large number of GPs in a county shown to be representative of Norway as a whole.
Keegal et al, 2005, Australia (71)	Incidence and prevalence rates for occupational contact dermatitis (OCD) in an Australian suburban area	To generate incidence and prevalence rates for OCD for a population of workers within a defined Australian community setting.	Two methods were used to collect data: Method One - 30 GPs, two dermatologists and one dermatology outpatient clinic in an outer suburban area of Melbourne reported each worker with suspected OCD. Method Two - workers living within the area who were referred to a tertiary referral OCD clinic were also included as cases within the study. Suspected cases were verified by patch testing. Incidence rates were calculated using the employed population of the defined area as a denominator.	41 confirmed incident cases of OCD resulted in an incidence rate of 20.5 per 100,000 persons employed. The paper tabulates results from all sources separately therefore the incidence rates based on GP reports alone (12 case) can be calculated. This resulted in a rate of 6 per 100,000 persons employed.	This paper demonstrates how incidence rates can be calculated from general practice data and discusses how this captures cases that are solely managed by a GP rather than other data sources such as SWORD that collect data from dermatologists.	This study benefits from the fact that cases are confirmed by gold standard clinical patch testing. The response rate from GPs was extremely low; only 63/700 (9%) of GPs participated. Despite this the working population of the area was still used as a denominator even though the majority of the population would not have been seen by a GP participating in the study. Therefore incidence rates would have been severely underestimated.

Name, Year, Country of Study	Title	Aims	Methods	Key findings	Conclusions and results relevant to thesis	Strengths/Limitations
Bongers et al, 2007, The Netherlands (72)	Carpal tunnel syndrome in general practice (1987 and 2001): incidence and the role of occupational and non-occupational factors	To compare incidence rates of carpal tunnel syndrome (CTS) in 1987 with rates in 2001, and to study the relationship with occupation	Researchers analysed data from the first (1987) and second (2001) Dutch National Survey of General Practice. The base population of these national surveys were patients registered with participating practices. Information about occupation was sought by mailing a questionnaire to all registered patients. Incidence rates were calculated for all new episodes classified by GPs, after consultation with the patient.	Incidence rates for 1987 and 2001 were 1.3 and 1.8 per 1000 respectively. Rates for females were three times higher than males in both study periods. For females, incidence rates were higher in unskilled and semi-skilled workers than rates found in skilled and higher-skilled professional job categories. Occupational skill level is associated with CTS in women, but not in men.	Calculation of incidence rates from general practice data. Rates are 10 times lower than results from community based studies as a large proportion of people with CTS do not consult their GP until symptoms are seriously affecting them.	Incidence rates are calculated using whole practice population and not just those of working age; this may affect association with occupation. Very limited occupational information, only split into skilled and un/semi skilled groups. Incidence rates were calculated from a large population shown to be representative of the national population.

1.5.1.2 The nature of work-related ill-health in general practice (Table 1.3)

The best source of information giving data on the type of work-related conditions seen in general practice seems to be from Australia, largely due to the BEACH (Bettering the Evaluation and Care of Health) Programme run by the University of Sydney (77). This Programme continuously collects information about general practice clinical activities in Australia. These include characteristics of GPs and patients, reasons for seeking care and problems managed. The data collected are of particular relevance because, with each case, the GP is asked whether the case is work-related. It has been developed over a period of 30 years and by July 2011 it was estimated to hold approximately 1,300,000 GP-patient encounter records. Data collection is on-going from a random sample of 1000 GPs reporting annually across Australia, with 20 of these GPs recording per week. Participants use a paper based reporting form to record details of 100 (including telephone) consecutive consultations. The data are used to produce annual statistics including data on work-related cases (78;79), and research specifically analysing the work-related aspects of the data (57). In 2009-10 work-related conditions accounted for 1.6% of problems, and were managed at a rate of 2.5 per 100 GP encounters. Of the total 2,529 work-related problems, the majority were musculoskeletal (57.1%). The most common of these were back complaints (16.2% of total work-related problems), sprains and strains (10.5%), musculoskeletal injuries (7.9%) and fractures (3.3%). Psychological problems were the next most frequently reported category of work-related ill-health, producing 10.9% of cases. Of these, depression (4.4%), acute stress reaction (2.2%), anxiety (1.9%) and post-traumatic stress disorder (1.8%) were reported most frequently. Other work-related problems made up 27.7% of work-related cases including skin injuries (3.9%) and lacerations (2.8%).

Data from BEACH have also been published in a study which concentrated solely on the work-related ill-health information collected by the project, comparing it to other sources of data, such as compensation based statistics (57). It was found that 42% of the work-related ill-health problems reported by GPs were due to injury. From this point in the paper it becomes a little confused; it states “the most common non-injury disorders for new work-related BEACH problems were psychological problems (anxiety/stress; depression) and skin problems, with each accounted for about 10% of all new problems”, however in tables provided musculoskeletal disorders are the most frequently recorded making up 27.8% of all new disease cases.

Another study by Copeman *et al*, also based in Australia, aimed to determine the amount and type of work-related injuries and disease presenting to general practitioners at a community health centre over a six month period (80). Approximately 7.2% of the patients consulting the five GPs were identified as having an occupational disease or injury. Of the 283 patients, 250 patients had work-related injuries and 33 had work-related diseases. Musculoskeletal conditions (52%), dermatitis (15%) and respiratory illness (9%) were the most common diseases recorded, while the most frequent injuries recorded were open wounds (28%) and sprains or strains (22%). There was no mention of psychological ill-health being included in the list of conditions. It was interesting to note that, of the five GPs participating in the study, one doctor with a specialist interest in work-related conditions diagnosed most of the cases of occupational disease. The authors suggest that this was due to the other GPs under diagnosing these conditions, as there was no evidence that this doctor preferentially attracted patients with work-related conditions. The literature search did not identify any publications with similar information based in the UK; therefore it was interesting to find reference in this research (to an unpublished report) describing a study based in Sheffield in 1987 where 10% of patients attending two group general practices in a lower social economic industrial area had a condition resulting from their work (81). This Sheffield based study found that dermatitis and noise induced hearing loss were the most frequently reported work-related conditions. The authors of the Australian study conclude that accurate and complete identification and recording of work-related problems is important in efforts to decrease the incidence of such health problems, and that general practitioners have an important role to play in this.

There are two other (Danish) publications that give an estimate of the proportion of consultations/patients seen in general practice with work-related conditions. One of these asked 33 GPs to register consultations over a three month period and found 1.1% of consultations were for work-related injury and 0.7% were for ‘occupationally conditioned complaints’ (82). Another study gives a quite different figure; 114 GPs registered all symptom related consultations over a four day period in the county of Ringkoebing, Denmark, and 15.9% of consultations were considered to be work-related. The results of this study also differed to others as there were more work-related disease consultations (12%), than those for workplace injury (3%). However, as in other studies, musculoskeletal disorders were most frequently reported, as well as being the diagnostic category with the highest proportion of work-relatedness, with 35% of all musculoskeletal disorders being classified as work-related (83).

Other papers such as one by Harber *et al* ‘Frequency of occupational health concerns in general clinics’ (84) and another (in Norwegian) by Hilt *et al* ‘Work-related diseases in general practice’ (85) would seem initially highly relevant to this review. However, these interviewer/questionnaire based studies asked patients visiting general medical clinics about the work-relatedness of their ill-health, rather than it being reported by a GP as a result of consultation with the patient. The work-relatedness of ill-health is therefore based on the patient’s own assessment (similar to the SWI survey in GB), although unlike the SWI the patient felt that the ill-health merited a visit to the GP with the problem. The USA based study by Harber *et al* was carried out in several general clinics in Los Angeles. Interview questions included asking the patient whether their work caused their ill-health, whether they felt work made the problem worse, and whether their ill-health had affected their work. Results were based on interviews from the first 108 patients, with 39% reporting that they thought that their problem was caused by work and 66% reporting that their medical condition was made worse by work. Health problems were reported to have a substantial effect on work, as 13% reported that they had changed their job because of health problems, and 18% had modified what work they did. In addition, 60% of subjects reported that changes in the work place could possibly improve their health problems. Work factors associated with the reported ill-health differed between those thought to cause the health problem compared to those that made the condition worse. Stress was generally considered to worsen rather than cause illness, whereas injuries were more frequently thought to be caused by work.

The paper concluded that concerns over work-related ill-health are common in general practice, and that the focus should not only be on illness caused by work but also on that made worse by work. The authors’ recommendations were that the training of physicians in general practice is insufficient (and questions asked in clinic are not adequate) to enable them to attribute an occupational factor to the cause or aggravation of a patients' ill-health, therefore this needed to be addressed. Harber *et al* also recommend further surveillance of occupational ill-health seen in a general practice setting, with existing surveillance and data collection being insufficient, resulting in a severe underestimation in the incidence of cases.

Harber's research was beneficial in eliciting patients' views on the work-relatedness of ill-health; however it was not clear whether or not those who were interviewed were visiting the practice because the work-related ill-health was their main health problem, or for another health issue. In addition, bias may have been introduced by using the first 108 subjects; the number of subjects interviewed in total is not given, or a reason for not using more results if data were available, or why they didn't use a random sample of subjects in the analysis. Patients stated whether they felt their work caused their ill-health *and* whether they felt work made the problem worse, i.e. this information was elicited from two questions as opposed to a single question asking if they felt they condition was caused *or* made worse by work (therefore making it possible to answer both questions affirmatively). It would have also been interesting to see if all the cases caused by work were included with those made worse by work, as this is not stated. However, of the 39% who reported that their illness was caused by work it was thought that few, if any, would have been picked up by any of the routine surveillance methods. It is also uncertain as to whether the patients would have reported their concerns to the clinicians, which would have been an interesting point to add to the original questionnaire, especially as many of the studies highlight poor occupational history taking by GPs.

Similarly, the Norwegian study by Hilt *et al* (85) asked patients (of working age) attending a general practice clinic during a six month period to complete a questionnaire asking; their reason for consultation, current employment and whether they felt the reason for consultation was related or caused by conditions in their workplace. To this they answered either 'yes certainly', 'yes possibly' or 'no'. Of the 412 patients who fulfilled the inclusion criteria and adequately completed the questionnaire, 46% believed their ill-health to have some relation to work (30% possibly, 16% certainly). The problems thought to be related to work were most frequently musculoskeletal (57%), cardiological (10%), respiratory (7%), neurological (6%), psychological (4%) and dermatological (3%). Patients with musculoskeletal problems thought that their problems were related to work most frequently, with 68% of patients associating musculoskeletal disorders with conditions in the workplace. It was interesting to note that, apart from conditions unlikely to have a work-related association (e.g. gynaecological/urinary, digestive), skin disease was thought to be associated with work least often (19% of cases). However the authors concede that when the conditions of the 412 patients are broken down into diagnostic groups, some of these categories are based on small numbers.

Table 1.3. The nature of work-related ill-health in general practice - Literature review summary table

Name, Year, Country of Study	Title	Aims	Methods	Key findings	Conclusions and results relevant to thesis	Strengths/Limitations
Britt et al, on-going, Australia (79)	General practice activity in Australia using BEACH (Bettering the Evaluation And Care of Health)	The BEACH Program continuously collects information about the clinical activities in general practice in Australia, in order to collect information about the characteristics of GPs, patients seen and problems managed.	Data collection is on-going from a random sample of 1000 GPs reporting annually across Australia, with 20 of these GPs recording per week. Participants use a paper based reporting form to record details of 100 (including telephone) consecutive consultations. With each case GPs indicate whether it is work-related.	In 2009 to 2010 work-related conditions accounted for 1.6% of problems. The majority of cases were musculoskeletal (57.1%) of which the most common were back complaints and sprains and strains. Psychological problems made up 10.9% of cases.	BEACH records cases from general practice selected by GPs as being work-related. Majority of work-related problems are musculoskeletal.	No information on occupation collected from patient. 30% response rate from GPs, however tests are carried out to ensure participants are representative of Australia as a whole and adjustment made where necessary. Not set up to record specifically work-related conditions and these make up a small proportion of cases.
Driscoll et al, 2002, Australia (57)	Surveillance of work-related disorders in Australia using general practitioner data	To compare information on work-related problems managed in general practice with data from other sources in Australia	Data from the BEACH programme (described above) was compared with data from other schemes including those based on compensation data.	Work-related conditions reported by BEACH present a different picture than that based on compensation data as any condition can be included in BEACH, whereas compensation data only includes specific more severe conditions and injuries. Musculoskeletal problems were the most frequent work-related problems reported.	Data from general practice records all categories of work-related ill-health unlike compensation data which includes specific conditions only.	No occupational information collected. Tables in this publication are confusing and do not match facts stated in the main text. Comparisons between schemes are difficult as not set up to measure the same outcomes.
Copeman et al, 1992, Australia (80)	Occupational injury and disease among patients presenting to general practitioners in a community health centre	To determine the number and types of work-related injuries and disease, the causes and details of the workers and workplaces.	All cases presenting at a community health centre in Brisbane during a six month study period were assessed for work-relatedness by practice nurses and then by GPs. Demographic and employment details of the patients were recorded. Injuries were only recorded if it was a new injury; patients with occupational diseases were included if the problem was new or pre-existing, but cases were recorded only once during the six month period.	The average number of consultations was 3.1 per patient. 7.2% of patients were identified as having an occupational disease or injury. 86% of these were male. The majority of the cases were working within manufacturing industries. Musculoskeletal conditions (52%), dermatitis (15%) and respiratory illness (9%) were the most common diseases recorded, while the most frequent injuries recorded were open wounds (28%) and sprains or strains (22%). There was no mention of psychological ill-health being included in the list of conditions.	Identification of work-related conditions in general practice including workplace information. One GP with specialist interest in occupational medicine recorded most of the conditions. Authors suggest this is a result of other GPs under diagnosing these conditions. Accurate identification and recording of occupational disease and injury in general practice is important in efforts to decrease incidence	Study based on a single practice with five GPs in one particular part of the country, therefore possible problems with external validity. Most cases diagnosed by one GP with specialist interest, cases seen by other GPs may have been missed.

Name, Year, Country of Study	Title	Aims	Methods	Key findings	Conclusions and results relevant to thesis	Strengths/Limitations
Haastrup, 1993, Denmark (82)	Occupation-related complaints in general practice on Fyn-occurrence, pattern of notification. A 3-month registration period, 1 September 1989 - 30 November 1989	To illustrate the occurrence of occupational injuries in general practice and the pattern of notification to the national register of occupational diseases.	33 GPs in Funen, Denmark registered all consultations considered to be occupational injuries during a three month period using a multiple choice form.	1.1% of all consultations were recorded as occupational accidents and 0.7% as occupationally related complaints. 37% of conditions were notified.	Occupationally related problems are extensive in general practice and only a minority of these cases were reported to the national register.	Study based in one area of Denmark and therefore may have problems when applying the results to the wider population. Cases recorded over a three month period and therefore may be subject to seasonal variation. Results based on a small number of cases.
Kibsgard et al, 1998, Denmark (83)	Occupational medicine in general practice. A study of the extent and nature of occupational injuries in the county of Ringkjobing	To estimate the occurrence and type of work-related incidents in primary health care in a Denmark county.	114 GPs registered symptom related consultations with patients of working age during four days over one year and evaluated whether the case was work-related.	Of 3017 registered consultations, 479 were work-related (15.9%). Of the total consultations 12% were work-related diseases and 3% work-related injury. The majority of cases assessed as being work-related were musculoskeletal; in addition, of all the musculoskeletal consultations 35% were considered work-related.	Identification of work-related conditions in general practice. Musculoskeletal problems made up the majority of work-related conditions and these physical problems were the conditions most often classified as related to the patients' occupation.	Study based in one area of Denmark and therefore may have problems when applying the results to the wider population. Cases recorded in four different days spread throughout the year to reduce seasonal bias.
Harber et al, 2001, USA (84)	Frequency of occupational health concerns in general clinics	To estimate the frequency of occupational factors in disease and injury.	108 patients in a general health care facility in Los Angeles were interviewed about the frequency and type of workplace-health interactions and their case notes reviewed. Clinical problems were categorised into diagnostic groups and occupations assigned to one of five levels.	66% of the 108 patients interviewed were male. 39% of patients thought that their problem was caused by work and 66% considered their condition to have been made worse by work. Stress was generally considered to worsen rather than cause illness, whereas injuries were more frequently thought to be caused by work. Health problems were reported to have a substantial effect on work, as 13% reported that they had changed their job because of health problems, and 18% had modified what work they did.	Concerns over work-related ill-health are common in general practice, and that the focus should not only be on illness caused by work but also on that made worse by work. The authors stated that training of physicians in general practice is insufficient to enable them to attribute an occupational factor to the patients' ill-health. Further surveillance of occupational ill-health seen in a general practice setting is recommended as existing surveillance and data collection is insufficient, resulting in a severe underestimation in the incidence of cases.	Assessment of work-relatedness was based on the patients opinions not the GPs. The study highlights the poor occupational history taking by GPs but does not state whether these work-related issues were discussed with the GPs in the consultation. Study results are based on a small number of patients (not randomly selected) from a Los Angeles general health care facility which may not be representative of the general population.

Name, Year, Country of Study	Title	Aims	Methods	Key findings	Conclusions and results relevant to thesis	Strengths/Limitations
Hilt et al, 2003, Norway (85)	Illness related to occupational factors encountered in a general practice setting	To examine the extent of illness encountered in a general practice setting that are related to occupational factors and their relation to specific occupational and diagnostic groups.	From December 2000 to May 2001, all patients of working age who visited a rural community medical centre in central Norway were asked to complete a questionnaire about their reason for seeing the GP, occupational status and whether they thought their illness was related to occupational factors.	Of the 412 patients who responded, 46% believed their ill-health was related to work. The problems thought to be related to work were most frequently musculoskeletal (57%), cardiological (10%), respiratory (7%), neurological (6%), psychological (4%) and dermatological (3%). Patients with musculoskeletal problems thought that their problems were related to work most frequently, with 68% of patients associating musculoskeletal disorders with conditions in the workplace.	Almost half of patients visiting a general practice clinic felt their ill-health was related to work. Musculoskeletal problems were the most frequently reported; in addition, of those patients with musculoskeletal problems, the majority attributed their problems to work.	Study based in a single practice in a coastal area of Norway therefore possible problems with external validity to the wider national and UK populations. Decisions about work-relatedness were based on patients opinions not GPs. Once cases are sub-divided by diagnostic categories they are based on small numbers.

1.5.1.3 GPs recognition and knowledge of issues surrounding work and health (Table 1.4)

The lack of occupational health training in general medical education and general practice training is well documented (56;86-88). Issues surrounding GPs' knowledge of work-related ill-health and ability to recognise a work-related condition when presented in clinic is a frequent theme. One of these publications 'Certification of occupational diseases as common diseases in a primary care setting' by Benavides *et al* (89) described a study which collected information on patients with sick leave who had been discharged by GPs in Spain. In Spain (as well as other European countries) the classification of a disease as either occupational or 'common' is crucial, as this determines the kind of compensation and the health care the individual will receive. It also affects whether the case will be included in national work-related ill-heath statistics. When an occupational disease is suspected, the worker will attend a clinic operated by the insurance company, however, apart from these circumstances, when a worker is ill they go to see a GP. As a result, occupational diseases can be incorrectly classified as 'common' as opposed to occupational. The researchers issued an occupational questionnaire to 207 discharged workers who had taken sick leave with diseases classified as 'common', from a 13 GP practice. They were also given access to patients' medical records and
two professionals, an occupational physician and a general practitioner independently reviewed the information for each patient. A third evaluator, also an occupational physician, provided a final assessment in cases where there was disagreement. The two physicians agreed on the probable occupational origin of 30 (of the 207) cases and disagreed on 34 cases. The third evaluator categorised three of the 34 cases as occupational, resulting in 33/207 (16%) cases being defined as occupational. The majority of these cases were musculoskeletal disorders (20/33), while 4/33 were respiratory diagnoses. Of note 74 of the 207 (36%) workers judged their own condition as occupationally related, which is more than double the proportion considered to be occupationally related by the medical practitioners.

This study design incorporates the use of a patient questionnaire and assessment of medical notes. It showed that occupational diseases in general practice are often unrecognised, and that a higher proportion of patients feel that their condition is work-related, than is judged to be so by a physician. The article concludes that diseases are not recognised as occupational due to three reasons; the workers' lack of information about the social security procedures, the physicians' lack of knowledge to enable them to correctly differentiate between occupational and other diseases, and underreporting by insurance companies. It recommends better training for GPs and for GPs to ask about the patient's employment during a consultation. The authors acknowledge that biases occur because the patients questioned had sickness certification, and were potentially at the more severe end of the disease spectrum for the practice populations. This suggests that the number of patients with an occupational disease might be higher than cited here. However, the authors stated that 16% of the cases were judged to be occupational, and that this is much greater than official statistics. These are not stated and it would have been of interest to see this comparison in the publication, however the authors estimated what difference the re-classification of 'common' diseases as occupational would mean in financial terms. Occupational diseases are compensated by insurance companies that may downplay the occupational origin of the disease, and sick leave attributed to 'common' disease is paid for by the social security system. In 1999 occupational diseases cost insurance companies 2,047 million Euros and 'common' diseases cost the social security system 2,738 million Euros. Therefore, if 16% of common disease were certified as occupational this would cost the insurance companies a further 438 million Euros. The study highlights some interesting points, however, as the process involved an occupational physician and a GP in assessing the work-relatedness of the cases it would have been interesting to assess the knowledge and experience of the two physicians who reviewed/evaluated the information by looking at the cases where the two physicians agreed and disagreed about work attribution.

Another study (based in the USA) by Stein and Frank (90) also combined a patient questionnaire with an assessment of case notes. These involved 362 patients being questioned on their perception of the work-relatedness of their ill-health; 38% of these reported current work-related ill-health problems. The notes (charts) of a random sample of 100 of these patients were reviewed, and the authors found that 41 charts had no occupational data recorded, and only five had any record of hazardous exposures. However, 60 of these patients had reported hazardous exposures. The study concluded that an individual commonly perceives work as an important determinant of health status, and that this is often overlooked by family physicians. The introduction of occupational health training in family practice was recommended.

Another study ‘Occupational health in general practice in an industrial area of Singapore’ written by Lee *et al* (91) concentrated on cases of occupational ill-health seen by two different groups of GPs; those who have not had post graduate training in occupational medicine (GPs) and those who have (GP-OMs). The study aimed to estimate the caseload of GPs in an industrialised area of Singapore, the proportion of those who were factory workers, and the numbers diagnosed with an occupational disease. The researchers also asked participating GPs to complete a brief assessment on their knowledge of occupational medicine. In total, 74 GPs were sent a questionnaire asking them about patients seen in the three months prior to the survey; the response rate was 89%. There was no significant difference in caseload between the two groups of doctors (GPs and OM-GPs), and in both groups the majority of GPs thought that the proportion of factory workers they saw with work-related ill-health was less than 10%. This study does not attempt to look at differences between how GPs and GP-OMs assessed work-relatedness, but it does say that GP-OMs scored better in the assessment of the occupational health knowledge (compared to GPs). The authors note that the study was dependant on recall bias, and recommend a prospective study with strict criteria of what constitutes a work-related illness.

Researchers in the USA found that lack of time was as important as inadequate knowledge when studying barriers to recognising occupational disease (92). Harber *et al* questioned 136 physicians in three groups (primary care, ‘occupational medicine-orientated’ and ‘Mexican’) about four possible barriers to recognising occupational disease. These were knowledge, time, unpleasant aspects (e.g. legal aspects and extra paperwork) and importance of occupational factors. Results showed that lack of time was as important as lack of knowledge, and these factors were generally comparable for primary care and ‘occupational medicine-orientated’ physicians. However, the ‘occupational medicine-orientated’ physicians felt that unpleasant aspects and lack of importance were more important than the primary care clinicians, perhaps a result of the greater experience in dealing with these issues. The authors conclude that increasing training in occupational medicine is not sufficient unless time constraints are overcome, to allow sufficient occupational histories to be taken in clinic and site visits. If it is not possible to take complete occupational histories for all patients, targeted brief occupational histories were recommended.

A study in the Netherlands aimed to describe the management of workers with certified sickness absence due to mental health problems by GPs and OPs, and to determine agreement in diagnosis, main cause of sickness absence and obstacles to return to work (93). Since 1998 employees in the Netherlands not only have their own GP, but also their own OP. This involved a cohort of 555 employees being interviewed about their mental health, and contacts with their GP and OP. Of particular interest, these employees were asked if they would give permission for the researchers to speak to their physicians; 72 GPs and/or OPs were interviewed. These included 26 cases where the GP and OP of the same employee were questioned, enabling direct comparisons of diagnosis and management. Although this study is not describing the difference between two types of GP (with and without occupational health training) the results highlight how physicians with this training differ to those without. According to the patients, GPs applied medical interventions such as referrals and prescriptions, but seldom asked about working conditions and therefore work-related interventions never applied. Perhaps unsurprisingly, OPs talked more often about working conditions, and most interventions applied by OPs were work-related interventions. The GPs and OPs interviewed who were physicians for the same employee showed poor agreement in diagnosis, the main cause of sickness absence and obstacles for return to work. For example, OPs more often reported overstrain/burnout, while GPs more frequently reported depression, and GPs mentioned the patients' personality and the nature of their ill-health as a barrier to return to work, whereas OPs mentioned conflict at work. The authors concluded that there is a lack of attention in the medical management by GPs to working conditions and work-related interventions, and that GPs feel the cause of sickness absence was much less likely to be due to working conditions and conflicts and more likely to be attributed to the disease and the personality of the patient. These findings suggest that if a GP does not discuss working conditions in patients with sickness absence due to mental ill-health problems, they might also miss a case of work-related mental ill-health when presented to them in clinic.

It seems surprising that GPs do not discuss working conditions with patients, particularly in relation to physical diagnoses such as musculoskeletal disorders. Other studies have shown that musculoskeletal disorders are the conditions most likely to be considered work-related by both GPs (83) and patients (85). A study by Weevers *et al* based in the Netherlands aimed to describe the communication about work-related issues between GPs and patients (who were actively employed) when consulting about a musculoskeletal problem (94). This study constituted a descriptive analysis of videotaped consultations which were systematically observed, and coded into specific categories. This method has advantages over other questionnaire based studies as the consultation is recorded as it happens, therefore eliminating recall bias. In addition, other studies with questionnaire based methodology may influence the outcome, by forcing the respondent to think about work when they may not have done so unprompted. For consultations in which work was discussed, communication characteristics about work were scored using eight questions. The questions covered issues such as; who initiated the discussion about work, how many times was work mentioned in the consultation, the influence of work on the disorder, the influence of the disorder on work and sickness absence/return to work. Work was discussed in a third (227/680) of the consultations, and in 69% of these consultations, it was the patient that brought up work-related issues. The authors concluded that work is not a standard topic of conversation in GP consultations, however discussion about work is important for early intervention and return to work, since the GP is often the first physician in contact with the patient.

Table 1.4. **GPs recognition and knowledge of issues surrounding work and health - *Literature review summary table***

Name, Year, Country of Study	Title	Aims	Methods	Key findings	Conclusions and results relevant to thesis	Strengths/Limitations
Benavides et al, 2005, Spain (89)	Certification of occupational diseases as common diseases in a primary care setting	To estimate the proportion of occupational diseases mis-classified as common diseases by GPs at a primary health care centre in Barcelona.	In Spain diseases are classified as occupational or common and this determines the sort of health care and compensation received. An occupational questionnaire was issued to 207 workers on sick leave due to diseases classified as common from a 13 GP practice. A GP and an OP reviewed these questionnaires and patient case notes and a second OP evaluated the information where there was a disagreement.	The GP and the OP agreed on the occupational origin of 30 cases and disagreed on 34. The third evaluator categorised three of the 34 cases as occupational, resulting in 33/207 (16%) cases being defined as occupational. The majority of these cases were musculoskeletal disorders (20/33). Of note, 74 of the 207 (36%) workers judged their own condition as occupationally related.	A significant proportion of cases are not recognised as occupational in a general practice setting. Patients consider their own ill-health as related to work more frequently than medical practitioners. Authors recommend better occupational health training for GPs.	Study took place in a single practice in Barcelona. Patients were on sick leave therefore the cases are likely to be more severe. Study biased due to seasonality; a number of the cases were upper respiratory tract infections, if these were eliminated the proportion considered occupational would be higher.
Stein et al, 1985, USA (90)	Patient and physician perspectives of work-related illness in family practice	To assess patients' perception of the work-relatedness of their illness in comparison to data recorded in patient notes.	362 patients in a family practice were asked, via a questionnaire, whether their current health problem was related to their occupation. A sample of 100 of these patients' selected at random had their case notes reviewed.	38% of patients felt their health problem was related to work. 41% of the 100 case notes reviewed had no occupational data recorded and only 5 had a record of hazardous exposure. 60 of these patients had reported hazardous exposures at work on the questionnaire.	Individuals often report occupation as an important factor in health status, but this is often overlooked by family physicians; further training is recommended.	The study took place in a single practice. This research may be subject to observational bias as patients may be more likely to think of their problems as work-related as they were being asked to consider that this might be the case whereas the GPs had not had this asked of them when they completed the case notes.
Lee et al, 2001, Singapore (91)	Occupational health in general practice in an industrial area of Singapore	To estimate the case load of work-related medical cases in factory workers and to survey knowledge and attitudes to occupational medicine among doctors in an industrial area in Singapore.	74 GPs in this area of Singapore were sent a questionnaire asking demographic details, information about overall case load, the number of factory worker consultations and the number of occupational health cases. GPs were also asked questions to test their knowledge of occupational medicine (OM).	66/74 GPs responded. 42 (64%) of these had no post-graduate training in OM (GPs). 36% had undergone such training (OM-GPs). The GPs had greater proportions of younger and female doctors than the OM-GP group. There was no significant difference regarding case load, factory workers and occupational health cases seen. OM-GPs scored better in the OM knowledge test.	The authors conclude that these results illustrate the need for improved OM training for GPs and recommend prospective study of work-related ill-health cases seen in general practice.	This study is confined to one particular industrialised area of Singapore and confined to factory workers and therefore may not be generalisable to all workers. It is also dependant on the recall bias of the GPs to estimate the number of factory workers seen and the proportion of OM cases which cannot be taken as a measure of incidence in the population.

Name, Year, Country of Study	Title	Aims	Methods	Key findings	Conclusions and results relevant to thesis	Strengths/Limitations
Harber et al, 2001, USA (92)	Time and knowledge barriers to recognising occupational disease	To identify the specific barriers to occupational disease recognition in clinical practitioners.	A questionnaire was developed to ask physicians about their perceived barriers to the recognition of occupational health. This was presented as a series of scaled statements about possible barriers ranging from strongly disagree to strongly agree. Three groups of physicians were questioned; GPs attending a CPD session, Occupational Health (OH) physicians and Mexican OH physicians.	Factors were grouped into four main categories; knowledge, time, unpleasant aspects (e.g. legal aspects and extra paperwork) and importance of occupational factors. Lack of time was as important as lack of knowledge, and these factors were generally comparable for primary care and 'OM-orientated' physicians.	Increasing training in OM is not sufficient unless time constraints are overcome, to allow sufficient occupational histories to be taken. If it is not possible to take complete occupational histories for all patients, targeted brief occupational histories were recommended.	The authors state that the GPs were attending a non-occupational health CPD session and that this was not likely to influence results, however it was not known if these GPs had any vocational OH training.
Anema et al, 2006, The Netherlands (93)	Medical care of employees long-term sick listed due to mental health problems	To describe medical management by the GP and OP of workers sick listed due to mental health problems.	A cohort of 555 employees sick listed for 12-20 weeks due to mental health problems were recruited and followed for a year. For 72 of these, the GP and/or OP of the patient were interviewed. Of note for 26 employees both the GP and the OP were interviewed.	Patients felt that GPs applied medical interventions such as referrals and prescriptions, but seldom asked about work. OPs talked about working conditions and applied work-related interventions. The GPs and OPs interviewed who were physicians for the same employee showed poor agreement in diagnosis, the main cause of sickness absence and obstacles for return to work. OPs more often reported overstrain/burnout, while GPs more frequently reported depression.	GPs rarely discuss working conditions during consultations with patients sick listed due to mental ill-health problems and are therefore likely to miss a work-related problem associated with the patient's ill-health. Agreement in medical diagnosis between GPs and OPs was poor.	This study benefits from the fact that in the Netherlands every employee has a GP and an OP, therefore direct comparisons can be made, however these were based on just 26 cases. It is also beneficial that the large cohort was derived from 7850 employees selected from social security data and not from a single region. These results may be affected by selection bias as a patient can choose which physician they preferred to visit.
Weevers et al, 2009, The Netherlands (94)	Communication about work between general practitioners and patients consulting for musculoskeletal disorders	To describe the communication about work-related matters between the GP and employed patients consulting for musculoskeletal disorders.	This study constituted a descriptive analysis of videotaped consultations which were systematically observed, and coded into specific categories. Questions covered issues such as; who initiated the discussion about work, how many times was work mentioned in the consultation, the influence of work on the disorder, the influence of the disorder on work and sickness absence/return to work. GPs rated the work-relatedness of the condition by scoring 1-5.	Of 680 videos where patients were discussing musculoskeletal problems, work was discussed in a third of the consultations, and in 69% of these, it was the patient that brought up work-related issues. The mean consultation length was 11.4 minutes. The extent to which the GP rated the condition as work-related was significantly correlated with the number of utterances made on work-related matters.	Work is not a standard topic of conversation during a GP consultation. Authors recommend education to encourage GPs to ask about a patients' work.	This study benefits from the large number of consultations analysed, applicable to most Dutch GPs. This method had advantages over questionnaire based studies as it eliminates recall bias. In addition, other studies with questionnaire based methodology may influence the outcome, by forcing the respondent to think about work when they may not have done so unprompted. However errors may have occurred when coding the interaction between the patient and GPs.

1.5.1.4 Systematic review

A systematic review by Weevers *et al* entitled 'Work-related disease in general practice: a systematic review' (95) had three main aims. These were to find information on the prevalence of potentially work-related diseases in a general practice population, the incidence for consulting a GP with a potentially work-related disease, and the relationship between diseases seen in general practice and work ability. Cochrane Standards and QUOROM principles had been used to review the published literature and the authors had also searched personal archives. A crude selection was carried out by the first author based on information in the title and abstracts, with the final selection made by the first and second authors after reading the full text, according to the following criteria:-

- The patients were of working age and in a GP population
- The disease should be work-related
- The publication should be a full report written in English or a Germanic language

The quality of the publications was assessed and scored (with + or -) using four criteria.

- The study population - general practice population and of working age
- The type of study – cross-sectional, retrospective cohort, prospective cohort
- The outcome assessment - based on self-reports, consultation, medical records
- The outcome definitions – prevalence or incidence rate calculated by authors or the information published within the article can be used to calculate rates

A study scoring three + or four + was considered to be of high quality;

The initial search produced 2701 results; 80 were chosen for the second stage and 21 for the final selection (plus one from the author's archives) resulting in 22 studies in all. Five of the studies looked at the prevalence of potentially work-related diseases in the general practice population, 13 addressed the prevalence and/or incidence of consulting a GP for a potentially work-related disease, five investigated the relationship between diseases seen in general practice and work ability, and a further two studies were based on patients' perspectives of the work-relatedness of their illness (some studies covered more than one area). There was 82% agreement on the scoring of the studies between the two main authors, with eight studies marked as three + or more, and were therefore considered to be of high quality.

The questions addressed by this systematic review were defined very precisely, and covered areas relevant to work-related ill-health in general practice. The authors admit that the initial search of the 2701 titles and abstracts was a crude one which is understandable considering the practicalities of handling the number of papers involved. Three databases were used in the search methodology, giving good coverage of the literature. Cochrane standards and QUOROM principles were used, ensuring that the search followed well-established principles. This systematic review was unable to answer in detail the questions posed (on prevalence and incidence of work-related disease seen in general practice) due to the lack of published information available. The eight high quality studies covered either asthma or musculoskeletal disorders; other diseases were not covered by the papers scored as high quality in the terms specified in the review.

Of the 22 studies highlighted in the Weevers review, all except one (found through a search of the authors' archives and written in Dutch) were included in the results of this search of the literature. Some have already been discussed however many were not considered entirely relevant. The Weevers review had a number of aims, of which only one, 'the incidence for consulting a GP with a potentially work-related disease' is directly related. The authors found 13 papers that were 'on the prevalence and/or incidence of consulting a GP with a potentially work-related disease', however the majority of these studies were not considered (in this review) to meet this criteria. Most of these 13 studies gave a measure of prevalence of disease (most frequently low back pain) based on questionnaires sent to a practice population (as opposed to GP consultations) (96) or involved cases that were not specifically work-related (62;67-69;97;98).

Weevers *et al* stated that they expected to find a wide range of scientific evidence on the subject of work-related ill-health in general practice, however they found a limited amount of research and two thirds of the studies selected were judged to be of low quality in the review. In addition, due to the differences in study design and definitions, outcome measures were difficult to compare. Comparisons between studies were also difficult due to international differences in social, legal and economic situations and the classification and compensation of work-related diseases. Studies included in the review reported high prevalence rates of work-related ill-health, with one third of the patients consulting GPs believing their illness to be work-related, however estimates by Harber *et al* and Stein *et al* (described in more detail in section 1.3.1.2) were based on the patients' opinion and not as a result of a consultation with a GP (84;90). The systematic review also found that one-year incidence data of lower back pain was reported in three studies but these were not specifically work-related (67-69;97). The publications also demonstrated that, despite patients' perceptions, few GPs took into consideration the work-related exposures of the disease. GPs have an important role in identifying and managing work-related ill-health and the authors recommend more occupational medicine training for GPs and improved communication with patients about issues surrounding work and health. In conclusion, Weevers *et al* felt that the review highlighted the need for further studies on work-related disease in general practice.

1.5.2 Sickness absence

1.5.2.1 Work-related sickness absence

The main source of information on work-related sickness absence is the SWI. This gives data on working days lost by variables including age, gender, type of ill-health, occupation and industry (31). In the 2010/2011 SWI survey, rates were higher for females than males (1.11 and 0.83 average days per worker respectively). Rates also increased with age group, with 16-24 year olds having a rate of 0.26 days per worker, and the 55 plus age group having 1.31 days per worker. Cases of work-related stress, anxiety and depression had a slightly higher rate of work-related sickness absence than musculoskeletal disorders (0.46 and 0.32 days respectively). 'Transport and mobile machine operatives' had the highest rate when analysed by occupation (1.55 days) and 'scientific and technical occupations' had the lowest rate (0.35 days). Analysis by industry showed that employees working within ‘human health and social service activities’ had the highest rate of work-related sickness absence (1.39 days), whereas those working within ‘accommodation and food service activities’ had the lowest rate (0.47 days). As illustrated in these figures, the SWI gives extremely useful and easily accessible information, however the information is based on self-reports and may not be based on medical opinion (such as that provided by a GP). SWI information is subject to recall bias, as the responder is asked to remember days lost from work in the previous 12 months.

1.5.2.2 The role of the GP

As well as being the first port of call when an individual feels unwell, in the UK GPs issue sickness certification after one week of a patient self-certifying sickness absence. Employees require a ‘Statement of Fitness for Work for Social Security of Statuary Sick Pay’ to enable them to remain away from work without losing pay, at least in the first six months of illness (99). As mentioned previously, prior to April 2010 GPs signed patients off from work; after this date a new sickness certificate was introduced (the ‘fit note’) enabling GPs to recommend tasks that a patient is capable of performing in the workplace, in order to help an individual remain within the working environment (22).

GPs are often described as having a ‘gatekeeper’ role, pertaining to the fact that a patient needs to visit a GP to gain access to other health services including specialist or community based care (e.g. hospital specialists and physiotherapy services), prescription medication and sickness certification (100;101). Sickness certification is a task frequently performed by GPs, and as gatekeepers to patients’ benefits GPs feel there is a difficult balance between helping the patient remain in the workplace whilst maintaining the doctor-patient relationship (102;103). GPs’ consideration of their gatekeeper role to the benefit system may lead them to resist issuing certification to patients. A qualitative study conducted in Norway investigated GPs’ opinions of their gatekeeper role after the introduction of a new patient-list system in 2001. In this patient-list system patients registered with a specific GP rather than a practice as a whole. It was thought this system would be more likely to prevent patients from ‘shopping’ between GPs to gain referrals and other services. This study found that GPs perceived themselves as less concerned about their gatekeeper role under this new system as they were more individually responsible for an individual patient's care and the health of the GP-patent relationship (104). Conversely, in the UK, a new GP contract introduced in 2004 meant that patients changed from being registered with an individual GP to a practice based registration (105). The findings of this Norwegian study therefore suggest that GPs may have become more aware of their gatekeeper role with a weakening of the GP-patient relationship. In addition to these considerations, GPs also feel the lack of training in sickness absence and return to work issues, at both undergraduate and postgraduate level, adds to the difficulties surrounding this task (106;107).

Over recent years there has been increased awareness of the importance of reducing the levels of sickness absence associated with benefits to patients' health and financial costs to the individual, employer and economy as a whole. In order to reduce the burden of sickness absence it is necessary to collect information to identify sectors of the public most at risk, and to adopt an evidence based approach to prevention. Most of the sickness absence research has been conducted in Scandinavian countries, where the welfare and certification systems differ significantly to those in the UK (24;108;109), and researchers have access to large datasets of sickness absence and benefit information (110). In the UK sickness absence information is more difficult to access as there is no routine method of systematically recording this information in general practice (111). As highlighted by Dame Carol Black's review in 2008 (22), the current system is paper-based and this has resulted in a lack of robust information on the number of sick notes issued and what they are used for.

A systematic review of sickness certification in European primary care (108) aimed to review the published literature which reported rates of sickness absence in general practice in Europe. The authors identified 11 papers that met the criteria defined in the review, the majority (6 studies) of which were from studies based in Scandinavia. Others were two studies from the UK, and one each from Spain, Switzerland and Malta. The authors found that comparison between countries was difficult, with variations in sickness absence policies for issues such as the period permitted for self-certification and benefit payments. The Maltese study (112) had the highest rates of certification, however Malta has the shortest period of self-certification allowed before a certificate is required from a GP. It was also found that, in general, the longer the employer pays benefit before the responsibility is passed over to a state funding body, the higher the rates of absence. Studies also used different outcome measures, based on different denominators. Rates were measured in three different methods; the number of certificates per person, the number of certificates per 1000 persons per year, or certificates per 100 consultations. Comparisons were therefore difficult, not only between countries but between studies from the same country, and the authors concluded that standardised reporting and a system that enables comparison across Europe would be beneficial for health and economic planning. These results concur with an earlier (non systematic) review by Tellnes (113), which also identified problems with comparability of sickness absence rates because of different methods, outcome measures and denominator. Tellnes also highlighted problems in drawing comparisons between studies from different countries, attributed to variations in diagnostic procedures and benefit legislation.

1.5.2.3 Sickness absence studies (Table 1.5)

There has been a lot of research on various aspects of sickness absence with data collection methods including self-report questionnaires and studies of workplace sickness absence records (or a combination of both these methods). Some of these studies examine how sickness absence rates differ with work-related factors. One of the best known sources of information in the UK based on workplace sickness absence records is the annual survey by the Confederation of British Industry (CBI) (25). The 2011 survey (reporting on sickness absence data for 2010) questioned 223 human resources (HR) practitioners and managers about approximately one million employees' sickness absence (described as 4.1% of UK employees). It also gives estimates of the financial costs of the absence to the economy (£17 billion in 2010). The average rate of absence per employee was 6.5 days costing £760; the costs per employee in the public sector averaging 46% more than in the private sector. Responders are asked to identify the three main causes of sickness absence in their organisation; non-work-related illness or injury and post-operative recovery were the most frequently reported reasons given, however work-related illness or injury was stated as the third most frequent reason (in 36% of manual workers and 16% of non-manual workers).

Results from this study are often cited, and the CBI itself purports that it “is an authoritative source of long-term data on trends and absence rates”. However, although some background is given about the survey (and its representativeness), there was no real information provided (in the published text or upon request) about sampling, response rates or other methodological procedures. It has been reported that response rates are low (circa 4%) and that a lack of sample weighting reduces comparative validity and reliability (114;115). In addition, comparison with other data suggest financial estimates may be underestimated; results from the CBI state that 26% of sickness absence is attributed to work-related ill-health and injury, however the HSE estimate the cost of solely work-related sickness absence as £14 billion in 2009/2010 (116), which is 82% of the £17 billion total burden estimated.

The on-going Whitehall II Study (117) is a large prospective cohort study of over 10,000 British civil servants aged 35 to 55. The aim of the study is to investigate the relationships between work, stress and health. A report based on this study commissioned by the HSE to examine work-related factors and ill-health (118) found that high levels of control, job demands and support at work were associated with lower rates of absence, and that ‘high decision authority’ was associated with a lower risk of both short and long periods of absence. Another publication based on the Whitehall cohort, by Head *et al* (119), found longer spells of sickness absence were associated with adverse change in decision latitude, change in psychosocial characteristics of work environment and increased levels of job demand. These studies relied on self-reported questionnaires for the information on work-related factors, and obtained the sickness absence information from HR computerised records.

Sickness absence information is also collected as part of the LFS, and reports are published by the Office for National Statistics (ONS) (120;121). The survey asks respondents whether they took days off because of sickness or injury in the reference week; this is usually the week before the interview. Statistics for 2011 showed that the main reasons for sickness absence are minor illnesses such as colds, sickness and diarrhoea with 33% of employees taking at least one day off sick attributed to these ailments during the year. Of the remaining ill-health categories, men have time away from work attributed to musculoskeletal problems such as back pain (8.5% of males and 5.9% of females) whereas women are more likely to have sickness absence attributed to stress, depression and anxiety (3.6% of males and 7.7% of females). The report also showed that rates are higher in the public sector than within the private sector (3.1% of those in the public sector were absent from work compared to 2.3% of employees within the private sector). As these data are only collected during the LFS reference week, they do not account for the total length of absence, as it can only record absence lasting for a maximum of seven days. The 'National Statistics feature' report on sickness absence from work in the UK (14) stated that although the LFS data cannot measure long-term absence, this only accounts for 5% of all sickness absence but is responsible for approximately a third of the total days lost. Information from these data can, however, produce sickness absence rates by calculating the proportion of employees that took at least one day off sick in the reference week and compare these rates by factors such as demography and employment sector.

A study based in Spain used computer files from the HR department of a bus company to investigate sickness absence (122). Researchers found highest rates in 'assistant staff' and bus drivers, with all occupational categories having significantly higher sickness absence rate ratios compared to rate ratios for employees in the managerial category. The authors conclude that occupational category is an important predictor of sickness absence for common diseases, and recommend further research on the association between working conditions and sickness absence. Furthermore they state that research needs to take into account the difference between sickness absence due to work-related conditions and that due to common diseases. Another study using a self-reported questionnaire and absence records was undertaken by Andrea *et al* in the Netherlands (123). The study population was selected from the Maastricht Cohort Study, a large on-going prospective study that was set up to examine fatigue in the working population. Study participants were selected who were still in work and who had visited their OP and GP in the last four months in relation to work. Sickness absence data was collected from company records and occupational health services. Of the 11,229 employees who responded, 1,723 (15.3%) had visited either their GP or OP in relation to work issues; complete sickness absence records were obtained for 1,271 of these. The study showed that long-term sickness absence was predicted by the presence of at least one long-term disease and level of ‘decision latitude’ (decision authority/level of control and skill level). The authors concluded that GPs and OPs should take these factors into consideration in identifying employees at risk of long-term sickness absence.

Table 1.5. Non-GP based sickness absence studies - Literature review summary table

Name, Year, Country of Study	Title	Aims	Methods	Key findings	Conclusions and results relevant to thesis	Strengths/Limitations
CBI, annually, UK (25)	The absence and workplace health survey	To assess (each year) the levels and costs of sickness absence (SA) within the UK workforce based on human resources (HR) records.	Conducted in January and February each year, respondents are asked to report absence data for the previous 12 month period.	In 2011 responses were received from HR practitioners and mangers from 223 organisations, including approximately one million employees. Average SA rate was 6.5 days per employee. Rates were highest amongst manual workers and amongst public sector workers. Work-related illness and injury was the third most frequent reason given for a period of absence. The financial cost of absence was estimated as £17billion.	Work related ill-health and injury are frequently (26%) attributed to periods of absence. Rates are highest amongst public sector workers. Mental health problems (non-work-related) are the primary cause of long-term absence.	A detailed description of methods used were not accessible, however it has been reported that response rates are extremely low (around 4%) and that a lack of sample weighting reduces the comparative validity and reliability of the survey.
Head et al, 2005, UK (119)	Influence of change in psychological work characteristics on sickness absence: the Whitehall II study	To study the influence of change in self perceived psychological work characteristics on subsequent rates of SA.	Civil servants aged 35 to 55 working in London offices were invited to participate in the Whitehall II study. 10,308 participants attended a screening examination and completed a questionnaire (phase one, 1985 to 1988). A further postal questionnaire was administered in 1989 (phase two) and another screening examination took place in 1991 to 1993 (phase three). Questionnaires asked about work characteristics and SA records were obtained from civil service pay centres.	SA information and baseline data were available for 3,817 employees who completed each phase of the study and were still working as civil servants. Adverse change in decision latitude predicted subsequent long spells of illness. A decrease in job demand was associated with reduced risk.	Adverse change in psychosocial work environment may lead to increased rates of SA.	Large cohort of civil service workers, therefore benefits from strength of large sample size although data may not be applicable to other industries due to differences in SA policies and workplace stressors. The study benefits from questioning the employees over a number of time periods, not only because it studies the effect of change in employment characteristics but also the responder repeats the questionnaire and therefore the answers are likely to be more reliable.
LFS data, annually, UK (120)	Sickness absence from work in the UK	To collect information from LFS respondents on whether they had taken SA in the reference week of the survey.	The LFS is carried out quarterly (around 120,000 respondents) and annually (around 340,000 respondents) on a random sample of households in the UK. In this questionnaire people are asked whether they took days off work because of sickness or injury in the reference week (week prior to interview).	In 2011 the main reasons for SA were minor illness, with 33% of employees taking at least one day off. Men more frequently have time away from work due to musculoskeletal problems and women due to mental ill health. SA rates were highest in public sector workers.	These data illustrate the difference in SA rates between sectors of the work force and within age and gender.	LFS SA data can only measure short time sickness absence as it is only taking data from a one week period. However it benefits from the fact that there will be little recall bias as the respondent is questioned about the week immediately prior to interview, In addition the LFS is a large survey with rigorous sampling and weighting methods to make it representative to the whole of the UK.

Name, Year, Country of Study	Title	Aims	Methods	Key findings	Conclusions and results relevant to thesis	Strengths/Limitations
Benavides et al, 2003, Spain (122)	Occupational categories and sickness absence certified as attributable to common diseases	To assess the relationship between occupational categories and SA due to common diseases in urban bus company workers.	Data from a cohort of 2,909 workers from a urban bus company in Barcelona between 1994 to 1996 were analysed. This included SA information attributed to common (not work-related diseases) of three days or more. Occupations were classified into eight categories including bus driver, administration and managers.	Assistant staff and bus drivers had the highest SA incidence rates. The managerial category had significantly lower SA rates than all other occupational categories. Females had higher rates than males.	Occupational category was found to be an important predictor of SA even though these results were shown in non-occupationally related diseases.	This study was conducted in a large cohort, but results were within bus company workers and therefore may not be generalisable to the wider population. Previous work by these authors have shown (89) that common disease may be frequently misclassified as common and it is stated that associations between SA and occupational categories for work-related diseases were clear in their data although this was not shown in the paper.
Andrea et al, 2002, The Netherlands (123)	Health problems and psychosocial work environment as predictors of long term sickness absence in employees who visited the occupational physician and/or general practitioner in relation to work: a prospective study	To determine whether psychosocial work environment and indicators of health problems are related to long-term SA in employees who visited GPs or OPs in relation to work.	The study population was selected from the Maastricht Cohort Study, a large prospective cohort study about fatigue at work collecting data from employees of 45 employers. Study participants were those who said (on a administered questionnaire) that they had visited a GP or OP in relation to work during the four months prior to baseline. Information on periods of absence was collected from company offices.	Of the 11,229 employees who responded, 1,723 (15.3%) had visited either their GP or OP in relation to work issues; complete SA records were obtained for 1,271 of these. The study showed that long-term SA was predicted by the presence of at least one long-term disease and level of 'decision latitude'.	The authors concluded that GPs and OPs should take these factors into consideration in identifying employees at risk of long-term SA.	This study benefits from being part of a large prospective cohort study, however the authors admit there was a 'considerable amount' of missing SA data as not all companies were able to deliver this information. However, participation bias was tested and found to be inconsequential therefore it was concluded that any bias would be small and non-differential.

1.5.2.3.1 Work-related sickness absence in general practice

There were a number of publications specifically studying sickness absence as seen in general practice. Many of these were qualitative, investigating GPs' and patients' attitudes to issuing sickness absence certificates and also some quantitative studies examining rates of sickness absence certificates issued by general practitioners in relation to patient factors such as ill-health, gender and (some) occupational information. However, the literature search did not find any studies that aimed to look specifically at the burden of sickness absence resulting from work-related ill-health and injury. Although not specifically based on work-related sickness absence, the published studies on sickness absence in general practice give insight into GPs' behaviour and patient-related factors that affect how individuals take time away from work.

1.5.2.3.2 General practitioners' views on sickness absence (Table 1.6)

Studies examining general practitioners' views on certifying sickness absence include qualitative studies by Hussey *et al* (103) and work carried out for the DWP by Hiscock and Ritchie (102). Also exploring GPs views on these issues are two papers by Wynne-Jones *et al;* one being a quantitative cross-sectional postal survey (124) and another systematically reviewing 'What do GPs feel about sickness certification?' (125). Some common themes are discussed, such as the GP-patient relationship, the GP role as certifier of absence and contradictory demands from other stakeholders in the GPs' 'gatekeeper' role. Hiscock and Ritchie reported that although some GPs found it straightforward, more often GPs found judging whether a patient is fit for work a highly complex process. A number of factors influenced the assessment of incapacity including patients' behaviour and busy surgeries, resulting in time pressures. A combination of these can lead to a GP feeling that it is easier to 'just sign' than be drawn into a lengthy discussion with a patient. They also reported more difficulty in assessing conditions such as back pain or anxiety, which are more subjective than conditions such as dermatitis, and are difficult to measure. As well as GP-patient relationships, GPs also found the lack of access to specialist and occupational advice was an additional difficulty in the decision making process in absence certification. The paper by Hussey *et al* also discussed the GP-patient relationship, and conflict with other stakeholders in the system such as the DWP. Most participants believed that their responsibility was primarily to the patient, and felt that sickness certification endangered the relationship with the patient. One GP stated that a patient didn't come back and see him/her for 10 years after the GP refused to issue a certificate. The researchers found that knowledge of the sickness certification system was poor, along with a lack of interest in this area. The GPs admitted they often use vague diagnoses such as 'debility' and even 'TALOIA' ('there's a lot of it about'), and illegible hand writing due to an uncertainty of what to write and their wish to preserve patient confidentiality. GPs also commented that statistics resulting from sickness certificates were meaningless because of these issues. About half the GPs wished their role as certifier was removed, and taken over by some other authoritative individual within the healthcare system. The systematic review which concentrated on conflict (with patients and other stakeholders), role responsibility and barriers to good practice, found similar views in GPs throughout Europe.

Wynne-Jones *et al* elicited GPs' views on the sickness certification process by means of a quantitative cross sectional postal questionnaire study (124). This involved a random sample of 2000 GPs being sent questionnaires throughout the UK, and an additional 154 questionnaires to GPs within the researchers' local Primary Care Trust (PCT) (Stoke-on-Trent). The questionnaire asked about demographic details and three broad topic areas; their certification practice (e.g. number of certificates per week, whether they ask the patient about work, the most common conditions), training in sickness certification, and their opinions on the sickness certification system. In total, 878 questionnaires were returned (a response rate of 42%), and over half of respondents were male (54%). GPs undertook an average of 7.2 sessions per week and issued a mean 10.3 certificates per week, with a wide range of certificates issued (1 to 120 per week). Female GPs reported issuing significantly fewer certificates than male GPs, and GPs who qualified after 1991 also issued fewer certificates (as compared to GPs who qualified before this date). The majority (55%) usually issued a two week length of absence most frequently. Psychological conditions such as depression and anxiety were most likely to result in certificates being issued followed by musculoskeletal conditions. Most (71%) physicians said the patient initiated the conversation about having time away from work and 62% of the GPs stated they always raise the issue of work in a consultation. Three quarters of responders said they had no training in sickness certification, and of those who had, 95% felt that the training helped them to issue certificates more appropriately. GPs were also asked if they felt they were the right people to be issuing certificates, opinions varied; 76% thought that GPs should issue some, 14% said none and 9% said GPs should be responsible for all certification. The authors conclude that the study highlights the lack of sickness certification training, the issues faced during consultations resulting in sickness certification and opportunities to improve the system (including contributions by other health care professionals).

This is a comprehensive study based on a large sample of GPs, which is an important indicator of the reliability of its interesting findings. The authors admit that recall bias may be an issue, and with a response rate of 42% there may be non-response bias; they recommend caution regarding generalisability to the UK population. In addition, the responders were over represented by female GPs, and as they issue statistically significantly fewer certificates, this may have influenced the results. Along with the 2000 randomly sampled GPs 154 local PCT GPs were targeted. This was presumably because it was thought that local GPs might be more likely to respond, so it was interesting to note that response rates were the same for both groups who were sent questionnaires. This PCT may be slightly over-represented but the authors state there was no difference in responses to individual variables when compared to the national sample. The questionnaire was developed and sent out at a similar time to the publication of ‘Working for a Healthier Tomorrow’ (22), which recommended the introduction of the ‘fit note’. It would be interesting to investigate the respondents’ thoughts about these plans or even their thoughts following the introduction of the ‘fit note’.

Some of the findings of Wynne-Jones *et al’s* study differed to those reported in a study based in Germany (126). This involved 14 general practitioners being surveyed on two days (a Thursday and the following Monday) by structured questionnaire for each patient consultation. It was found that 40% of consulting patients were issued with sickness certification, and this was significantly higher on a Monday than a Thursday. Patients presenting with digestive, musculoskeletal, cardiovascular or skin problems had the highest probability of being issued with sickness certification, however, consultations for psychological problems were not mentioned. Of particular interest, in most instances (154/178 (86%) the doctor initiated the sickness certification process, which seems extremely high in view of other study findings (127;128). However, this study involved a small number of GPs, on just two days, in a particularly area of Germany, and the authors concede this.

1.5.2.3.3 Sickness absence reported by general practitioners (Table 1.7)

Scandinavian countries have been the leaders in research in sickness absence, and one of the most frequently cited researchers is Gunnar Tellnes who has been publishing work on sickness absence and general practice for 30 years. Three of his studies most relevant include two based on the same four week study period in Buskerud, Norway in 1985. One study aimed to investigate the 'Inter-doctor variation in sickness certification' (19) and another the 'Incidence of sickness certification' (128). The first study describes the analysis of 2,999 persons certified sick by 107 GPs. The GPs were questioned about their attitudes to sickness certification, however researchers found no association between the responses to these questions and the duration of absence issued on certificates. The most interesting finding was that the duration of absence was significantly longer in patients issued certification by the oldest doctors (agreeing with findings by Wynne-Jones *et al* (124)), and that GPs working part-time as industrial medical officers issued statistically significantly shorter periods of absence. The latter finding suggests that a difference in knowledge and training may influence GPs' behaviour when issuing sickness certificates, helping to keep patients at work.

The second of Tellnes' papers describes an analysis of all certificates registered with the Insurance Offices who deal with sickness benefit in Norway (128). The first diagnosis stated in the certificate of working age persons was considered as the reason for sickness certification. During the four week study period, 5,042 certificates were registered. Most (81%) were issued by GPs, with other physicians issuing the remainder including hospital specialists/occupational physicians. The incidence rate of sickness certification was calculated as 580 per 1000 employed persons per year (using the employed population of Buskerrud as the denominator). Incidence rates were highest for respiratory disease and musculoskeletal problems, being almost twice as high as those for injuries, and four times as high as rates for mental disorders. Tellnes concludes that these results were comparable to a national health morbidity survey, and that the diagnosis on the initial certificate gives a good indication of the distribution of a nation's health problems.

A third paper by Tellnes *et al* discusses the 'Occupational Factors in Sickness Certification' (129). In 1986, again in Buskerud county, Norway, 118 GPs completed questionnaires whenever they issued sickness certificates, as did the patients. The GPs answered questions about diagnosis and work and the patients answered questions about demography, civil status, occupation and problems/worries outside work. In one week GPs completed 2,052 questionnaires relating to the certificates issued, and the corresponding patients completed 1,413 questionnaires. Physical workload was considered to be the contributory cause of sickness absence in half of patients (48%), particularly for farmers, builders, caretakers and cleaners. Psychological factors were considered contributory in a third of cases (32%), and were significantly associated with marital status, most frequently in divorced/separated individuals, and with those with engaged in sedentary work. Psychological factors also most frequently contributed to sickness absence in engineers, and the authors speculate that this may be due to the pressure of fulfilling contract targets. Some 11% of patients with psychological problems at work also reported problems and worries at home; this highlights the difficulty in attributing a work-related cause in subjective conditions such as mental ill-health as these are often multifactorial in aetiology. The authors recommend better collaboration between occupational and community medicine to assess the patients' home and work situations.

Although the literature search did not find any papers specifically studying work-related sickness absence seen in general practice, there are two key papers giving further insight into all categories of sickness absence seen in general practice in the UK. One of them, again by Wynne-Jones *et al* is 'Identification of UK sickness certification rates standardised for age and sex' (23). This study benefits from the fact that the data are derived from an established GP research network (Keele GP Research Partnership (KGPRP)), which consists of 28 GP practices in North Staffordshire. As such, the participating GPs are more aware of the importance of keeping accurate records for research purposes. UK GPs are currently not obliged to record sickness absence data electronically, so it is unlikely that GPs outwith a network such as this would be so accurate in their records. Previous research with this network has shown their electronic sickness absence records to match those recorded by the patient self-reporting via a questionnaire (130).

The aim of the study was to report sickness certification rates in the UK population as a whole, by sex, age and common condition. Data from 14 practices within the KGPRP provided information from two archives; one providing sickness absence information and another, providing information about the consultation including the Read codes of the diagnosis. These were matched together using a unique identifier. Data were analysed for the whole of 2005, and during this time 148,176 patients of working age were registered with the participating practices and 6,398 received one or more sickness certificates. These patients received a total of 15,640 certificates, with a range of one to 20 certificates per person (average 2.44). The overall rate of sickness certification was 101.67 certificates per 1000 person years, equating to one in 10 patients receiving a certificate. Rates were significantly higher in females (109.76) compared to 93.68 certificates per 1000 person years for men. Sickness certification rates were highest for mental disorders (27.78), musculoskeletal (22.84), injury/poisonings (7.79), respiratory (7.11) and ill-defined conditions/working diagnoses (6.63). Generally, rates increased with age. The highest rate was for 50-54 year old females with a rate of 43.37 certificates per 1000 person years. This study, using a network of GPs engaged in research, provides robust evidence (through the large dataset used) amongst the increasing awareness of the sickness absence burden caused by mental ill-health and musculoskeletal problems in the UK. The authors accept that the study was carried out solely in one region of the UK, and therefore may not be totally representative; North Staffordshire having a higher proportion of lower socioeconomic classes than other areas which may increase the level of certification. This study was not able to examine the duration of absence due to limits to the information recorded on the sickness certification archive, however other research which concentrated on duration of absence showed that mild mental disorders and musculoskeletal complaints accounted for over half the absence certified (24).

This paper ‘Patient factors associated with duration of certified sickness absence and transition to long-term incapacity’ by Shiels *et al* used a unique method of collecting sickness certification information in the absence of reliable/routine electronic recording methods. Again, this study was based on a research network of GPs, the Mersey Primary Care R & D Consortium. The nine practices involved had a combined list of 50,000 patients of working age. In order to collect the data researchers worked with the DWP to produce modified pads of MED3 and MED5 certificates incorporating carbonised copies for each certificate written. These pads were used by all GPs in the participating practices for 12 months. Information from the certificates was coded and collated onto a database for analysis. Data included type of certificate, date, ID number, GP code, patient postcode date of birth, gender, duration of sick note and reason/diagnosis associated with the certification. Duration of episodes was calculated by totalling all periods of absence issued. The results comprised a wealth of information, but to summarise the main findings, 13,127 certificates were issued to 6,271 patients in the 12 month data collection period. The mean length of sickness absence per episode was 9.9 weeks, and nearly 10% of patients had a period of certification of over 28 weeks in total. Over half of the certified days were due to mild mental and musculoskeletal problems, contributing with 39.7% and 15.4% of days respectively. Logistic regression analysis showed that social deprivation and increasing age were risk factors for the development of long-term absence, as were mild mental disorders. The authors claim that this study reports the most comprehensive quantitative study of sickness certification to date (2004). It is certainly a comprehensive study, giving a longitudinal view of certified absence with evidence (based on a large dataset) on the duration of absence and the risk to long-term incapacity. Again, data collection was confined to a particular area of the UK which is also recognised as having high levels of social deprivation, which might influence the results.

Table 1.6. General practitioners' views on sickness absence – Literature review summary table

Name, Year, Country of Study	Title	Aims	Methods	Key findings	Conclusions and results relevant to thesis	Strengths/Limitations
Hiscock et al, 2001, UK (102)	The role of the GP in sickness certification	This study was funded by the Department of Work and Pensions (DWP) to inform policy design and guidance and training for GPs. It explores the role of GPs in providing medical evidence about incapacity for work.	This study used qualitative methods. In depth interviews were conducted with 33 GPs and towards the end of the project discussions were held with five small 'strategic groups' of GPs to explore the issues raised during the in-depth interviews.	Themes discussed included the GP-patient relationship, the GP role as certifier of absence and contradictory demands from other stakeholders in the GPs' 'gatekeeper' role. GPs found judging whether a patient is fit for work a highly complex process. Factors influenced the assessment of incapacity, including patients' behaviour and time pressures leading to a GP feeling that it is easier to 'just sign'. They also reported more difficulty in assessing subjective conditions such as back pain or anxiety.	Sickness certification is a complex process balancing the needs of patients and stakeholders. GPs found the lack of access to specialist and occupational advice was an additional difficulty in the decision making process in absence certification.	This study is very comprehensive with research questions that are appropriate to the study objectives. It benefits in the fact that the themes and issues raised in the interviews with the 33 GPs were then discussed further in the strategic groups. The participating GPs were selected to be regionally representative of GPs in GB.
Hussey et al, 2004, Scotland (103)	Sickness certification system in the United Kingdom: Qualitative views of general practitioners in Scotland	To explore how GPs operate the sickness certification system, how they view the system and suggestions for change.	The study consisted of GPs from the Glasgow, Tayside and Highland regions of Scotland. Recruitment strategies and topic guide were developed from two initial focus groups. Following this,11 one hour sessions were held with a total of 67 participants (between four and eight participants in each). Participants were selected using purposeful sampling. Eight of the 11 groups discussed study topics and the final three groups used theoretical sampling to investigate emergent themes.	GPs felt the doctor-patient relationship conflicted with the GPs' role as issuer of sickness certification and experienced contradictory demands from other system stakeholders. Many wished to relinquish the gatekeeper role or continue subject to major change. Knowledge of the sickness certification system was poor, along with a lack of interest in this area. GPs also commented that statistics resulting from sickness certificates were meaningless because of these issues.	GPs were unhappy with the conflicting role of social security gatekeeper and patient advocate. They expressed difficulty knowing what to write on certificates to maintain patient confidentiality, therefore felt that statistics resulting from sickness certificates were meaningless.	The study title states that it relates to the sickness certification system in the UK, but only GPs from Scotland were questioned therefore there may be issues of applying these results UK-wide. There were many issues relating to GPs gatekeeper role (of social security). GPs may have expressed their views on this subject more strongly if they knew the project was funded by the DWP.
Wynne-Jones et al, 2010, UK (124)	Sickness certification and the GP: what really happens in practice?	To investigate and describe British GPs' sickness certification practices.	Cross-sectional nationwide postal survey of 2154 UK GPs. In addition to demographic information, GPs were asked about certification practices, training in sickness certification, their opinions about the certification process and opinions about how the system could be improved.	There was a response rate of 42%. 54% were male and respondents worked an average of 7.2 sessions per week. GPs issued an average of 10.3 certificates a week. GPs stated they issued certificates for mental ill-health and musculoskeletal problems most frequently. 71% of GPs stated that the patient initiated the discussion about certification most frequently and 71% said they had no training in sickness certification; of those that had, 95% felt the training had helped them issue certificates more appropriately.	Musculoskeletal and mental ill-health cases were certified most frequently. Most GPs had not received any training in sickness certification. Training had helped issue more appropriate certificates. The majority of GPs said they always or often asked patients about their work status.	Comprehensive study asking a large sample of GPs many questions of use to other researchers, e.g. certificates issued per week, number of sessions per week etc. The authors admit that the study may have a potential problem with recall bias and a response rate of 42% may lead to response bias when generalising to the national level. Responders were over-represented by female GPs who issue significantly fewer certificates.

Name, Year, Country of Study	Title	Aims	Methods	Key findings	Conclusions and results relevant to thesis	Strengths/Limitations
Wynne-Jones et al, 2010, UK (125)	What do GPs feel about sickness certification? A systematic search and narrative review	To systematically review the literature reporting GPs' attitudes towards sickness certification.	Online bibliographies were searched for relevant publications upto 2010; in addition reference lists of these papers were also searched. Papers not meeting inclusion criteria based on abstracts were discarded and full texts were reviewed by two researchers. For papers to be included they had to meet the following criteria: conducted in primary care with clinically active GPs. The studies had to express GPs opinions of sickness certification, elicited through questionnaires or interview.	18 papers were identified; the majority of the papers were from Scandinavia (11), 5 from the UK and one each from The Netherlands and Switzerland. Three themes were identified; conflict, role responsibility and barriers to good practice. Conflict was regarding the need for sickness certification between the patient and GP. The GP has to balance their responsibility towards the patient, the state and society as a whole. Barriers to good practice were described as the patients themselves and the system as a whole.	This review examining GPs views on sickness certification highlighted similar issues found in other papers eliciting GPs opinions on this topic and how these are common problems experienced by GPs throughout Europe. In particular their role and responsibility to the patient and the difficulty balancing this with stakeholders such as benefit systems.	This review is inclusive as it did not put any restrictions regarding the quality of the paper. It also benefits from the fact that papers using a variety of methods (quantitative, qualitative and systematic reviews) were included so a range of issues were highlighted. This may have led to problems in over interpreting the information, however grouping the data into themes minimized this problem.

Table 1.7. Sickness absence reported by general practitioners – Literature review summary table

Name, Year, Country of Study	Title	Aims	Methods	Key findings	Conclusions and results relevant to thesis	Strengths/Limitations
Tellnes et al, 1990, Norway (19)	Inter-doctor variation in sickness certification	To analyse the influence of doctor-related factors on the duration of SA episodes.	In April 1986, 188 of the 122 GPs in Buskerud county, Norway participated in a SA survey and 107 of these issued sickness certification during a four-week period (Feb to Mar 1985). These 107 GPs were issued a questionnaire asking for demographic and practice details and questions to elicit their attitude towards sickness certification. Duration of absence was provided from the National Insurance Administration database.	There was no association between GPs attitudes and duration of absence. Absence was significantly longer when issued by older GPs and shorter when issued by specialists in general practice or those that worked part time as industrial medical officers. Musculoskeletal disorders and respiratory diseases had the longest duration of absence	GPs that work part-time as industrial medical officers issued shorter periods of absence, suggesting those GPs with training and experience in the relationship between work and health may feel it is not beneficial to issue long periods of absence to patients.	The authors state the demographic of employed persons in Buskerud county are similar to that of the whole of Norway, therefore the external validity should be sufficient. GPs were only included in this study if they had issued sickness certification during the four week study period; it would have been preferable to include all GPs as the study is possibly biased towards higher certification GPs.
Tellnes et al, 1989, Norway(128)	Incidence of sickness certification	To describe population based cause, gender and age specific incidences of sickness certification.	This study is based on the same SA data collected in the study above from Buskerud county, Norway during four weeks (Feb to Mar 1985). The first diagnosis stated on the certificate was taken as the main cause of SA. The incidence of sickness certification was expressed as the number of initial certificates per 1000 employed persons (106,019) per year.	The annual incidence rate was estimated at 580 per 1000 persons employed per annum; it was slightly higher for females (496, males 568). The most frequent cause of sickness certification was respiratory disease (162), musculoskeletal disorders (145) and mental ill-health (36). Younger employees (16-39 years) had higher rates of absence than older workers (40-69). Mental ill-health rates were highest in females and injuries highest in males.	Calculation of incidence rates from general practice data. Rates of sickness certification were highest in females and for respiratory, musculoskeletal and mental ill-health.	Incidence rates were calculated by dividing four weeks data by the working population, therefore underestimating the incidence rate per annum. The study is likely to be affected by seasonal bias as it was conducted in the winter when there were high rates of respiratory disease. The diagnosis stated on the certificate may not reflect the disease noted in the doctors records. Somatic reasons may have been recorded on the certificate when co-morbid with psychological diagnoses therefore reducing the rates due to mental ill-health.
Tellnes et al, 1990, Norway (129)	Occupational factors in sickness certification	To estimate the contribution of physical workload and psychological factors at work.	118 of the 122 GPs in Buskerud county, Norway were asked to complete a questionnaire whenever they issued a sickness certificate for one week in April 1986. At the end of the consultation, the patient was given a questionnaire (asking similar questions as those answered by the GP) about the work-relatedness of the case and asked to mail it to researchers.	GPs completed 2052 questionnaires; patient completed 1413. Physical workload was the contributory cause of SA in half of patients (48%), particularly for farmers, builders, caretakers and cleaners. Psychological factors were considered contributory in a third of cases (32%), and were significantly associated with marital status, and with those workers engaged in sedentary work. 11% of patients with psychological problems at work also reported problems and worries at home.	Agreement between the GP and patient on work-related factors was better for assessment of the contribution of physical workload rather than psychological stressors. This, and the fact that psychological problems were associated with marital status and problems at home highlights the difficulty in attributing a work-related cause in subjective conditions such as mental ill-health as these are often multifactorial in aetiology.	The main emphasis of this paper was to assess the work-related factors associated with the ill-health that was sickness certified. There was some measure of the level of agreement between the GP and patients' answers to the questionnaire, but the study may have benefited with further analysis of these data. Once again the study was carried out in one area of Norway although the authors state the GP and patient population was representative. There may also be seasonal bias.

Name, Year, Country of Study	Title	Aims	Methods	Key findings	Conclusions and results relevant to thesis	Strengths/Limitations
Wynne-Jones et al, 2009, UK (23)	Identification of UK sickness certification rates, standardised for age and sex	To report sickness certification rates in a UK population for the most common conditions presented in general practice.	This study used data derived from the established GP research network in Keele (KGPRP), which consists of 28 GP practices. Data for 2005 from 14 of these practices provided information from two archives; one providing sickness absence information and another, providing information about the consultation including the Read codes of the diagnosis. These were matched together using a unique identifier.	During the study period, 148,176 patients of working age were registered with the participating practices and 6,398 received one or more sickness certificates resulting in a total of 15,640 certificates, with a range of one to 20 certificates per person (average 2.44). The overall rate of sickness certification was 101.67 certificates per 1000 person years. Rates were significantly higher in females (109.76) compared to males (93.68). Sickness certification rates were highest for mental (27.78) and musculoskeletal disorders (22.84). Generally, rates increased with age.	Sickness certification rates were highest for females and for patients consulting for mental ill-health conditions, therefore highest rates overall were for females with mental health conditions and around 50 years of age. Rates for musculoskeletal conditions were also high; these were highest in males.	This study is based on a large dataset and uses a network of GPs engaged in research and as such provides robust evidence of the factors attributing to the sickness absence burden in the UK. The authors accept that the study was carried out solely in one region of the UK (with a higher proportion of lower socioeconomic classes), and therefore may not be totally representative. This may have increased the level of certification. This study was not able to examine the duration of absence due to limits to the information recorded on the sickness certification archive.
Shiels et al, 2004, UK (24)	Patient factors associated with duration of certified sickness absence and transition to long-term incapacity	To explore the relationship between patient factors long-term work incapacity, focusing on musculoskeletal and mild mental health disorders.	This study was carried out over 12 months within nine practices who were part of the Mersey Primary Care R & D Consortium which had a combined list of 50,000 patients of working age. Researchers (in collaboration with the DWP) produced modified MED3 and MED5 certificate pads incorporating carbonised copies. Information from the certificates was coded and collated onto a database for analysis and included duration of sick note and reason/diagnosis associated with the certification. Duration of episodes was calculated by totalling all periods of absence issued.	13,127 certificates were issued to 6,271 patients. The mean length of sickness absence per episode was 9.9 weeks, and nearly 10% of patients had a period of certification of over 28 weeks in total. Over half of the certified days were due to mild mental and musculoskeletal problems, contributing with 39.7% and 15.4% of days respectively. Logistic regression analysis showed that social deprivation and increasing age were risk factors for the development of long-term absence, as were mild mental disorders.	Diagnosis is a significant factor in predicting the length of certified absence; mental ill-health was responsible for almost 40% of sickness absence certified. Males had longer periods of absence. Absence length increases with age.	This is a comprehensive study, giving a longitudinal view of certified absence with evidence (based on a large dataset) on the duration of absence and the risk to long-term incapacity. Data was collected prospectively eliminating any problems associated with recall bias. Data collection was confined to a particular area of the UK recognised as having high levels of social deprivation, which might influence the results.

1.5.3 Synthesis of literature review

The principal finding from this review of the literature is the lack of published information on work-related ill-health as recognised by general practitioners, particularly in the UK. This dearth of GP based information has also been reported in the systematic review by Weevers *et al* (95). Many studies that are available are based on the opinions of patients visiting community based clinics, but not originating from the GPs themselves. Most studies giving information on the type of work-related ill-health seen by GPs is based on studies from Australia (57;79;80) and Scandinavia (82;83;85). Comparisons are difficult due to differences in the way that researchers categorise diseases, or because studies concentrate on specific conditions or workplaces, which can make results difficult to generalise to the wider population. In addition, international differences in social, legal and economic situations, and the classification and compensation of work-related diseases can also make comparisons difficult. Also discussed in this review are studies that have estimated rates of incidence or prevalence from general practice data, however, apart from the Australian based occupational skin study by Keegal *et al* (71), these estimates have not specifically been undertaken for work-related conditions. The studies have been included as they discuss work-related factors influencing the particular type of ill-health (e.g. low back pain) (68;69;75). Studies that attempt to calculate rates of incidence or sickness certification use different denominators and methods of calculation; some use the population of the region as a denominator (71;128), or the registered practice population (23;72), while others use incident cases (or certificates issued) per consultation or practice contact (131).

What is known, is that according to patients questioned, work-related ill-health concerns are common in general practice, with studies reporting 38% to 46% of patients believing their condition to be related to work (84;85;90). However, studies based on GPs' reports suggest the proportion of cases presented in clinics considered to be work-related is much lower, with estimates of 1.6% (79) and 7.2% (80). In the study by Benavides et al (89), 36% of sick listed patients judged their own condition to be related to their occupation, but GPs and OPs assessed only 16% of these same conditions as work-related. Evidence generally shows that musculoskeletal and mental ill-health disorders are the most common types of work-related ill-health seen by clinicians (57;79). Of the studies examining categories of occupational ill-health seen in general practice, older studies found that musculoskeletal disorders and work-related injuries made up the majority of cases (80;82), with often no mention of work-related psychological problems. In more recent studies, mental ill-health is one of the most commonly reported diagnostic categories, along with musculoskeletal disorders (79). This is possibly due to the changing nature of work and how it affects individuals' health, and also changes in attitudes to psychological problems.

There is a weight of evidence that there is a lack of training amongst general practitioners in work-related ill-health issues (56;86-88;132), and also in certification of sickness absence (124;133). There may therefore be disparity in patients' and GPs' opinions about the work-relatedness of a case through this lack of training, as GPs do not necessarily raise the issue of work during a consultation, and a patient's occupation is rarely recorded in medical records. Evidence has shown that GPs (and other physicians) with training in matters of work and health ask patients about work, and therefore recognise work-related problems. Trained GPs are also more aware of the benefits of work on health, and are likely to issue fewer and more appropriate sickness certificates as a result (124).

There were many studies of sickness absence as a whole, including research assessing work-related factors related to increased rates (23;119), and diagnostic (23;111), demographic (23;110) and employment groups (122;129) associated with absence from work. However, specifically for work-related sickness absence, the best source of information was found in the self-reported SWI (31); no information could be found on work-related sickness absence as determined by GPs. In sickness absence studies in general, mental-ill health problems were often responsible for the highest rates of sickness absence (23;24). It was interesting to note that in a study by Campbell *et al* (134), GPs rated patients with psychological problems as more ill, less work shy, and less fit for work, and described GPs as feeling more sympathy towards these patients than those presenting with physical problems. However, after psychological problems, musculoskeletal disorders were shown to be responsible for most episodes and work days lost (23;111). Research eliciting GPs' opinions on their role as sickness absence certifiers, had similar findings, especially relating to issues surrounding the GP-patient relationship

(102;103). When patients request sickness certification, GPs stated that their role as patient advocate was often difficult to maintain, especially when they also had increasing awareness that work is beneficial to patients' health and well-being. GPs were also aware of their position as 'gatekeeper' to the benefits system.

It is apparent that there are few estimates of the incidence of work-related ill-health seen in a general practice setting. In addition, information about the case mix of these problems, and how these cases are managed in practice (with sickness absence or referrals) is also lacking, particularly in the UK. As GPs have an important role in identifying and treating work-related ill-heath, being the first port of call for most patients in the UK, they have a unique opportunity to establish a link between a disease and the workplace. This role is all the more relevant as GPs are issuers of sickness certification, and the well documented evidence (16) of the benefits of helping an individual remain in the workplace merits further investigation.

In GB, the SWI gives estimates of rates of incidence based on self-reports (31) while information provided through THOR's network estimates incidence and also describes the nature of work-related ill-health reported by OPs and clinical specialists (13;40-43;45;46). As discussed in the Dutch CTS study by Bongers *et al* (72), incidence rates based on GP reported information are likely to be lower (in this study, 10 times lower) than population-based studies. When estimates are based on data which only include patients whose symptoms have driven them to actively seek medical help or opinion, it is not known how (or if) these differ for other types of ill-health. Studies described in this thesis have found that musculoskeletal conditions were most frequently considered by patients as being related to work (85). Patients' opinions on the work-relatedness of their condition will influence rates of self-reported ill-health, however how this may affect rates (of self-reported and GP reported) work-related ill-health is not yet known. In the studies described by de Bono (52) and Keegal (71) both refer to THOR's specialist schemes (SWORD and EPIDERM). De Bono highlighted possible underestimation from clinical specialists' reporting and recommended a prospective GP based study assessing all new presentations of asthma in terms of occupational aetiology. Keegal discussed how the study of occupational skin disease in general practice included the less severe cases not collected through dermatologists' reports to EPIDERM, and concludes that data from GPs would contribute to a better understanding of the epidemiology, through a process of triangulation with other datasets. Studies and surveillance of work-related ill-health in general practice are also recommended by other researchers (84;95).

This literature review has highlighted how data from general practice should provide an important source of knowledge in achieving a better understanding of the causes and types of work-related ill-health, and the resulting absence from work in the UK. The increased knowledge of the extent of this problem would also help to plan improved training and awareness about occupational health matters amongst general practitioners, thus resulting in improved management and patient care. Data from GPs, triangulated with other national sources of data, will help to give a better understanding of the burden of work-related ill-health across primary and secondary healthcare services, and add to evidence led intervention policies.

1.6 Objectives and outline of this thesis

The principal aim of this thesis is to estimate the incidence of work-related ill-health in the UK/GB as determined in general practice through a UK-wide surveillance scheme (The Health & Occupation Reporting network in General Practice (THOR-GP)), to critically compare general practice reporting with other data sources and to evaluate the incidence and sickness absence burden of work-related ill-health.

This thesis has been written in an 'alternative format', with the results section presented as a series of four papers with an additional chapter to explore the methods of incidence rate calculation. This format was chosen to enable the information to be published as early as possible, and therefore to make it accessible to other researchers. Due to the development of methods, data availability and compatibility with other data sources, some of the papers/chapters are based on work-related ill-health reported within GB and others include data from Northern Ireland, and therefore relate to the whole of the UK.

The objectives of the five papers/chapters that make up the results can be summarised into three main research questions.

1. What is the incidence of work-related ill-health as seen in general practice?

What is the nature of work-related ill-health as seen in a general practice setting, and what are the best methods of estimating rates of incidence as determined by GPs in GB?

2. How does the GP estimated incidence of work-related ill-health differ from that of other data sources?

What determines the differences between the work-related ill-health reported by the different data sources that make up the three different levels of the health surveillance pyramid; self-reports, GP reports and clinical specialists'/occupational physicians' reports?

3. What factors affect the rates of sickness absence associated with work-related ill-health reported by GPs?

How do sickness absence rates differ by work-related and other factors?

Chapter Three (Work-related ill-health in general practice, as reported to a UK-wide surveillance scheme (135)) is a paper published in the British Journal of General Practice in 2008. This outlines the methodology of GP reporting and describes the results of the first two full calendar years of data collection. This chapter describes the nature of the cases reported as work-related by GPs by diagnosis, demography and industry. There is also a basic description of the GP certified sickness absence associated with these cases illustrating how sickness absence differs by diagnostic category.

Chapter Four (Calculating incidence rates of work-related ill-health from general practice) explores issues surrounding estimating national incidence rates of work-related ill-health based on GP reported data. There are fewer than 1% of GB GPs participating in THOR-GP, therefore simply extrapolating these GPs' reported cases to produce national estimates may lead to biases in outcomes, as THOR-GPs may not be representative (of GB as a whole) in their geographical distribution. Two methods of calculating incidence rates using GP reported data have been used in this thesis and these are compared and discussed. An abridged version of this chapter, concentrating on just one aspect (population characterisation using patient versus practice postcode) is being submitted for peer review.

Chapter Five (Comparisons of work-related ill-health reported by GPs with other data sources), containins two papers (136;137), which compare data reported by GPs with information reported by occupational physicians and clinical specialists (in THOR) and patients' self-reports (as published in the Survey of Work-related Illness (SWI)). The first paper compares the two groups of physicians who report information on all categories of work-related ill-health (GPs and occupational physicians), and discusses factors that may influence differences in reporting patterns. The second paper compares and triangulates data reported from three levels of the work-related surveillance pyramid, i.e. from self-reports (SWI), GPs (THOR-GP) and clinical specialists (THOR). Incidence rates resulting from the data reported to these schemes are compared, along with differences in case mix. Factors influencing reporting patterns are discussed, along with THOR-GP referral data (from primary to secondary care). The aim of this paper is to determine whether comparisons of data sources can validate or improve estimates of nationally reported incidence of work-related ill-health.

Chapter Six (Work-related ill-health sickness absence as reported by UK general practitioners (138)) analyses the sickness absence associated with the cases reported to THOR-GP, prior to the introduction of the 'fit note' in April 2010. This paper examines how rates of sickness absence vary by demographic, diagnostic and employment factors (such as public versus private sector and self-employment).

Chapter Seven evaluates the main findings presented in this thesis and how they have addressed the objectives and research questions. It discusses the strengths and weakness of the study and the results in relation to other published work and ultimately discusses the principle objective of a GP's role in estimating the incidence of work-related ill-health in GB. This chapter concludes with recommendations for further work.

1.7 The Health & Occupation network in General Practice (THOR-GP)

These objectives were addressed by examining the work-related ill-health as reported by GPs to THOR-GP. THOR-GP was set up in 2005 to collect information on work-related ill-health and sickness absence in the UK as seen in a general practice setting. This scheme was designed to collect information from cases reported by a network of GPs who have been trained to Diploma level in occupational medicine (DOccMed), as set by the Faculty of Occupational Medicine in the UK (139). As discussed, few GPs have this vocational training (estimated at 4% of UK GPs (140;141)). However, as it is widely recognised that GPs have a lack of training about issues surrounding work and health, it was thought preferable that participating GPs should have the training and experience to recognise a work-related cause (or aggravation) of ill-health when presented in clinic. It was hoped that recruitment of these GPs would not only improve the validity of the data (through experienced assessment of work-related aetiology) but that they would also be more motivated to participate.

This information, previously unrecorded, aimed to achieve a greater understanding of occupational ill-health in the UK. THOR-GP collects information from general practice, and enables analysis of medically certified work-related ill-health data (as opposed to self-reported data), and calculation of incidence rates from a wider population to that previously covered within THOR's specialists schemes. In addition, THOR-GP is also in a unique position to collect information on sickness certification and onward referrals associated with the reported cases.

1.8 Contributions of co-authors and collaborators to published papers

As discussed, the results section of this thesis is presented as a series of four papers with an additional chapter to explore the methods of incidence rate calculation. The published papers have a number of co-authors; most of which contributed to all of the four published papers. I am the first author on all of the published papers and as such was responsible for the concept, design and structure of the papers, and the analysis, text, figures and tables contained therein. THOR-GP is part of the wider THOR network of which Professor Raymond Agius is principle investigator and Dr Susan Turner and Dr Roseanne

McNamee are co-investigators and as such have contributed to the concept of the research and the publications. In addition, Professor Agius and Dr Turner were the supervisors of this PhD and therefore edited text and commented on content. Dr McNamee, as a medical statistician advised on statistical analysis and in particular, using Census data linked to postcode information to characterise a population denominator.

Dr Kevan Thorley is a GP with specialist interest in occupational health who acted as an advisor on the project. Collecting data from general practice offered many challenges beyond the experience gained prior to 2005 in the THOR clinical specialist schemes, such as electronic and sickness absence data collection. Therefore Dr Thorley was able to give advice on enabling THOR data collection to work within general clinical practice. On the paper in Section 5.2 (Comparison of work-related ill-health data from different GB sources) there are two additional co-authors, Dr Melanie Carder and Dr Annemarie Money who both work on the THOR specialist schemes. Drs Carder and Money contributed to this publication by providing the data on incidence rates calculated from respiratory physicians, dermatologists, rheumatologists and psychiatrists.

Chapter Two: Methods

This section describes the methods used in setting up the THOR-GP scheme in 2005, and the data collection and analysis procedures. It also describes methods used to code and categorise GP data to allow comparisons with information from other sources, and the collection of denominator data in order to enable calculation of GB incidence rates. Some of these methods are repeated in the results section in the papers submitted for peer review. Data collection procedures in THOR-GP developed as the scheme progressed as it was only possible to establish how best to collect some of the data once there was greater insight into how GPs reported cases of work-related ill-health. THOR-GP data collection is on-going and continues beyond the scope of this thesis. However, for consistency, this chapter is written in the past tense to cover the scheme preparation and data collection that occurred during the five year period from 2005 to 2009.

2.1 THOR-GP as part of the wider THOR network

As discussed previously, THOR-GP developed as a result of work undertaken in THOR collecting information on work-related ill-health from clinical specialists and occupational physicians. Therefore THOR-GP reporting, case criteria, coding and analytical methods were developed from those established through many years of data collection within the other THOR schemes. This was particularly the case for methods used within OPRA as this was the only other scheme collecting data on all categories of work-related ill-health unlike clinical specialists (e.g. dermatologists reporting cases of skin disease to EPIDERM). These long standing methods have proven face validity and repeatability and were therefore adopted and adapted for use in GP reporting. In addition, the use of similar methods allowed comparisons in reporting patterns between the different groups of reporters. Differences pertaining to GP data collection are highlighted and discussed below.

2.2 Setting up the surveillance scheme

HSE funding for THOR-GP was secured in November 2004; once this was completed work began to recruit eligible GPs and put reporting procedures in place. This resulted in data collection commencing on 1st June 2005.

2.2.1 GP participation

Problems in recruiting GPs to participate in research are well documented, with issues including lack of time, interest, and concerns about patient confidentiality listed as obstacles to GP recruitment (142;143). Few hours (if any) are committed to formal occupational medical training at undergraduate level, resulting in a lack of interest and knowledge of issues surrounding work and health amongst general practitioners (132;144;145). Therefore, in order to maximise THOR-GP participation, GPs who had undertaken postgraduate training to diploma level in occupational medicine (DOccMed) of the Faculty of Occupational Medicine (FOM) were targeted for recruitment. It was hoped that recruiting GPs with an interest in this area of medicine would improve recruitment rates and also reporting response rates once GPs had agreed to participate. Targeting these GPs would theoretically improve the internal validity of the study; their assessment of a patient's occupational history and resulting recognition of the work-relatedness of a consulting case was likely to be more accurate than other GPs without this vocational training. The predicted benefits of this recruitment strategy was considered to outweigh potential problems with the external validity of the project due to observer bias. It was thought that these GPs would provide the best measure of incidence as other GPs may well see a similar number of work-related cases in their clinics, however fail to recognise them as such. Specifying this (trained to DOccMed level) criteria for recruitment also potentially caused problems with recruitment as it limited the number of eligible GPs to approach; only 4% of GPs in the UK are estimated as having undertaken this training (140;141).

2.2.1.1 Pilot study

The Centre for Occupational & Environmental Health (COEH) at the University of Manchester runs a number of courses in Occupational Medicine including the diploma course (146). In order to evaluate the feasibility of the study and test whether GPs with DOccMed training (henceforth named 'diplomates') would participate in the scheme, a sample of 100 GPs who had taken the COEH course were asked to return a reply slip indicating whether they would be willing to participate in principle. Just under half (43/100) of these GPs said that they would be interested in taking part in the scheme. This was considered a positive enough response to achieve a viable level of GP participation. In addition, to assess the UK distribution of diplomates, the postcodes of a sample of 500 GPs were entered into a Geographical Information System (Arc GIS). This mapped the location of these 500 diplomates and showed a good UK wide distribution (Figure 2.1).

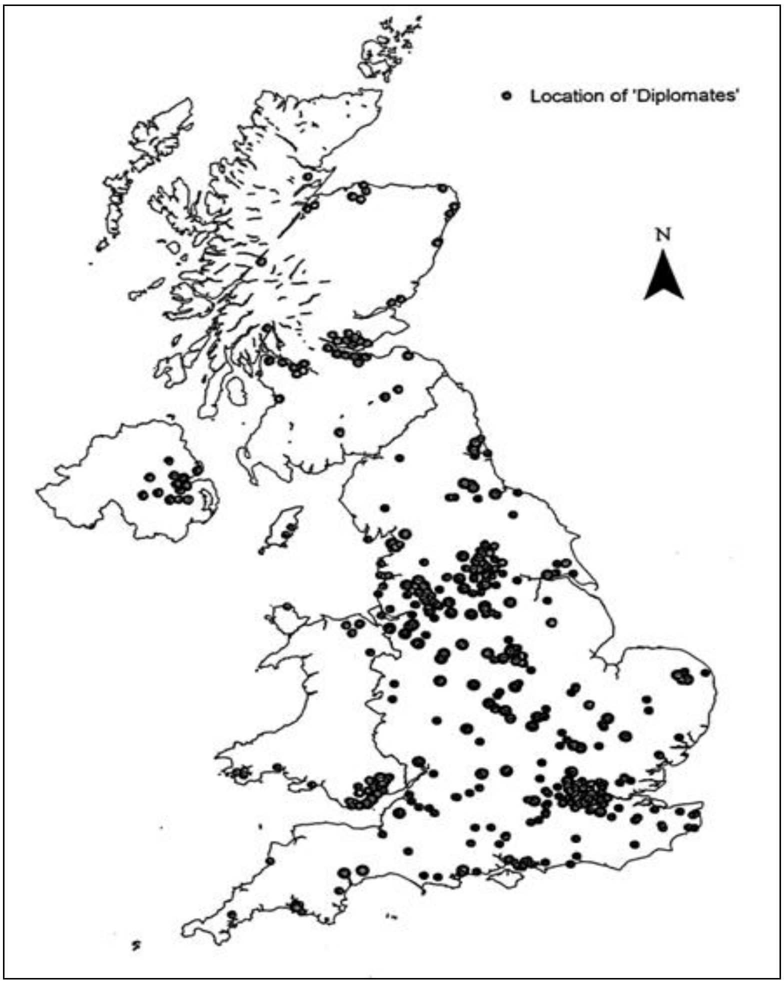

Figure 2.1. UK location of 500 sampled diplomates

2.2.1.2 Number of participants

The diploma course within COEH had been running since 1994, and in June 2005 there were 840 diplomates who had undertaken the course. Based on the results of the recruitment pilot study, it was estimated that THOR-GP would be able to maintain a participation level of between 250 and 300 GPs at any one time. It was estimated that this number of GPs would report approximately 1,000 cases per annum. This was validated by a power calculation which gave an estimation of the numbers needed to detect a 10-15% change (as in HSE’s Revitalising Health & Safety Strategy (147)) in incident cases of work-related ill-health over two years (Appendix One).

2.2.1.3 Sources of recruitment

In order to gain the DOccMed qualification, GPs undertake a suitable course then apply to the FOM to take the examination for the diploma. The primary source of recruitment for THOR-GP was the alumni of the DOccMed course run by the COEH at the University of Manchester (148). Other sources of recruitment were used to provide information on GPs who had trained for their DOccMed elsewhere. The eligibility criteria for these (non-COEH trained) potential recruits were slightly different, as educational records within COEH allowed University of Manchester trained GPs who had completed the training (even if they had not gained the qualification) to join THOR-GP. GPs trained elsewhere had to have gained the DOccMed qualification as this was the only way to establish that they had undergone diploma level training. GPs with higher level qualifications were also considered eligible and approached for recruitment. The qualifications awarded by the FOM are:

- Diploma in Occupational Medicine (DOccMed)
- Associateship (AFOM)
- Membership (MFOM)*
- Fellowship (FFOM)*

*The MFOM and FFOM are awards for specialist qualification in occupational medicine, therefore would not be expected to be held amongst practicing GPs.

It was hoped that the past students of the diploma course at COEH might be more willing to participate in THOR-GP, relying on an affinity with the University of Manchester. Also, as the COEH's course is delivered by distributed learning it was hoped the diplomates would be located throughout the UK (as illustrated in Figure 2.1). Approximately 100 new students enrol on the diploma course each year; therefore not only did this source of recruitment have a large number of alumni, it would also be a source of new THOR-GP recruits as the scheme progressed.

Other sources of GPs who had achieved the Diploma (or higher qualification) in occupational medicine were also used to identify eligilble GPs. These included a website (specialistsinfo.com) holding details of over 42,000 GPs of which 524 (1.2%) stated a specialist interest in occupational medicine (149); not all of these were listed as having the DOccMed qualification. Potential recruits were identified by selecting those stating an interest in occupational medicine. In the initial recruitment drive in 2005, this resulted in 300 potential GPs to approach. Their qualifications were checked, and if eligible, they were added to the recruitment list. A further 72 eligible GPs were identified by this method. Professional lists of physicians who had gained qualifications in occupational medicine were also consulted for potential recruits, however these lists did not state whether the physician was practicing as a GP. These additional recruitment sources did not give comprehensive information on all UK GPs and their qualifications, but were used supplementary to the list of COEH trained diplomates to provide information on GPs trained elsewhere.

Subsequent to these methods used in the initial recruitment drive, it was also possible to identify other suitable physicians by conducting an internet search using the terms ‘GP DipOccmed OR DOccmed OR AFOM’. This was one of the sources of information used as the project progressed in order to maintain participation levels and identified general practice websites where they listed GPs working within the surgery, and their qualifications.

2.2.1.4 Approaches

All potential reporters were sent postal information (Appendix Two) describing THOR-GP and its aims and reporting benefits, and were asked to return a reply slip (Appendix Three) using an enclosed stamped addressed envelope. The reply slip asked them to tick one of the following options:

- Yes, I would be willing to participate in THOR-GP
- I would not be willing to participate in THOR-GP
- I am not eligible to participate in THOR-GP, as I am no longer working in general practice. - If you are no longer working in general practice, do you work in full-time occupational health?

If they were not trained at the COEH in the University of Manchester they were asked to list their FOM qualification.

If willing to participate, they were also asked to provide correct contact details and if different, details of their practice address.

2.2.1.5 Follow-up

A month after the initial approach, all non-responders were sent a further mailing. After this second stage, all non-responders had their address details double checked using on-line sources of GP information (149;150). Some of the address details were found to be out of date and if a telephone number was listed for a non-responding GP's practice details, a phone call was made to see if the doctor still worked within the practice, or if not, where they currently worked. If a new address was available the GP was sent a third mailing.

2.2.1.6 THOR-GP promotion

Publications that are circulated to general practices (such as 'Pulse' magazine (151)) were identified, and articles outlining the aims and benefits of the study were submitted for publication (Appendix Four). Articles and abstracts were also submitted for publication in the newsletter of the Society of Occupational Medicine (SOM) and at professional conferences (Appendix Five) in an attempt to raise awareness of the scheme amongst eligible GPs. This resulted in additional GPs joining the scheme after they had made contact expressing a wish to participate.

2.2.1.7 Participation incentives

It was hoped that GPs with occupational medicine training would be willing to participate in the scheme. However, unlike hospital based consultants, who report to THOR without financial incentives, GPs' income is based on items of service, including specific individual activities, contributions to health schemes and data recording (particularly as part of the Quality Outcomes Framework (QOF) system). Motivating GPs was perceived to be difficult without some form of remuneration; research has shown that response rates are improved and incrementally related to levels of payment (52;152-155), therefore participants were offered £100 or £200 per annum (depending on reporting frequency (see 2.4.3)) for actively participating. A reporter was considered to be actively participating if they sent in case data or information stating that they had not seen any relevant cases in a particular reporting period (a zero return (see 2.3.4)). They were not given financial remuneration solely for submitting case information as this may have resulted in over-reporting. Other incentives were also offered:

- Free on-line Continuing Professional Development (CPD)
- Regular reports and updates from THOR-GP
- Participation in a network of over 2,000 physicians (including clinical specialists) in THOR
- Simple user friendly reporting methods

2.2.1.8 Recording GP participation

A Microsoft Access database was set up to include information on every physician approached, or who made an approach to COEH to join the scheme. Each entry recorded address details, participation status, recruitment and reporting responses. In order to maintain accurate records of recruitment and participation the database was designed to record each stage of the process. Each approach and subsequent response was recorded as a separate event on the database. This enabled assessment in reporting behaviour, trends and participation levels. Any reasons for non-participation were also recorded (e.g. not working in general practice, retired etc.)

2.2.1.9 GPs participating in THOR-GP

Overall, 31.5% of GPs approached to participate in THOR-GP agreed to take part. The response to the recruitment letter differed by recruitment source; primarily due to the number of GPs that responded who were not eligible to participate as they were not working within general practice (Table 2.1). A larger proportion (14.8%) of COEH diplomates responded that they were ineligible to participate than recruits from other sources (2.8%). It is not known whether the COEH diplomates are working as GPs when they are approached, whereas other sources of recruitment (such as specialistinfo.com) are based on lists of practicing GPs. Once the Not Applicable respondents were removed from the recruitment data, response rates for the two groups of reporters were similar (COEH diplomats 35.6%, non-COEH recruitment source 36.7%). Table 2.1 also illustrates how 178 (78.1%) of the 228 current reporters (2012) were made up of COEH diplomats.

Table 2.1. Response to THOR-GP recruitment (2005 to 2012)

Participation Status	COEH Diplomates		Non-COEH Recruitment Source		Total approached	
Participated	N	%	N	%	N	%
Current reporter	178	14.0	50	14.0	228	14.0
Withdrawn	187	14.7	68	19.1	255	15.7
Withdrawn retired	2	0.2	1	0.3	3	0.2
Pending	19	1.5	8	2.2	27	1.7
Total participated	**386**	**30.4**	**127**	**35.7**	**513**	**31.5**
Never participated						
No response	521	41.0	163	45.8	684	42.0
Replied Not Applicable	188	14.8	10	2.8	198	12.2
Replied No	166	13.1	52	14.6	218	13.4
Replied Retired	10	0.8	4	1.1	14	0.9
Total never participated	**885**	**69.6**	**229**	**64.3**	**1114**	**68.5**
Total approached	**1271**	**100.0**	**356**	**100.0**	**1627**	**100.0**

In order to test whether THOR-GP was subject to participation bias, 200 GPs were selected at random from the ‘participated’ and ‘never participated’ groups and compared by age and gender. The age of the GP was not known therefore the year of full registration was used as it gave a relative estimation of a GP’s age when comparing two groups of physicians. The year of full registration for each GP was found on the General Medical Council (GMC) website (156). If it was not possible to identify the GP due to a common surname, an alternative GP was randomly selected from the group of GPs.

The two groups of GPs had a similar gender mix; males made up 150 (75.0%) of the ‘participated’ GPs and 152 (76.0%) of the ‘never participated’ GPs. The age of full registration was found not to be significantly different (t = -1.470, p=0.143). The mean for ‘participated’ GPs’ was 1987 whereas ‘never participated’ GPs’ had the mean of 1988 (Table 2.2).

Table 2.2. Statistics for year of full registration for 'participated' and 'never participated' GPs

Statistics	Participated	Never participated
N	200	200
Mean	1987	1988
Median	1987	1988
Standard Deviation	8.364	9.217
Range	45	40
Minimum	1962	1971
Maximum	2007	2011

In addition to age and gender, the two groups of GPs (all 1627 on the THOR-GP database) were analysed to investigate whether they differed in their geographical distribution (Figure 2.2). Both groups of GPs were found to be similarly distributed (Figure 2.3) and significantly correlated (r_s = 0.818, n=12, p=0.001) using Spearman's rank correlation coefficient.

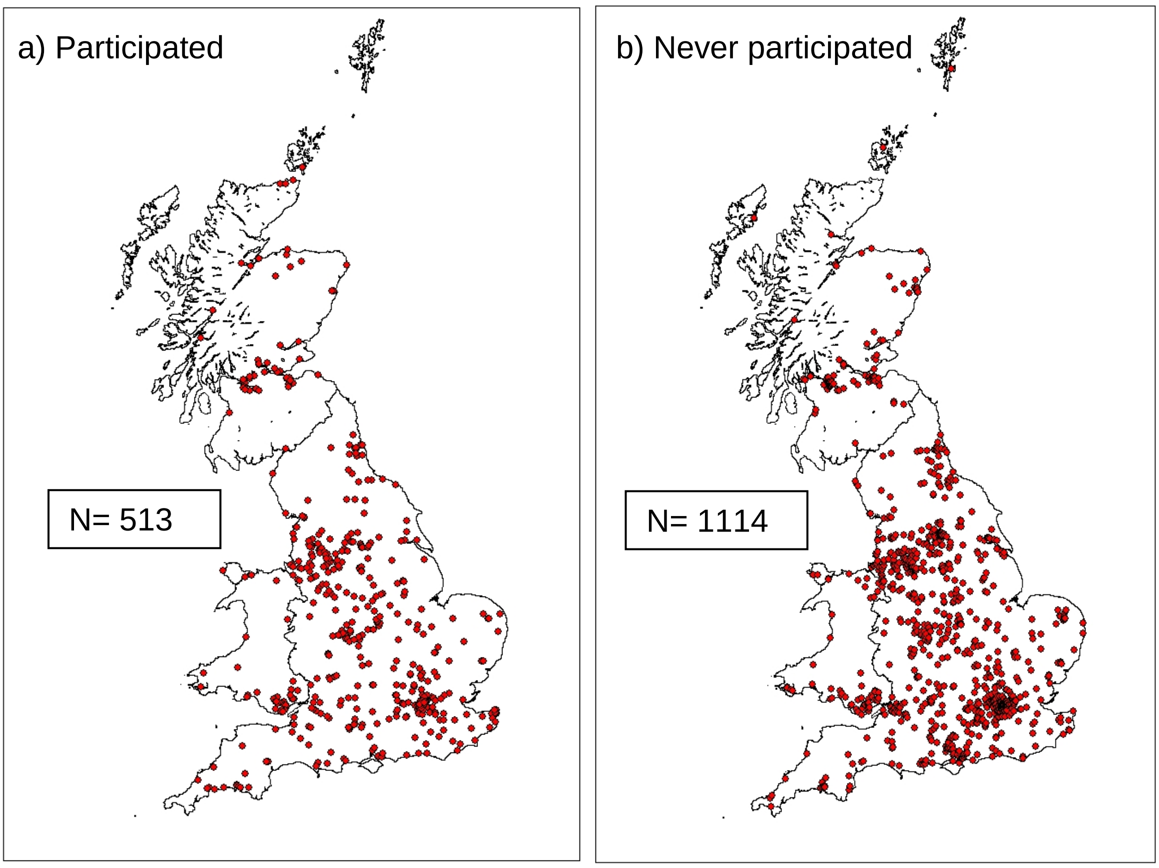

Figure 2.2. Geographical distribution of GB GPs a) Participated b) Never participated

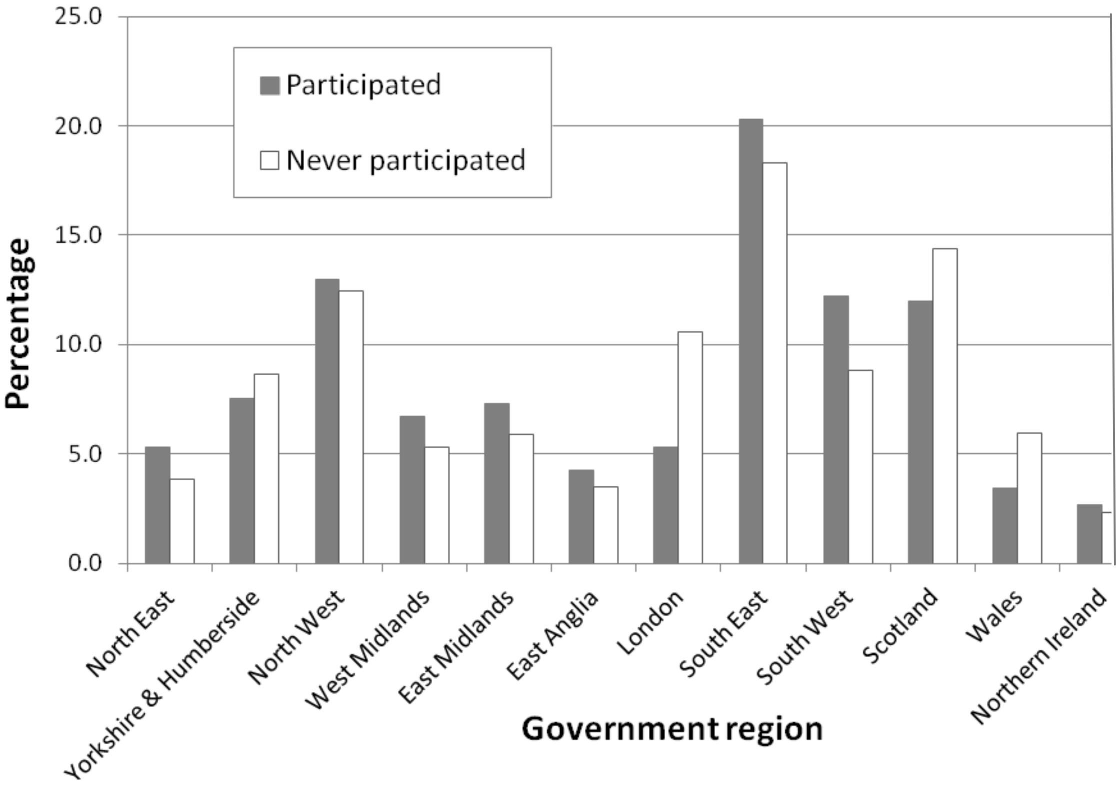

Figure 2.3. Proportional distribution of 'participated' and 'never participated' GPs by government region

2.2.1.10 Collecting data from new recruits

Participation in THOR-GP was maintained at between 250 to 300 GPs at any single point in time. Recruitment was a continual process, with participants leaving the scheme due to reasons such as a change in practice or retirement. In June 2005, 52 GPs had agreed to participate, and initially this was considered a reasonable number of participants with whom to commence a pilot period of data collection. During this period, recruitment continued and reached the target of between 250 to 300 at the beginning of 2006. This initial period of data collection (from June to December 2005) allowed the validity and reproducibility of the data collection methods to be tested and adjusted accordingly. After the initial start date of 1st June 2005, new recruits that subsequently agreed to participate in the scheme were asked to commence reporting on the first day of the month following their positive response to the recruitment process.

2.3 Data collection

The preceding THOR clinical specialist schemes collected data using paper-based methods, via a monthly postal report card. In 2004 a questionnaire was sent out to a random selection of reporters of these existing THOR schemes asking their opinions on electronic data transfer methods for THOR reports (157). Most reporters were favourably disposed to electronic means of communication although one third preferred the existing paper based methods. As a result of this favourable response, in 2005, electronic reporting methods (using a web-based reporting form) were trialled amongst reporters to SWORD and EPIDERM schemes set up for respiratory physicians and dermatologists in the Republic of Ireland (ROI). The reporting form for these ROI schemes was slightly different than the form designed for GP participation; however this trial enabled the testing of secure electronic data transfer methods. It was proposed that reporting to THOR-GP was to be launched exclusively using electronic methods to reflect the increasing use of electronic systems (largely due to the introduction of QOF in 2004) for storing medical records and other information in clinical general practice.

2.3.1 Case criteria

When considering whether a case was eligible to report to THOR-GP, the GP was asked to consider a number of criteria. These were the same (apart from elements unique to reports originating from general clinical practice e.g. sickness absence) as the criteria used by the THOR clinical specialist and occupational physicians. For a case to be eligible to report to THOR-GP it had to be a new case, diagnosed by the reporting GP themselves in their general practice clinic, during their specified reporting month, as being caused or aggravated by work exposure or working environment. GPs were asked not to report cases diagnosed outside their specified month as this would lead to an overestimate of cases (and therefore incidence).

GPs were advised that in order to report a case they could report symptoms if a specific diagnosis had not yet been made and that the scheme relied on the physician's clinical judgement for the case reports. Studies amongst the groups of doctors within THOR have shown that for most, the decision on whether a disease is work-related or not depends on the clinician's judgement on the balance of probabilities (whether it is more likely than not) (158).

Guidance was sent out to the participating GPs before they started reporting (which is also on the THOR-GP website) suggesting what they should consider when assessing a case for work-relatedness. These were as follows;

- Whether the disease would have occurred in the absence of work exposure
- Or whether work exposure was a major factor in causation
- Pre-existing illness in which work conditions made a substantial difference to severity may also be included in the consideration

GPs were also sent a summary document to emphasise the four main principles that had to be fulfilled in order for a case to be eligible for submission to THOR-GP (Appendix Six)

1. Cases should be only those seen by the THOR-GP reporter, personally. (i.e. not those seen by other GPs in the practice)

2. Cases should be only those that are work-related, i.e. the patient's diagnosis/symptoms has been caused or aggravated by work

3. Cases should be only those presented to the participating GP for the first time in their reporting month. i.e. incident (not prevalent) cases.

4. Cases should be only those seen in general practice (i.e. not cases reported from occupational health clinics or any other clinical practice setting)

In addition to general guidance on the eligibility of a case, there was also information on reporting criteria for specific diagnoses within each of the major diagnostic categories (Appendix Seven).

2.3.2 Reporting new cases

Prior to the launch of the scheme in June 2005, a THOR-GP website was constructed. This provided the information and reporting guidance outlined above. Moreover, from this site (159) each GP accessed a password protected web form (Figure 2.4) using unique login information (sent to them prior to the beginning of their first reporting month). Whenever the participating GPs saw a case in their clinical general practice that they believed to be caused or aggravated by a patient's work (and fulfilling the other criteria listed in 2.3.1) they accessed the web form and submitted case details as listed in Table 2.3.

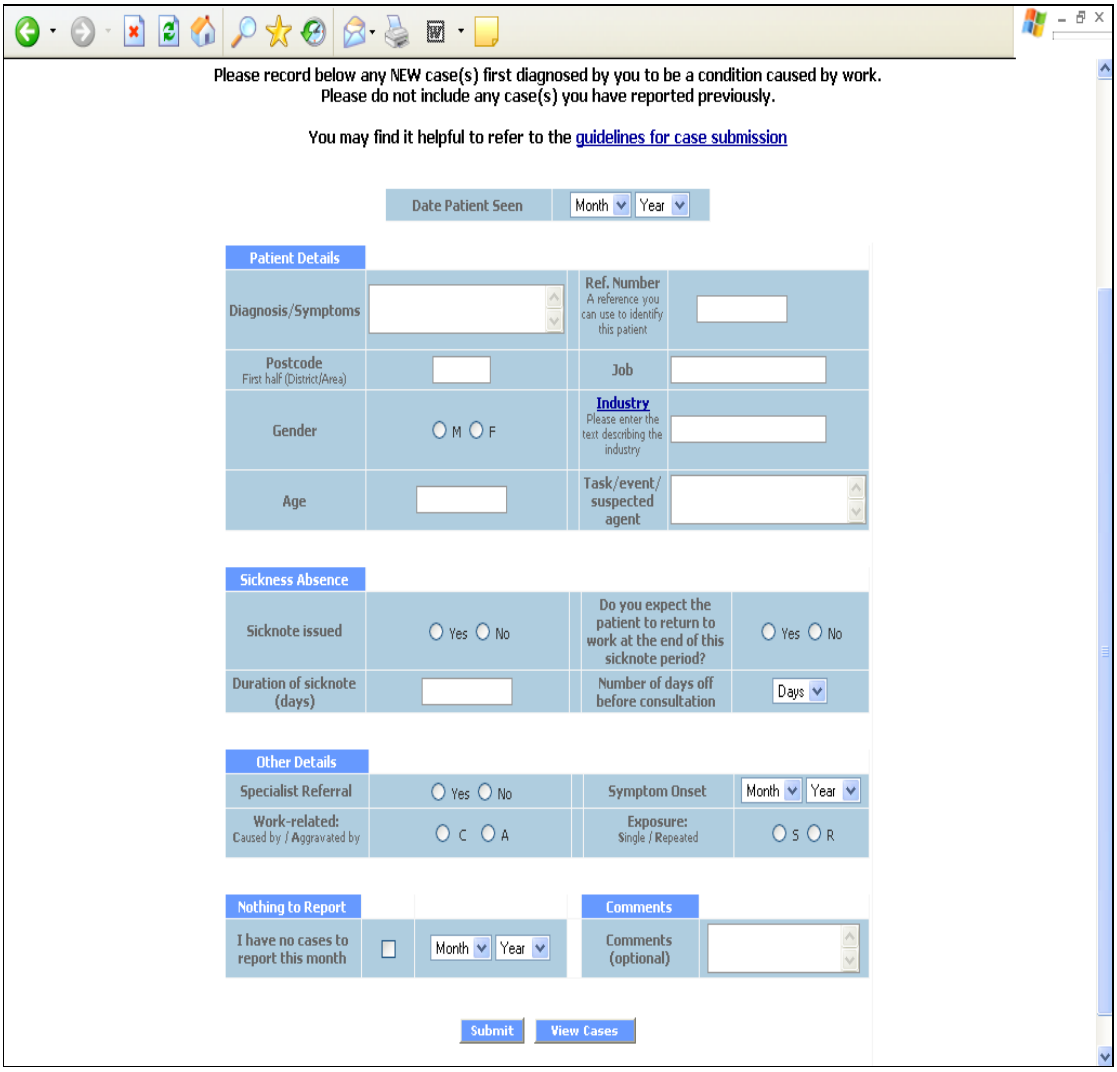

Figure 2.4. THOR-GP reporting webform 2009

The demographic details (age, gender postcode) and information on employment, diagnosis and suspected agent/task/event were the same as the details requested from occupational physicians reporting to OPRA. Other THOR schemes that collect information solely on a single category of work-related ill-health (such as SWORD and EPIDERM) are slightly different in that the physician is asked to select a diagnosis using tick boxes rather than describing the diagnosis in free text. THOR-GP was unique in its ability to collect information on sickness absence and onward patient referrals. These fields had not been used before in THOR data collection and the initial design of the webform in relation to these data were validated during the trial period of data collection in 2005. A number of adjustments were made (e.g. the addition of drop-down menus) to increase the user-friendliness of the data collection tool and improve the quality of the information gathered.

Table 2.3. Data collected via the THOR-GP web form

Information	Data Field
Date patient seen	Month and year
Patient Details	Diagnosis/symptoms Postcode (first half) Gender Age Reference number (for the GP's use) Job Industry Task/event/suspected agent
Sickness absence	Sick note issued (y/n) Duration of sick note Whether the GP expected the patient to return after this sick note period?(y/n) Number of days absent from work before consultation with GP
Other details	Referral on to another health care professional (y/n) Type of referral (e.g. hospital consultant) Type of consultant (if hospital consultant referral) Work relatedness (caused or aggravated) Date of symptom onset (month and year) Exposure (single/repeated) to causative agent/factor

In addition to the diagnosis (and/or symptom), other fields such as job, industry and agent/task/event were free text boxes where the GP entered descriptive information. Some fields only required a yes or no answer, and these were presented as radio buttons. The industry field was provided with a link that gave GPs the opportunity to select from a list of clickable options. The 'type of referral' and 'type of consultant' fields required the reporter to select from a drop down list (Figure 2.5), which was kept as simple as possible to facilitate reporting. The options were as follows:

Type of referral

- Hospital consultant
- Physiotherapist
- Other mental health practitioner
- Occupational health specialist
- Other

If ‘hospital consultant’ was selected from the first list then reporters were asked to select from a list of clinical specialties, namely:

- Audiologist/ENT surgeon
- Dermatologist
- Infectious disease consultant
- Neurologist
- Oncologist
- Ophthalmologist
- Orthopaedic surgeon
- Psychiatrist
- Respiratory physician
- Rheumatologist
- Other

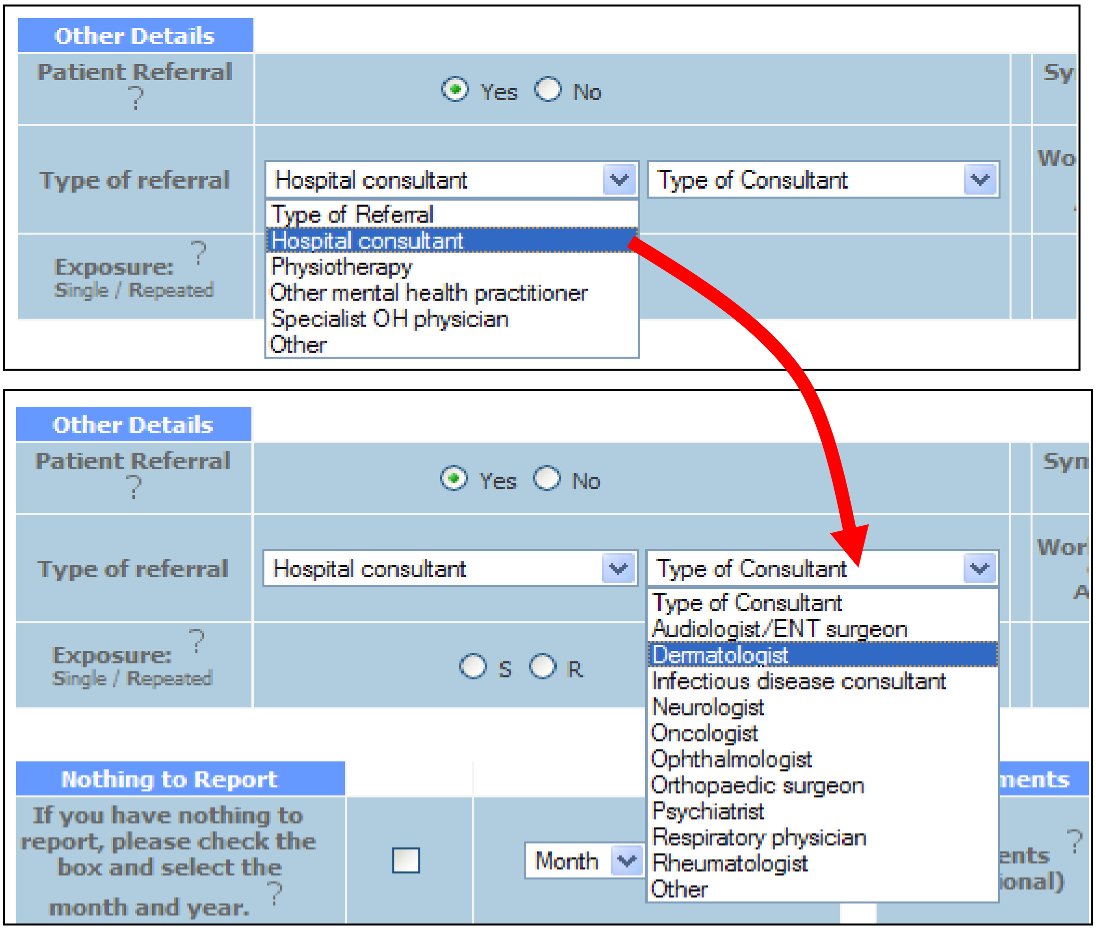

Figure 2.5. Referral drop-down menus on the THOR-GP webform

Once the reporter had completed the form for an individual case report they clicked the 'submit case' button at the foot of the form. After they had submitted a case it was possible for the reporter to view the details submitted (of ***all*** previously submitted cases). The username used by the reporter to access the form was attached to each case entry so the reporter could be identified in association with each case, for database management and analysis purposes.

2.3.3 Reporting sickness absence

THOR-GP differed from the other THOR (specialist) schemes in collecting data about sickness absence to help estimate the 'burden' of work-related ill-health.

2.3.3.1 Prospective data collection

As shown in Table 2.3, reporters were asked to report the sickness absence issued with a new case submission; this would only record the length of time associated with the first sick note issued. Therefore, at the end of an initial sick note period, GPs were given the facility to record details of any subsequent sickness certification associated with a case. An additional web form (also accessed from the THOR-GP website) enabled GPs to report longitudinal sickness absence data. They were able to view their previously submitted case, select the case ID number and complete the field 'Sickness absence has been issued for a further X days' (Appendix Eight).

2.3.3.2 Retrospective data collection

Most sickness absence data in THOR-GP were reported at the time of the initial consultation. As described above, GPs were able to report further certified absence giving a longitudinal view of the sickness absence associated with each case; however it was uncertain whether all GPs provided complete data, especially for cases with long-term sickness. Therefore, the sickness absence data in THOR-GP were continuously audited. A year retrospectively, a sample of GPs was asked how long in total the patient was away from work. So as not to overburden reporters, GPs were only asked to do this for a maximum of two cases per annum.

2.3.4 Zero returns and response data

In order to estimate incidence and reporter trends (in addition to the case report information), it was important to know whether the GP had not seen any relevant cases during a particular reporting period. At the end of each reporting month, GPs who had not seen any relevant cases during that reporting period were asked to access the web form and send a 'zero return' by clicking a button which states 'I have nothing to report'. It was also important to know whether there was any particular reason for this, for example because they were on leave or absent from work for other reasons. If there were valid reasons for not seeing potential cases, the GP was removed from the number of GPs reporting that month. Submission of a zero return established that a GP was actively reporting (or as described above, not able to report for a specific reason and not seeing patients) but that no cases were seen that fulfilled the reporting criteria. This differentiated them from a non-responding GP, who had not submitted any cases because the reporter had forgotten or did not have time to actively participate. For every month of a GP's participation their response was recorded, namely whether the participant had reported cases or sickness absence returns (and if so, how many), if they had sent in a 'zero return', if they were unable to report, or if they had not sent any data (a non-response) for a particular month. This enabled month by month response information to be calculated. The type of reporting method was also recorded; most submissions were via the web form, however 'zero return' information was also received via email.

2.3.5 Chase-ups

In order to achieve as high a response rate as possible, reporters were emailed twice a month to remind them that they needed to submit a return (cases or zero) if they had not yet done so for the previous month. There were two types of reminder emails; one was a standard email sent at the beginning of the month asking the reporter to log on to the web form and send a return for the previous month, and the other, which was sent middle of the month following their allocated reporting period, was an automatic email containing three clickable options (Appendix Nine).

- I did not see any relevant cases in <x month>
- I do have cases to report for <x month> and will send them shortly>
- I have no cases to report as I was not actively practicing in <x month> (therefore saw no cases at all, work-related or otherwise)

This automated email was introduced in August 2006 in an attempt to reduce the level of non-response. It was thought likely that this would increase the proportion of GPs submitting zero returns as it made it easier for them to submit this response; however it was thought preferable to have some form of response from a GP than none at all (Table 2.4). With each submission, the method used to respond was recorded (e.g. web form, automatic email etc.), thereby enabling the effect of this change in methodology to be examined.

Table 2.4. THOR-GP response 2006 to 2009

	2006 N	2006 %	2007 N	2007 %	2008 N	2008 %	2009 N	2009 %	2006 to 2009 N	2006 to 2009 %
Reported cases	949	26.7	799	21.1	778	23.7	640	21.4	3166	23.2
Zero returns	999	28.1	1179	31.1	1244	37.8	1230	41.1	4652	34.2
Webform	855	85.5*	780	66.2*	822	66.1*	843	68.5*	3300	70.9*
Automatic email	144	16.8*	399	33.8*	422	33.9*	387	31.5*	1352	29.1*
No response	1603	45.1	1810	47.8	1265	38.5	1122	37.5	5800	42.6
Total reporter months	3551	100.0	3788	100.0	3287	100.0	2992	100.0	13618	100.0
Mean reporters reporting per month	296	–	316	–	274	–	249	–	284	–

*percentage of zero returns

2.4 Maintaining participation

Reporters leave surveillance schemes for a number of reasons; withdrawal due to lack of time, retirement, change in type of practice etc. THOR-GP aimed to have between 250 and 300 GPs participating in the scheme at any one time, so it was essential to continue with recruitment as the scheme progressed. However, although it was important to maintain reporter numbers, it was also important to ensure those that were enrolled on the scheme were actively participating and not falsely inflating reporter numbers.

2.4.1 Persistent non-response

There were reporters who, month by month, did not respond with any cases or ‘zero returns’. In order to counteract this problem, a reporter was emailed after six months of non-response and advised that they would be removed from the list of reporters if there was no further response (issued a ‘yellow card’). If, after a further month, there had been no response to this ‘yellow card’ the GP was removed from the list of active reporters (issued a ‘red-card’) and therefore withdrawn from THOR-GP. This methodology (as other methods developed within THOR-GP) was implemented as a result of the pilot process in 2005, but also in response to an assessment of reporter behaviour with the increase in the number of reporters at the beginning of 2006. Some reporters agreed to join and failed to send a single response while others would report occasionally and then their submissions would cease. It was considered that six months of non-response would indicate that a reporter was no longer (or had never started) actively participating in the scheme therefore the red-carding procedure was first implemented in June 2006 with 13 persistent non-responders being contacted. The inclusion of non-responders gave an inflated figure for GP participation however it did not affect incident rate calculation as this was based on active reporters only (see 2.8.1 and 2.8.3.6).

2.4.2 On-going recruitment

The ‘red-card’ process and the loss of reporters for other reasons, resulted in reporter numbers falling, therefore recruitment to THOR-GP was on-going. The main source of new recruits was the diplomates of the DOccMed course at the COEH with two intakes of student each year, but other sources of GPs who had received relevant occupational medicine training (as described in section 2.2.1.3) were also approached. Once THOR-GP had been collecting data for six months, information on the scheme was included in the course material given to COEH DOccMed students to encourage them to participate upon course completion. Other new recruits resulted from GPs expressing an interest in participation after being made aware of the scheme through peer reviewed publications, and following conference presentations.

2.4.3 Reporting frequency

When THOR-GP commenced in 2005, all reporters were reporting continuously, submitting cases throughout the year (known as core reporting). This achieved a maximal throughput of numerator cases, and permitted the scheme to rapidly provide early data on the distribution and nature of cases reported from general practice. However, in 2007, sample reporting was introduced. This is when a GP (or other physician in THOR’s specialist schemes) report for one randomly assigned month a year. Research (160) has shown that sample reporting may give a better estimate of incidence as it is less prone to reporter fatigue, being less demanding on participants’ time. This research undertaken with a group of occupational physicians participating in OPRA, suggests the increase in incidence produced by sample reporting may also be a result of over-reporting with reporters ‘harvesting’ cases from previous months. However, during the period of GP reporting discussed in this thesis (2005 to 2009), very few GPs were participating as sample reporters (Table 2.5) and therefore any resulting bias was minimal. Sample reporting was also introduced as it was less costly to fund as GPs' remuneration was reduced in line with this reduction in reporting frequency from £200 to £100 per annum. Cases submitted by sample reporters were multiplied by 12 and added to cases reported by core reporters to give annual estimates. The proportion of sample reporters increased each year, in particular, in 2010 when the core:sample reporter ratio was 1:4 (Table 2.5)

Table 2.5. Core and sample reporters 2005 to 2010 (average number of reporters per month)

Year	Core n(%)	Sample n(%)	Core:Sample ratio
2005	89 (100)	0 (0)	–
2006	295 (100)	0 (0)	–
2007	314 (98)	8 (2)	40:1
2008	272 (95)	13 (5)	21:1
2009	244 (88)	32 (12)	8:1
2010	57 (22)	208 (78)	1:4

2.5 Data handling

2.5.1 Data transmission and storage

The THOR-GP website was https secured. All data were submitted via the on-line web form using HTTP and SSL/TLS protocols to ensure secure, authenticated and encrypted communication of data to and from the users' browser and the University of Manchester's servers. When a case was submitted to THOR-GP it was stored in a MySQL database. This generated an email to the data handlers, who entered the THOR-GP MS Access database (stored on the local University of Manchester server) and downloaded the new data from the MySQL database.

2.5.2 Initial data handling

When new cases entered the local database they were automatically assigned a unique case ID number. They underwent initial checking processes and errors were corrected (such as typographical or spelling mistakes). If any information was missing, unclear or did not fulfil case criteria (e.g. possibly not being work-related), this was noted and the GP contacted for clarification of the case details. The response (case report, sickness absence or blank return) was also recorded in the database.

2.6 Data coding

To enable quantitative analysis, all data submitted as a text field were coded. All coding was carried out by two independent coders, and any differences were reconciled by a third person.

2.6.1 Diagnostic category and disease, injury or symptom

THOR-GP data were categorised into the diagnostic groups used within the other THOR schemes to enable comparisons between work-related ill-health data reported by different groups of physicians. The main diagnostic categories were the same as those used in OPRA, as this occupational physician reporting scheme was the only other scheme within THOR where physicians reported the patient diagnosis using free text. In the specialist schemes such as SWORD and MOSS, reporting physicians selected a diagnosis from a pre-defined list of work-related diagnoses. Cases were classified into the six major diagnostic categories shown in Table 2.6

Table 2.6. Major diagnostic categories for classification of THOR-GP (and OPRA) cases

Category	Disease
1	Respiratory disease
2	Skin disease
3	Musculoskeletal disorders
4	Hearing loss
5	Mental ill health
6	Other (e.g. minor injury, infections etc.)

These major categories were further classified into specific diagnoses in-line with the systems used in the THOR specialist reporting schemes. However, for GP data, further categories were added to the established list to cope with the observation that GPs often reported a list of symptoms (e.g. shortness of breath, wheeze and cough) rather than assigning a specific diagnosis such as asthma. Specific diagnoses classified within the major categories were:

Respiratory

- Allergic alveolitis
- Asthma
- Bronchitis / emphysema
- Infectious diseases
- Inhalation accidents
- Benign pleural disease
- Malignant Mesothelioma
- Lung cancer
- Pneumoconiosis
- Other respiratory illness
    - Rhinitis*
    - Throat problems*
    - Respiratory symptoms*
    - Other*

Skin

- Contact dermatitis
- Contact urticaria
- Folliculitis/acne
- Infective skin disease
- Mechanical skin disease
- Nail conditions
- Skin neoplasia

- Other dermatoses
  - Thermal burns*
  - Caustic burns*
  - Dermatitis symptoms*
  - Other*

Musculoskeletal disorders

Upper limb disorders:

Hand/wrist/arm

- Carpal tunnel syndrome
- Other nerve entrapment
- Tendon sheath/tendon condition
- Raynaud's
- Hand Arm Vibration Syndrome (HAVS, previously: VWF)
- Pain: pathology ill defined
- Osteoarthritis

Elbow

- Epicondylitis/bursitis
- Pain: pathology ill defined
- Osteoarthritis

Shoulder

- Rotator cuff injury/bursitis
- Pain: pathology ill defined
- Osteoarthritis

Spine/back disorders:

Neck/thoracic spine

- Spondylosis/disc problem
- Pain: muscular pattern
- Pain: pathology ill defined
- Osteoarthritis

Lumbar spine/trunk

- Spondylosis/disc problem
- Mechanical back pain
- Pain: pathology ill defined
- Osteoarthritis

Lower limb disorders:

Hip/knee/leg

- Inflammation/bursitis
- Pain: pathology ill defined
- Osteoarthritis

Ankle/foot

- Inflammation
- Pain: pathology ill defined
- Osteoarthritis

Other musculoskeletal disorders

Audiological

- Sensorineural hearing loss
- Tinnitus
- Balance problems
- Tympanic disorders
- Other problems

Stress and mental ill-health

- Anxiety/depression
- Post-traumatic stress disorder
- Other work-related stress
- Alcohol or drug abuse
- Psychotic episode
- Other mental ill-health
- Other stress related symptoms

Other work-related ill-health

- Cuts/lacerations*
- Infections (not classified above)*
- Eye*
- Headaches*
- Other*

*Categories specific to THOR-GP

In the UK, general practice consultation data are typically coded using the Read code morbidity coding system (161). However, the diagnoses/symptom described by GPs were coded using the International Classification of Diseases (ICD10) codes (162). This was to ensure coding systems were compatible (and comparable) internationally and with other THOR (particularly OPRA) databases. Appendix 10 shows a list of the most frequently used ICD10 codes, these codes were then grouped into the categories shown above.

Each case was also coded as being either a disease or an injury. A classification for defining disease or injury was adopted from methods used to record work-related ill-health in community clinics (80). These methods stated that 'an injury is the result of a single traumatic event where the harm is immediately apparent' (coded as 1) and 'a disease results from repeated or long-term exposure to an agent or event' (coded as 0). Injury has also been defined by the World Health Organisation as 'an acute exposure to physical agents such as mechanical energy, heat, electricity, chemicals and ionizing radiation, interacting with the body in amounts, or at rates, that exceed the threshold of human tolerance' (163).

2.6.2 Geographical region

The postcode district information (first half of postcode) was coded using the LFS region and county classification (Appendix 11). For example, M13 would be coded as Region 14 (Greater Manchester) and County 63 (Greater Manchester) and TN17 would be coded as Region 10 (Rest of South East (i.e. not including London)) and County 44 (Kent).

2.6.3 Industry and occupation

Industry was coded using the Standard Industrial Classification (SIC 2003) (164) and occupation, using the Standard Occupational Classification (SOC 2000) (165). SIC 2003 is a four digit coding system; THOR-GP data was coded to the two digit level (62 industries) which are grouped into 17 major sections. For example, a fish processor would be coded within Industry 15 (Manufacture of food products and beverages) which is grouped into the wider Section D (Manufacturing). SOC 2000 is also a four digit system; THOR-GP data was coded to the finest four digit level. There are 353 SOC codes (unit groups), these are grouped into 81 minor groups, and in turn into 25 sub-major groups and nine major groups. A fish processor would be coded as unit group 5433 (Fishmonger, poultry dressers) which is grouped into minor group 543 (Food preparation trades), then into Sub-major Group 54 (Textiles, printing and other skilled trades) which is within Major group five (Skilled trades occupations).

2.6.4 Agent, event and task

Agents suspected of causing (or contributing to) cases of respiratory and skin disease were coded, including all chemical agents and less specific terms (e.g. wet work, or welding fume). Lists of agents (which differ slightly for respiratory and skin disease) had been used to code other THOR data since 1989, and were originally drawn up in conjunction with the Health & Safety Executive (HSE). (Appendix 12 and 13). All chemically defined agents were also coded with a Chemical Abstracts Registry Number (CAS code) (166). Musculoskeletal disorders were coded using task and movement codes (Appendix 14), which used a coding system that was devised within THOR and has been tested for reliability (167). Cases of mental ill-health were coded using a system covering precipitating events (Appendix 15). (168;169)

2.7 Data cleaning and preparation

Once all the data were coded and entered into the access database, they were exported via MS Excel into the statistical package for social sciences (SPSS) version 15. An SPSS programme containing all ICD10 and substance codes previously used in THOR checked for errors and assigned ICD10 codes into the diagnostic categories described in 2.6.1; any unrecognised codes were detected as errors, and checked for inputting accuracy. Many of these unrecognised codes (particularly in the early stages of data collection) were found to be correct but had not been previously used in THOR, such as disease symptoms and injuries. These new codes were assigned a diagnostic category and added into the SPSS programme.

2.8 Calculating incidence rates

One of the principle aims of THOR-GP was to use the data to calculate the best possible estimates of incidence of work-related ill-health in GB. In order to calculate incidence rates the numerator (incident cases of work-related ill-health) needs to be divided by a suitable denominator (population from which the cases are derived). The resulting figure can then be multiplied by 100,000 to provide an incidence rate for work-related ill-health per 100,000 persons employed in GB.

THOR-GP has, by design around 250 to 300 GPs participating in the scheme at any one time. This constitutes approximately 1% of GPs in GB.

Two methods were used to calculate rates of incidence in THOR-GP.

- LFS denominator method – This method was used in the earlier stages of THOR-GP data collection, prior to the work carried out to establish the THOR-GP denominator based on participating GPs practice populations. This method extrapolated THOR-GP numerator data to produce estimates for GB, dividing this numerator by national LFS denominator data. This assumed that the THOR-GP population was representative of GB as a whole.

- THOR-GP population denominator method - this established the size and characteristics of the THOR-GP population.

2.8.1 LFS denominator method

In order to extrapolate THOR-GP cases up to GB figures and calculate GB incidence rates, the data were adjusted by reporter response rate and part-time practice. As THOR-GPs have received diploma level training in occupational medicine, many of them worked a few sessions a week in occupational health clinics; surveys of participating GPs' clinical practice estimated that THOR-GPs work 70% of full-time equivalence in general practice (see section 2.8.2). This is relevant because only cases seen in the participants' general practice clinical setting should have been reported to THOR-GP. This adjusted numerator (i.e. all incident case reports) was then multiplied by the number (full-time equivalent) of GB GPs (170-172). This estimate of GB cases was divided by the number of persons employed according to the LFS and multiplied by 100,000 to give incidence rates per 100,000 persons employed.

To illustrate this method, a theoretical GB annual incidence rate has been calculated with a working example shown in red.

<u>Step 1. Number of cases reported per annum</u>

125 cases, 5 of which were reported by sample reporters

<u>Step 2. Cases from sample reporters were multiplied by 12 and added to cases from core reporters to give an estimated number of cases</u>

120 + (5 x 12) = 120 + 60 = 180 estimated cases

<u>Step 3. Number of cases reported per GP</u>.

This was calculated by taking the number of case reports and dividing it by the average number of GPs actively reporting (submitting a case or zero return) each month (183 GPs reporting per month at a 75% response rate = 137 active GPs). This thereby adjusted the numerator for the reporters' response rate.

180 / 137 = 1.314 cases per GP

Step 4. Adjusting for the part-time (PT) practice of THOR-GPs.

THOR-GPs were estimated as working 70% of full-time in general practice (see 2.8.2), therefore the numerator was adjusted to give the number of cases reported per GP if they were practicing full-time.

1.314 / 70 x 100 = 1.877 cases per GP

Step 5. Extrapolating the numerator to GB figures.

As THOR-GP cases had been adjusted to assume full-time practice, the estimated figure for the number of Full-Time Equivalent (FTE) GPs in GB (41094) was used to estimate cases in GB (170-172).

1.877 x 41094 = 77,133 cases in GB

Step 6. Calculation of incidence rates

This number of GB cases was then divided by the number of persons employed in the corresponding time period in GB according to the LFS (173) (28,000,000 in this illustrative example) and multiplied by 100,000 to give an incidence rate per 100,000 persons employed.

77,133 / 28,000,000 = 276 cases per 100,000 persons employed per annum

2.8.2 Number of GP sessions and part-time practice

All participating GPs were sent a questionnaire (Appendix 16) asking them about the number of GPs in their practice, the number of sessions carried out themselves each week, and the number of sessions in total taken by all the GPs in the practice. The information provided by this survey was used in both methods of calculating incidence rates from THOR-GP data. Of the 236 GPs who were sent this survey, 200 (85%) GPs responded, and their total number of sessions per week = 1399. If full-time practice was considered to be 10 sessions per week (AM and PM clinics, five days a week), this would mean that, if all these GPs worked full-time the number of sessions would = 2,000; THOR-GPs therefore worked 70% of this. The total number of practice sessions taken by participating GPs' practices was 8076, therefore the questionnaire also showed that overall, THOR-GPs carried out 17% of all the sessions in the participating GPs' practices.

2.8.3 THOR-GP denominator method

The LFS denominator method described in section 2.8.1, assumed that these GPs and their patients are representative of the whole GB population, whereas the information may be subject to certain biases (such as geographical distribution affecting how a population registered with each GP practice is employed). THOR-GP numerator data were based on cases of work-related ill-health reported by participating GPs, therefore the equivalent denominator information should be the registered population of participating practices broken down by those of working age (working age is persons aged 16 to 64 years inclusive), who were also in employment (economically active).

In order to have a better understanding of THOR-GP's population it was necessary to develop methodology to characterise this population. The characteristics and health indicators of a practice population based on the patients' postcodes is considered to be the 'gold standard' method but it has been often reported that these data are not easily accessible to researchers (174;175). Therefore, it was considered unlikely that all GPs would provide their patient postcode files. As a result, an alternative method of estimating the THOR-GP population was developed, based on the postcode of the participating GPs' practice. Both methods (practice and patient postcode) required some understanding of Census geography, including a hierarchical set of areas defined for the release of 2001 Census data in the UK. Output Areas (OAs) are the smallest areas in common use across the UK; the larger hierarchical areas are different for England/Wales and Scotland (Figure 2.6) (176-178).

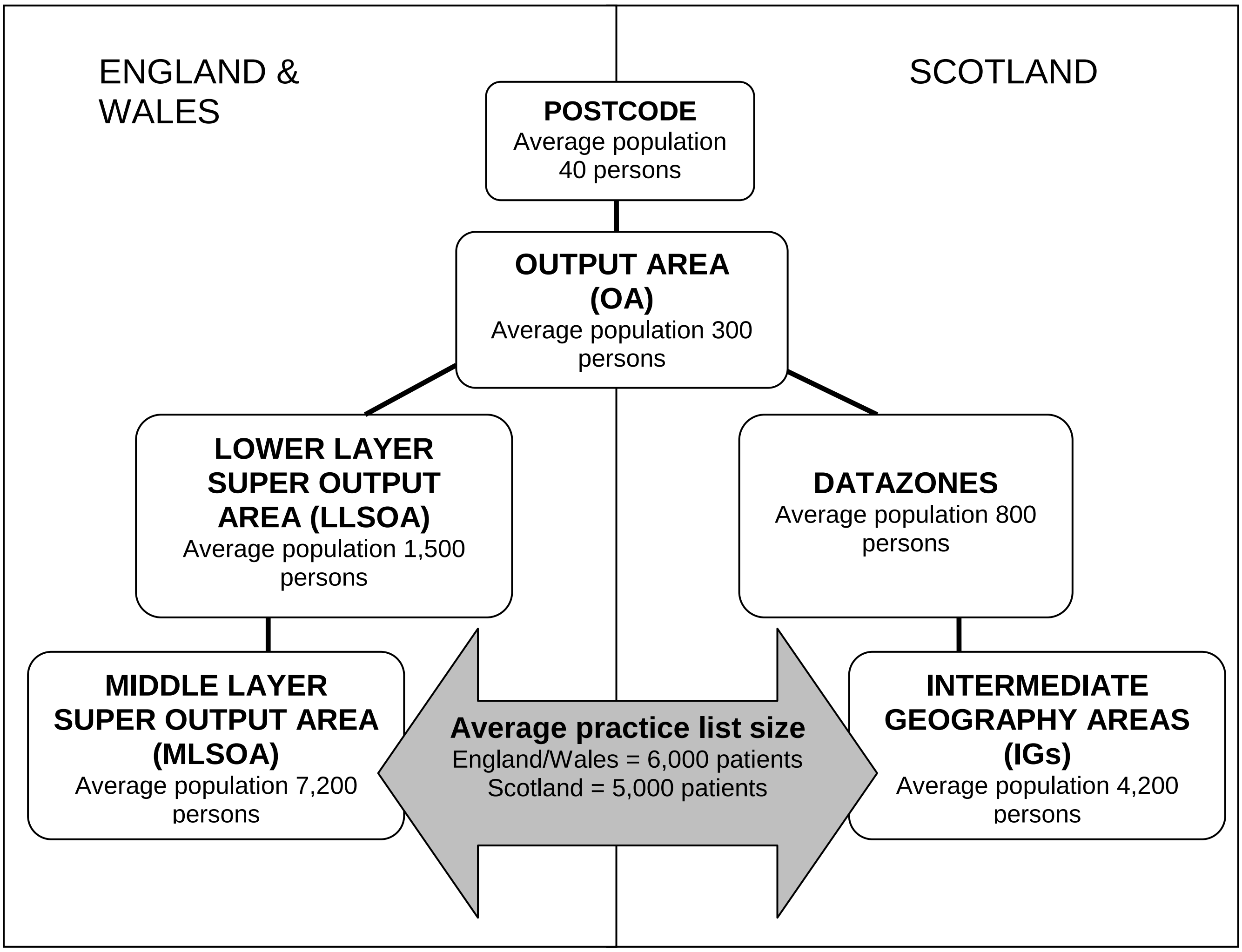

Figure 2.6. Hierarchical areas used in Census data classification

2.8.3.1 Denominator based on patient postcode (Method A)

Participating GPs were asked to provide information (age, gender and postcode) of all patients registered with their practice. It was clear through consultation with a number of GPs that although extracting the age and gender information via the GP IT systems used in practices (EMIS, GPASS, TOREX etc.), was fairly straightforward, extracting the postcode list was more complicated. Therefore, with the help of these GP advisors, step-by-step guidelines (e.g. Appendix 17) were written for the different GP systems explaining how to extract this information, and were sent out as a request for patients' information. These instructions also explained how, once the data was extracted, the GP should separate postcode information from age and gender details, to negate any concerns about potential identification of individual patients.

The postcode information received was separated into two groups; postcodes from England & Wales, and Scottish postcodes. These were linked to their corresponding Output Areas (OAs) and lists of areas so identified were sent to the Office of National Statistics (ONS) and the General Register Office for Scotland (GROS), for populations within each OA to be broken down by Standard Industrial Classification (SIC) and Standard Occupational Classification (SOC). There was huge variation in the number of patients within each OA; for OAs geographically near the practice, the majority of the population was registered with the THOR-GP practice, however other OAs had only one patient registered with the practice.

Figure 2.7 shows the distribution of registered patient postcodes around one THOR-GP's practice, and Figure 2.8 illustrates the variation in the number of patients residing within OAs around another THOR-GPs practice. Approximately 15% of OAs in the THOR-GP population had just one patient residing in them; therefore it was essential that the characteristics of all OAs were included in the total THOR-GP population. However, it would have been inaccurate for the population of every OA to be included in the THOR-GP population with equal weighting; therefore methods to weight the data accordingly were developed for ONS and GROS to use to extract the required information from their databases (Tables 2.7 to 2.11).

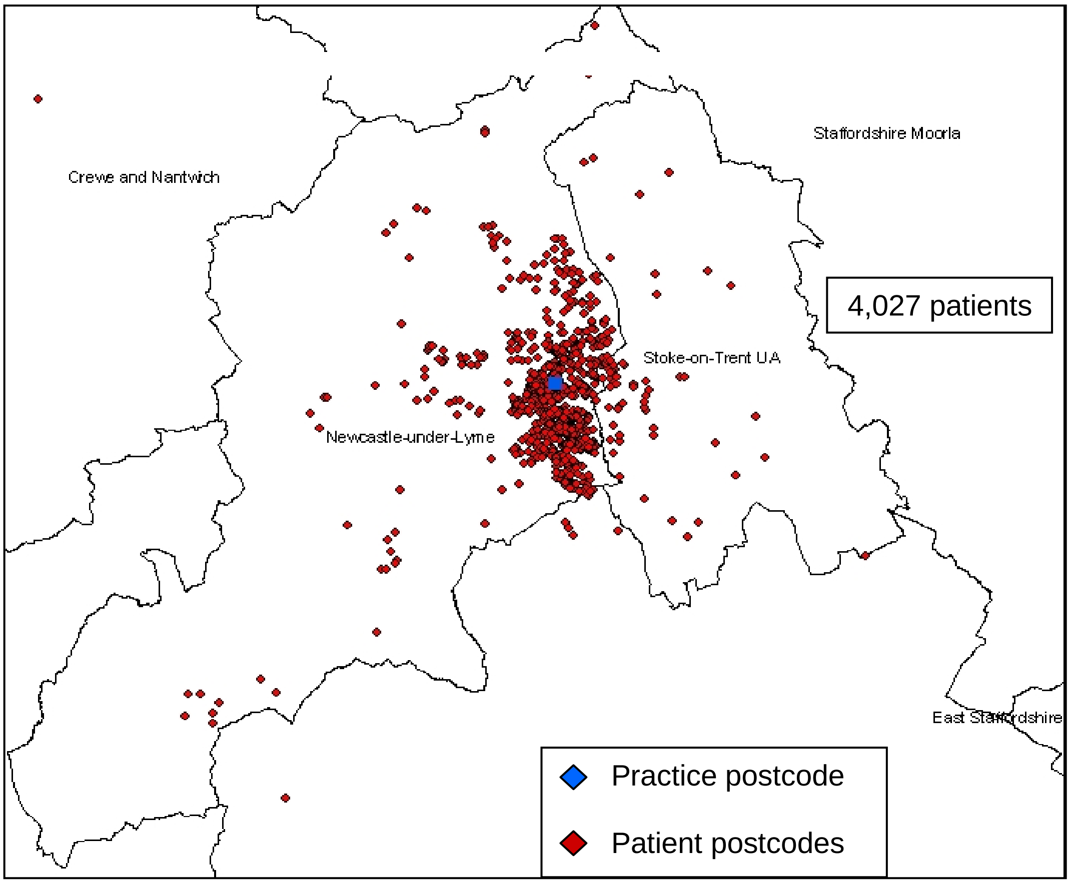

Figure 2.7. Example of one THOR-GP participant's practice and the distribution of registered patients' postcodes

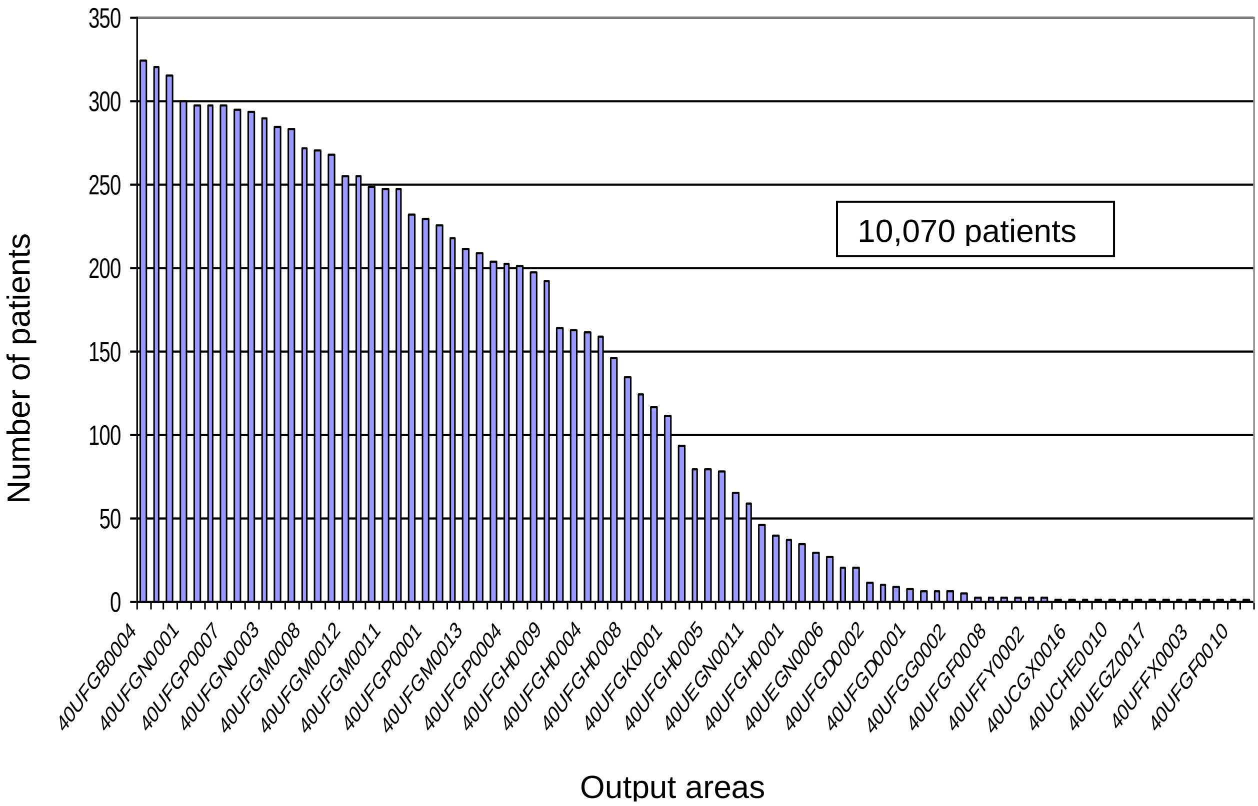

Figure 2.8. Number of patients within each output area registered with one THOR-GP participant's practice

Each OA needed to be broken down by SIC and separately broken down by SOC (i.e. not SIC and SOC cross tabulated) then the results of all the OAs pooled together to provide information on the total employment of the study population. The method involved calculating the proportional breakdown by SIC and SOC for each OA and multiplying (and therefore weighting) these proportions by the number of patients in that OA. As the data was subject to disclosure restrictions it was not possible for ONS or GROS to provide the details of each OA, therefore it was necessary to ask them to calculate the weighting for each OA and add the results together. There are 353 SOC codes and 62 SIC codes according to this level of classification, however the weighting method has been illustrated below using an example of 10 fictitious SIC codes. The same methodology also applies to SOC codes.

<u>OA weighting method</u>

For demonstration purposes the methodology has been illustrated using a simplified example of a population of 238 patients residing in 3 OAs in England/Wales (ONS data).

The tables 2.8 to 2.10 consist of the fields in Table 2.7.

Table 2.7 Explanation of the data in Tables 2.8 to 2.10

COLUMN 1 **SIC code**	**COLUMN 2** **Number of persons in OA**	**COLUMN 3** **% persons in OA**	**COLUMN 4** **Number of persons in OA in THOR-GP**
SIC	Number of people by SIC in OA according to ONS data	Proportional breakdown of SIC within OA	Proportion multiplied by number of THOR-GP patients within OA (Column 3 X number of persons in OA)

Table 2.8 OA1 with a total of 434 residents of whom 222 are THOR-GP patients

SIC code	Number of persons in OA	% persons in OA	Number of persons in OA in THOR-GP
1	97	0.22	49.62
2	53	0.12	27.11
3	4	0.01	2.05
4	78	0.18	39.90
5	63	0.15	32.23
6	22	0.05	11.25
7	14	0.03	7.16
8	32	0.07	16.37
9	51	0.12	26.09
10	20	0.05	10.23
Total	**434**	**1.00**	**222.00**

Table 2.9 OA2 with a total of 308 residents of whom 15 are THOR-GP patients

SIC code	Number of persons in OA	% persons in OA	Number of persons in OA in THOR-GP
1	50	0.16	2.44
2	26	0.08	1.27
3	62	0.20	3.02
4	44	0.14	2.14
5	36	0.12	1.75
6	12	0.04	0.58
7	5	0.02	0.24
8	29	0.09	1.41
9	30	0.10	1.46
10	14	0.05	0.68
Total	**308**	**1.00**	**15.00**

Table 2.10 OA3 with a total of 378 residents of whom 1 is a THOR-GP patient

SIC code	Number of persons in OA	% persons in OA	Number of persons in OA in THOR-GP
1	76	0.20	0.20
2	32	0.08	0.08
3	12	0.03	0.03
4	25	0.07	0.07
5	68	0.18	0.18
6	59	0.16	0.16
7	20	0.05	0.05
8	47	0.12	0.12
9	9	0.02	0.02
10	30	0.08	0.08
Total	**378**	**1.00**	**1.00**

The resulting THOR-GP population was the combination of these 3 OAs combined as in Table 2.11.

Table 2.11 Results from OA1+OA2+OA3 = employment of total population

SIC code	OA1	OA2	OA3	OA combined
1	49.62	2.44	0.20	52.25
2	27.11	1.27	0.08	28.46
3	2.05	3.02	0.03	5.10
4	39.90	2.14	0.07	42.11
5	32.23	1.75	0.18	34.16
6	11.25	0.58	0.16	11.99
7	7.16	0.24	0.05	7.46
8	16.37	1.41	0.12	17.91
9	26.09	1.46	0.02	27.57
10	10.23	0.68	0.08	10.99
Total	**222**	**15**	**1**	**238.00**

ONS then sent only the details of the results in the final column of Table 2.11 (OA combined) therefore avoiding any disclosure problems and the risk to patient anonymity.

The postcode information provided by the GPs listed all the patients registered with the practice, however, the final THOR-GP population denominator needed to be adjusted to include only those who were of working age and were also employed. As it was not possible to know which of the patients within each OA fell within this group, the weighting also had to apply to two extra categories in addition to each SIC and SOC; ‘persons outside working age’ and ‘persons of working age but not in employment’. These could then be excluded from the population figures.

2.8.3.2 Denominator based on practice postcode (Method B)

For THOR-GP practices where patient postcode data were not available, an area within the geographical hierarchy of similar population size to the average practice list in GB was chosen (Figure 2.6). The average practice list size was estimated as 6,000 patients for England/Wales and 5,000 for Scotland (179). The nearest geographical area in magnitude to this is the Middle Layer Super Output Area (MLSOAs) for England/Wales and Intermediate Geography (IG) areas for Scotland. All of the MLSOAs and IG area codes associated with the practice postcodes were compiled and sent to either ONS or to GROS to be broken down by SIC and SOC.

2.8.3.3 Multiple THOR-GPs in a single practice

Some of the THOR-GPs worked in the same practice. As these GPs share the same practice population, there is an increased chance for a patient within these populations to be seen by a THOR-GP reporter (rather than another non-THOR-GP within the practice) than there would be if only one GP within the practice reported to THOR-GP (as is the case for most THOR-GPs). Therefore, for these GPs, OAs, MLSOAs or IGs were included in the data sent to ONS and GRO-Scotland twice.

2.8.3.4 Comparing and validating patient (Method A) and postcode (Method B) denominator methods

After two letters reminding GPs to send their patient postcode information it was decided that the highest possible response rate had been achieved. This therefore meant there were two population areas; Area One GPs (where patient postcode information was provided), and Area Two GPs where there was no patient postcode information. For Area One, the population was characterised using both methods of denominator characterisation (patient and practice postcode data) in order to validate the methods used in the absence of the 'gold standard' patient postcode data. The two areas were compared by industrial and occupational employment and also by the size of the population. Further details of methods used are shown in Chapter 4 (section 4.2.4).

2.8.3.5 Adjusting the size of the population estimated by practice postcode

The size of the Area One population (estimated from lists of patient postcodes) was likely to be a more accurate estimate of population size, as it was made up of the patients within the practice. Area Two was estimated using the population size of the MLSOA and IG area corresponding to the practice postcode, and was likely to be less accurate. The population size of Area Two was adjusted using published data on practice list size (180-182). The practice list size data included all the patients registered to a practice, this therefore itself needed to be adjusted to include only those who were economically active. According to ONS data for 2010, 64% of the population are of working age (16 to 64) and of those, 71% are employed (183;184).

2.8.3.6 Incidence calculation using the THOR-GP population denominator method

To illustrate this method, each step of the calculation is explained in a stepwise fashion. These rates were calculated for individual industrial sections.

Step 1. The THOR-GP population (P) was calculated by summing the four different populations.

The total THOR-GP population was the sum of the population of Area One (patient postcode (Method A) and Area Two (practice postcode (Method B) adjusted for practice size) for England/Wales and Area One and Area Two (adjusted for practice size) for Scotland.

E/W 1 + E/W 2 + S 1 + S 2 = P

Step 2. Denominator (D) adjusted by number of sessions

As described in section 2.7.2, the participating GPs take 17% of the total practice sessions, therefore covered 17% of the THOR-GP population.

P x 0.17 = D

Step 3. Numerator adjusted by response rate.

The numerator (estimated cases) (C) was adjusted by the response rate (e.g. 75%), to estimate the number of cases that would have been received if all THOR-GPs had reported (N)

C / 75 x 100 = N

Step 4. The numerator (N) was divided by the denominator (D) and multiplied by 100,000 to get an incidence rate per 100,000 persons employed per annum

N / Z x 100,000 = incidence rate per 100,000 persons employed per annum

2.8.3.7 Calculating GB incidence rates from THOR-GP incidence rates

Results from the calculations illustrated in section 2.7.3.6 above estimated the incidence rates of work-related ill-health within the THOR-GP population. It was not known if this population differed in employment to that of the GB population; therefore the two populations were compared by age and gender, and by the distribution of industrial employment. The THOR-GP population was characterised using Census 2001 data; therefore results were compared (using ratios of % distribution by industry) to contemporary LFS data and also LFS information from 2006 to 2008 (contemporary with the numerator). The resulting ratios of % were used to apply weighting to the THOR-GP incidence rates to estimate incidence rates for the GB population as a whole. These methods are described in full in Chapter Four (section 4.2.6)

2.9 Comparisons with other data sources

In order to investigate how information on work-related ill-health reported from general practice may differ from that originating from other sources, THOR-GP data were compared to reports from occupational physicians (OPs). Data reported from THOR-GP and OPRA were analysed by diagnosis, gender and industry. Likelihood ratios were calculated to analyse whether difference in reporting were as a result of biases in industrial coverage of occupational health services. Case reports and incidence rates from THOR-GP were compared and triangulated with reports from THOR clinical specialists (rheumatologists, psychiatrists, respiratory physicians and dermatologists) and the self-reported data from the SWI. In addition to incidence rates, data were compared by diagnostic case mix and triangulated with rates of referral from primary to secondary care as reported to THOR-GP (See Section 2.10.2).

2.10 Analysis

The specific analyses used to achieve the objectives of this thesis are described in the individual methods sections of the published papers comprising the results section. The methods of analyses and statistical tests used for each objective are summarised below. All data were analysed using SPSS (version 15).

2.10.1 Incidence and nature of work-related ill-health as determined in general practice

The first objective was to investigate the nature of work-related ill-health seen and reported by GPs in their general clinical practice. This was achieved primarily through descriptive proportional analysis to give an overall picture of the cases seen by GPs (Table 2.12). In Chapter Three 'Work-related ill-health in general practice, as reported to a UK-wide surveillance scheme' (135) the work-related ill-health reported was described by diagnoses, gender and industrial sector; these data were also cross-tabulated to illustrate how the type of work-related ill-health varied by industry. In Section 5.1 'Comparison of work-related ill-health reporting by occupational physicians and general practitioners' the proportional distribution of cases by age group was described, and also the breakdown of diagnostic category by gender. In Section 5.2 'Comparison of work-related ill-health data from different GB sources' (137) the THOR-GP case mix was described in greater detail, illustrating the cases reported within each diagnostic category. Referral patterns may also be influenced by diagnosis; this was assessed by examining the proportion of cases that were referred by GPs to hospital specialists and other health practitioners.

Table 2.12. Analyses used to determine the nature of work-related ill-health seen in general practice

Outcome measure	Method of analysis	Chapter/Section
Diagnosis	Proportional breakdown by major diagnostic category	3
	Cross-tabulated by industry	3
	Diagnostic category by gender	5.1
	More detailed case mix within diagnostic category	5.2
	Referral patterns by diagnostic category	5.2
Gender	Cases reported by gender	3
	Within diagnostic category	5.1
Age	Cases reported proportionally by age group and gender	5.1
	Mean age	5.1

Section 5.2 also showed the incidence rates per 100,000 persons per annum for each diagnostic category, and Chapter Six ‘Work-related sickness absence as reported by UK general practitioners’ tabulates incidence rates (for all cases, musculoskeletal and mental ill-health) for each industrial sector. These incidence rates were calculated using the interim LFS denominator method (described in full in 2.8.1) which was used to calculate incidence rates whilst THOR-GP practices’ patient postcode information was being gathered and analysed. The LFS denominator method involved extrapolating the cases reported by THOR-GP participants to give GB estimates and dividing these by LFS employment data.

Developing methods to calculate incidence rates from data reported to THOR-GP was the principle aim of this thesis. The interim (LFS denominator) method described above assumed that the THOR-GP population is representative of GB as a whole. However in order to develop a more accurate method of calculating incidence it was necessary to characterise the THOR-GP population using patient postcode information linked to census data. Chapter Four (and Section 2.8.1) described how this postcode information was analysed and compared to information based on the postcode of the practice instead of the individual patient postcode information. The industrial employment of the two populations was compared using a Pearson Chi squared test. With a large sample size a formal test of significance can often give a small p value even if there is only a slight difference in the distribution. It was therefore decided that a difference of 5% or less in the population within each industry using the two methods was acceptable i.e. the two populations were considered to be similar in their distribution. To examine this, the proportion of the population employed within a particular industry based on practice postcode was divided by the corresponding proportion based on patient postcode to give a ratio of percentages. Populations were considered similarly distributed with when the ratio of percentages ranged 0.95 and 1.05. This method was also used to compare the industrial distribution of the THOR-GP population to the working population of GB; a weighting method based on these ratios of percentages was used to make the incidence rates calculated within the THOR-GP population representative of the GB population. The gender mix of the THOR-GP and GB populations were compared proportionally and the age by a comparison of medians. The incidence rates calculated using the LFS denominator and the THOR-GP denominator method were compared by calculating incidence rate ratios. These analyses used to estimate and characterise the THOR-GP population and calculate incidence rates are summarised in Table 2.13.

Table 2.13. Analyses used to estimate and determine the THOR-GP population and calculate incidence rates

Outcome measure	Method of analysis	Chapter/Section
Incidence rates (LFS denominator method)	For all cases, musculoskeletal and mental ill-health - Calculated for industrial sections	6
	Calculated for each diagnostic category	5.2 and 6
Incidence rates (THOR-GP denominator method)	Calculated for industrial sections	4
	Compared with incidence rates for LFS denominator method using incidence rate ratios	4
THOR-GP population	Industrial employment estimated using patient and practice postcode. Distribution compared with Chi squared test and by calculating ratios of percentages	4
	Industrial employment compared with GB population in 2001 and 2006 to 2008 using ratios of percentages	4
	Age and gender compared with GB population using median and proportional gender mix	4
	Industrial employment adjusted using weighting system based on ratio of percentages to make THOR-GP incidence rates represent the GB population	4

2.10.2 Work-related ill-health as determined in general practice compared with work-related ill-health based on self-reports and reports from occupational physicians and clinical specialists

Chapter 5 concentrates on comparisons of work-related ill-health reported by GPs with other data sources. In Section 5.1 comparisons were made with reports by occupational physicians to OPRA. Demographic information was compared by carrying out an independent t-test of means on the age reported with each case and plotting the proportional distribution of the data submitted by the two groups of physicians (GPs and OPs) by age group and gender. These illustrated differences in the age and gender mix between the cases reported by the two groups of physicians. Cases were also cross-tabulated by diagnostic category and gender to compare the type and gender mix of cases reported by GPs and OPs. The proportional distribution of the industrial employment of THOR-GP and OPRA reports were compared to LFS data; this aimed to investigate whether OPRA reports were biased towards particular industries as a result of the coverage of occupational health services in the UK. The likelihood ratio (LR) of GPs and OPs reporting a case of mental ill-health was calculated by dividing the proportion of OPs' cases which were reported as mental ill-health by the proportion of GPs' mental ill-health cases. These LRs were subsequently calculated separately for each industry and combined to give a Mantel-Haenszel LR stratified and adjusted by industry. This showed whether differences in the diagnostic categories reported by the two groups were an effect of occupational health coverage in the UK. Similarly, this test was also carried out to investigate whether differences in the gender mix of cases was an effect of industrial coverage. The LR was calculated by dividing the proportion of female reports from OPs by the proportion of GP reports in females and as for diagnoses, stratified by industry. The analyses used to compare GP and OP reporting is summarised in Table 2.14.

Table 2.14. Analyses used to compare work-related ill-health reported by GPs and OPs

Outcome measure	Method of analysis	Chapter/Section
Age	T-test of means	5.1
	Proportional distribution by age group	5.1
Gender	Proportional distribution	5.1
	Cross-tabulated by diagnoses	5.1
	LRs for reporting females calculated for each industry to give a combined Mantel-Haenszel LR stratified and adjusted by industry	5.1
Diagnoses	Cross-tabulated by industry	5.1
	LRs for reporting mental ill-health calculated for each industry to give a combined Mantel-Haenszel LR stratified and adjusted by industry	5.1
Industry	Proportional distribution compared with LFS population data	5.1

In Section 5.2, work-related ill-health data collected from self-reporting individuals was compared with case information reported by GPs and clinical specialists by analysing data from the SWI, THOR-GP and THOR (SWORD, EPIDERM, MOSS and SOSMI clinical specialist schemes) respectively (Table 2.15). Incidence rates (using the LFS as the denominator) were calculated for each diagnostic category and compared. The incidence rate of cases referred from THOR-GP within each diagnostic category was compared with the clinical specialists' incidence rates by calculating the incidence rate ratio (clinical specialist rate/GP referral rate). This examined how similarly these two rates corresponded and triangulated; in theory, if clinical specialist cases are made up of cases referred by general practitioners the incidence rate ratio would be close to one. THOR-GP referral data was also tabulated to compare how referral patterns differ by diagnostic category, including referrals to other health practitioners (such as physiotherapists) as well as information on referrals to hospital specialists. Data from SWI, THOR-GP and THOR were analysed further to breakdown the cases within each diagnostic category and assess whether case mix varied by data source. For the SWI, this detailed case information was only available for musculoskeletal disorders.

Table 2.15. Analyses used to compare work-related ill-health collected from self-reports with case report from THOR-GPs and THOR clinical specialists

Outcome measure	Method of analysis	Chapter/Section
Incidence rates	For each major diagnostic category	5.2
THOR-GP referral patterns	Incidence rate ratios calculated for each diagnostic category (clinical specialist rate/GP referral rate)	5.2
	Proportional breakdown of patient referrals by diagnostic category	5.2
Diagnoses	Proportional breakdown of case mix within each diagnostic category	5.2

2.10.3 Sickness absence

THOR-GP data were analysed to examine the employment, diagnostic and demographic factors associated with work-related sickness absence (Table 2.16). In Chapter 3 there is a descriptive breakdown of the sickness absence data reported in the first two full calendar years of THOR-GP data collection (2006 to 2007). For individual diagnostic categories this shows the proportion of cases issued with sickness certification, the total number of days certified and the proportion of days certified. In Chapter 6, a larger dataset of the sickness absence information (2006 to 2009) was examined in further detail. The total number of days sickness absence for each case was calculated by summing three variables; 'number of days certified', 'additional days certified' (when a patient returns at the end of the initial sickness absence period) and 'number of days sickness absence before consultation'. The frequency distribution of the number of days reported with each case was plotted to illustrate the periods of absence most frequently reported. A chi squared test was used to analyse whether the proportion of cases reported with sickness absence differed by gender; in addition, the mean and the median of the number of days absence for males and females was compared. A chi squared test was also used to examine whether diagnosis had a significant association with the proportion of cases reported with sickness absence. The mean and median of the length of absence was also compared for diagnoses. Sickness absence comparisons were carried out by age group (proportion of cases with sickness absence, mean and median).

In order to examine whether the sickness absence associated with the case reports varied by industry, similar comparisons (as above for age and gender) were carried out. Variations in the sickness absence reported from certain industries may well be a result of the type of work-related ill-health most frequently reported; therefore results were shown separately for musculoskeletal and mental ill-health cases. Industries were classified as ‘mostly public’ and ‘mostly private’ to assess whether the results differed across these two sectors. Some sectors are more ‘public’ than others. Public administration and defence employees are almost all within the public sector; however health care and education include private hospitals and schools. ONS states that the public sector is comprised of central government, local government and public corporations as defined for the UK National Accounts, and publishes information on whether employees within industrial sections were mostly within the public or private sector (185;186). Results (proportion of cases with sickness absence and mean number of days per case) for each industry were shown alongside incidence rates per 100,000 persons employed per annum calculated using the LFS denominator method. The proportion of cases within each industry with associated sickness absence was tested for correlations with the mental ill-health incidence rate and the proportion of self-employment using the Spearman’s rank correlation coefficient. This was used instead of the Pearson’s correlation coefficient (despite the reduced chance of getting a significant result) as a normal distribution could not be presumed and values are approximated. The correlation with mental ill-health incidence was examined to test the hypothesis that higher rates of sickness absence are present in industries with the highest rates of mental ill-health incidence. In addition, correlation with self-employment tested the hypothesis that sickness absence rates may be also related to motivational and personal factors. Self-employed workers are likely to suffer financially when unable to work.

Table 2.16. Analyses used to examine the employment, diagnostic and demographic factors associated with work-related sickness absence

Outcome measure	Method of analysis	Chapter/Section
Diagnosis	Proportion of cases issued with sickness certification	3
	Total number of days certified	3
	Proportion of total days sickness absence attributed to each diagnostic category	3
	Proportion of cases reported with sickness absence, mean and median of number of days absence per case	6
	Incidence rates (LFS denominator method), proportion of cases reported with sickness absence and mean number of days absence per case for industrial sector	6
Gender	Chi squared test for proportion of cases reported with sickness absence	6
	Mean and median of number of days absence per case	6
Age	Proportion of cases reported with sickness absence, mean and median of number of days absence per case	6
Industry	Incidence rates (LFS denominator method), proportion of cases reported with sickness absence and mean number of days absence per case for industrial sector for all cases, and for musculoskeletal and mental ill-health cases	6
	Spearman's rank correlation coefficient used to test association of the proportion of cases reported with sickness absence with mental ill-health incidence rates for each industry	6
	Spearman's rank correlation coefficient used to test association of the proportion of cases reported with sickness absence with the proportion of self employment within each industry	6

2.11 Ethics

Ethical approval for THOR specialist schemes was granted by the North West Multi-centre Research Ethics Committee (MREC) in 2003 (MREC 02/8/72). Approval for THOR-GP was gained as a non-substantial amendment to this original request in January 2005. This approval gave permission for data collection from GPs using electronic reporting methods, and also allowed recording of sickness absence data.

Chapter Three: Work-related ill-health and sickness absence in general practice, as reported to a UK-wide surveillance scheme.

Hussey L, Turner S, Thorley K, McNamee R, Agius R. **Work-related ill-health and sickness absence in general practice, as reported to a UK-wide surveillance scheme.** Br J Gen Prac, 2008:58, 637-640. (Appendix 18)

Note: The text shown here may have been subject to minor edits in the final published version.

3.1 Abstract

GPs with training in occupational medicine report cases of work-related ill-health and sickness absence to THOR-GP using an on-line web form. This paper describes the data reported in 2006 and 2007.

GPs mainly reported musculoskeletal disorders and mental ill-health. A much larger proportion of the mental ill-health cases were sickness absence certified, making up 55.9% of the total days certified. Musculoskeletal disorders are the most frequently reported diagnoses of work-related ill-health but mental ill-health is responsible for most work-related sickness absence.

3.2 Introduction

In 2006/2007 an estimated 2.2 million people self-reported work-related ill-health. Of these cases, approximately three-quarters were musculoskeletal or psychiatric/psychological diagnoses. The sickness absence resulting from these work-related diagnoses (36 million days lost) (31) make up around a quarter of total days lost in the UK (22). Preventative measures aiming to reduce the burden of work-related ill-health and the associated sickness absence require information on causal factors and employment sectors at risk. One source of such information is The Health and Occupation Reporting network (THOR) (44), comprising surveillance schemes that collect anonymised case reports of work-related ill-health as seen by clinical specialists and occupational physicians (13;41;187;188).

There is little published research on work-related ill-health seen by general practitioners (GPs) (95), although some estimates suggest that over a third of patients in a general practice setting attribute their problems to work (84;89). Non-recognition and under-reporting of work-related ill-health have also been recognised as important factors within community based studies (52), with a lack of vocational occupational medicine training being a possible contributing factor (56;145).

In order to assess the extent and nature of work-related ill-health seen in general practice, THOR-GP (The Health and Occupation Reporting network in General Practice) was established. This paper describes THOR-GP's methodology and data collected from the first two full calendar years (2006-2007) of the scheme.

3.3 Methods

From May 2005 onwards, GPs trained to at least Diploma level (namely DOccMed of the Faculty of Occupational Medicine (139)) were invited to join THOR-GP. GPs were identified using examination pass lists, physicians' websites citing areas of specialist interest (149), and past student intakes from the Diploma course at the Centre for Occupational and Environmental Health at the University of Manchester (146). Recruitment was a continual process, with GPs commencing reporting the month after agreeing to participate. Reporting therefore commenced in June 2005, while participant numbers increased until the target (300 GPs) was reached in April 2006.

THOR-GP reporting, coding and analytical methods were developed from those within an established THOR scheme, OPRA (Occupational Physicians Reporting Activity) (189) incorporating newly developed electronic reporting systems (using a web form located on the THOR-GP website (159)). GPs complete details of any cases they see in their general practice, which they believe to have been caused or aggravated by work. Web form details include; demographic information (age, gender and first half of postcode), diagnosis, occupation, industry, and suspected causal agent/task/event. With each reported case GPs provide any additional information on sickness certification issued and patient referrals. GPs are also asked to return a blank report if they have 'nothing to report' in any month.

Reminders are sent out twice monthly by email to encourage any outstanding cases or ‘nothing to report’ returns.

THOR-GP data from 2006 and 2007 were analysed using SPSS version 15.

3.4 Results

On average 267 GPs reported to THOR-GP returning 2872 cases (2923 diagnoses, some cases being co-morbid) of work-related ill-health (0.4 cases/reporter/month). The mean age of cases reported by GPs was 40.4 years.

Over half the cases reported by GPs were of musculoskeletal disorders, while mental ill-health accounted for almost a third of the diagnoses. Of all the 2872 cases reported 50.0% were issued with sickness certification; the proportion of cases issued with certification differed greatly by diagnostic category with a much larger proportion of mental ill-health cases issued with certification than other diagnoses (Table 3.1). There were 40,317 days certified from the reported cases. Reports of mental ill-health were responsible for the majority of these (55.9%).

Table 3.1. Diagnostic groups reported by GPs 2006 to 2007

Diagnoses	Number of diagnoses	% of total diagnoses	% of diagnoses issued with sickness certification	Number of days certified (diagnoses)	% of total days certified (diagnoses)
Musculoskeletal	1558	53.3%	42.2%	14865	36.0%
Mental ill-health	869	29.7%	78.8%	23099	55.9%
Skin	268	9.2%	14.6%	646	1.6%
Respiratory	87	3.0%	33.3%	692	1.7%
Audiological	17	0.6%	23.5%	238	0.6%
Other diagnoses	124	4.2%	46.8%	1748	4.2%
Total (diagnoses)	2923*	100.0%	N/A	41288*	100.0%

**Some cases are comorbid; therefore there are more diagnoses than cases and more days certified when diagnoses are analysed separately.*

Within the musculoskeletal category, most reports were either hand/wrist/arm or lumbar spine/trunk disorders. For mental ill-health diagnoses, GPs mainly reported 'stress', and anxiety/depression. Almost 80% of the skin cases were reports of contact dermatitis, and respiratory disease cases consisted of asthma, asthma-related symptoms, or rhinitis. Audiological diagnoses were most often noise induced hearing loss, while the 'other' category included minor trauma and infections not classified elsewhere (for example ocular diagnoses).

Fewer cases were reported in females (43.7%) and this pattern for fewer female reports was noted in all diagnostic categories apart from mental ill-health where they accounted for 58.5% of cases.

Cases were reported most frequently from the health care sector (13.5%), construction (10.6%), public administration & defence (9.5%) and retail (9.5%). The diagnostic case mix differed greatly between industries; sectors such as construction and retail had higher levels of musculoskeletal disorders, whereas industries such as health & social care, public administration & defence and education had more reports of mental ill-health (Table 3.2). Notably hotel & catering had larger proportions of work-related skin conditions.

Table 3.2. Diagnoses reported by GPs by industry 2006 to 2007

Industry	Musculoskeletal		Mental ill-health		Other cases		Total	
	Number of diagnoses	% within industry	Number of diagnoses	% within industry	Number of diagnoses	% within industry	Total diagnoses*	Total %
All cases	1558	53.3%	869	29.7%	496	17.0%	2923	100.0%
Health & social care	169	42.9%	187	47.5%	38	9.6%	394	100.0%
Construction	240	77.4%	23	7.4%	47	15.2%	310	100.0%
Public administration & defence	113	40.5%	120	43.0%	47	16.8%	280	100.0%
Retail	169	61.0%	84	30.3%	24	8.7%	277	100.0%
Education	39	24.1%	104	64.2%	19	11.7%	162	100.0%
Catering	63	46.0%	25	18.2%	49	35.8%	137	100.0%
Other industries	765	56.1%	326	23.9%	272	19.9%	1363	100.0%

**Some cases are comorbid; therefore there are more diagnoses than cases*

3.5 Discussion

3.5.1 Summary of main findings

These data highlight the burden of work-related mental ill-health and musculoskeletal disorders, when compared to other morbidities, and in particular, the extent to which work-related mental ill-health contributes to sickness absence. Musculoskeletal disorders are the most frequently reported diagnoses but mental ill-health is responsible for most work-related sickness absence, with over three-quarters of these cases issued with sickness certification making up over half of the total days certified.

3.5.2 Strengths and limitations of the study

THOR-GP data will be used to calculate national incidence rates, and to do this it is necessary to characterise the THOR-GP denominator and assess how the THOR-GP population compares to the entire UK. Preliminary analysis have been carried out to show how the areas represented by THOR-GP practices compare to the whole of the UK. Office of National Statistics (190) data showed that areas represented by THOR-GP practices were proportionally almost identical to the whole of the UK in their industrial breakdown (Appendix 18).

THOR-GP benefits from the contribution of reporters who are all medically qualified practitioners with additional training in occupational medicine to consider work and its attribution in relation to ill-health. This may mean that they differ from other GPs, not only in their distribution, but also in their clinical behaviour and reporting preferences and patterns. Thus, one study has shown that GPs working part-time in occupational medicine issued certificates of significantly shorter duration (19). THOR-GPs may also differ from other GPs in their working timetables and tasks within their practices. These are all issues currently under investigation.

3.5.3 Comparison with existing literature

Mild mental health disorders have also been shown to be responsible for the most days certified from all GP consultations (39.7%; although not solely work-related) (24), followed by musculoskeletal disorders (15.4%). All other diagnoses made up the remaining 44.9% of days certified, compared to just 8.2% of the work-related cases reported to THOR-GP. One study found that doctors were more likely to issue a sick note to a patient with a psychological problem because he/she needed one, whereas they would issue certification to a patient with physical problems in order to maintain a relationship with them (134). Little information has been published on the proportion of clinical practice that is work-related, but estimates range from 39% based on patients' opinions (84) and 7.2% (80) and 16%(89) based on GPs' case evaluations.

Other THOR (44) schemes are extremely valuable in evaluating trends (11) and assessing hazards in the workplace, but data will only be captured by these schemes if the patient is referred to a clinical specialist or if they have access to an occupational physician. Only a small proportion (12-34%) of the UK workforce have access to occupational health services, with OPRA reporting likely to originate from larger industries (9;191). The majority of the population has access to a GP (51) and they are usually the first port of call for patients with any sort of ill-health. GPs are also in the unique position of being able to provide additional information on sickness absence. THOR-GP may therefore give a truer picture of the national burden of work-related ill-health than that reported by other groups of physicians in the UK.

3.5.4 Implications for clinical practice and future research

THOR-GP highlights the potential for data collected from general practice on work-related ill-health and sickness absence. Such information will make an important contribution to building up a picture of the interaction between work and health and the identification of workplace hazards and populations at risk. Therefore, this is invaluable in planning health interventions to reduce risk to employees and absence from work. The variation in case mix between industries illustrates that measures put in place to prevent work-related ill-health need to be made to fit the specific industries rather than a blanket policy approach (22).

Chapter 4: Calculating incidence rates of work-related ill-health from general practice

4.1 Introduction

The calculation of incidence rates of specific outcomes is an important measure of the health of a population. They are used to assess how rates of disease and injury may change over time and which sections of the population are most affected by different types of ill-health. In an occupational context, when related to specific industries, occupations or exposures, they are used to express risk. In order to calculate incidence rates there needs to be a measure of incident (new) cases of a condition within a specified time period (e.g. per annum); which is then divided by an appropriate denominator, i.e. the population from which the cases are derived). When the aim is to measure incidence in population sub-groups (e.g. for employment groups), the corresponding denominators must be known.

For health studies based within general practice, the population denominator used is often the patients registered with practice(s) participating in the study (192;193). However, some studies use other denominators such as patients consulting over a specified period of time (194). The characteristics and health indicators of a practice population cannot be easily obtained from each individual patient registered with a practice, however linking patients' postcodes to Census area data can provide information from which to characterise a practice population, including demographic and employment data (195;196). In the absence of personal information, denominator characterisation based on linking patients' postcodes in this way is considered to be the 'gold standard' method but it has often been reported that these data are not easily accessible to researchers (174;175). In the absence of patient postcode data, population characteristics based on the postcode of the practice are often used (174;175;197;198). Previous studies have compared use of patients' and practice postcode; Strong *et al* (198) found deprivation scores based on patients' and practice postcodes correlated well, whereas McLean *et al* (197) described how analysis based on practice postcode underestimated the relationship between deprivation and ill-health.

The Health & Occupation Reporting network in General Practice (THOR-GP) is a UK-wide surveillance scheme collecting information on work-related ill-health and sickness absence as reported by 250-300 GPs trained to diploma (DipOccMed) level in occupational medicine (135) The principal aim of THOR-GP is to establish incidence rates of work-related ill-health in a general practice setting, and to identify which UK employees are most at risk of becoming ill through their work activities. It is therefore essential to establish how the population of participating GPs' practices is employed; enabling calculation of incidence rates of work-related ill-health in different sectors of the work-force. The aim of this study was to estimate the size and distribution by industrial employment of the THOR-GP population and also to establish how this compared to the GB population to enable calculation of GB incidence rates. In addition, this chapter aimed to assess how estimates based on linking the postcode of the participating practices to Census data, compared to those based on the 'gold standard' patient postcode information.

4.2 Methods

GPs participating in THOR-GP report incident cases and associated sickness absence information for any case seen in their general clinical practice which they feel has been caused or aggravated by the patient's occupation (135;138) In order to estimate the employment of the study population, between 2007 and 2009, all GB GPs (i.e. not including THOR-GPs from Northern Ireland) participating in the study (236 GPs) were asked to provide a list of postcodes of all patients registered with their practice. They were also asked to provide a list of patients' age and gender. The age and gender lists were separate and unlinked to patient postcode information in order address concerns regarding patient identifiably expressed by a few of the participating GPs. GPs used a variety of IT systems in their practice, and consultation with key scheme participants showed that, although these systems were easily able to run queries for patient information such as age and gender, producing a list of registered patients' postcodes was not straightforward and also novel. With the help of these key GPs, step by step guidelines were produced for the IT systems used by the majority of GPs, enabling them to produce these postcode lists. Non responders were sent two reminder letters.

4.2.1 Patient and practice postcode information

The annual response rate for routine reporting process (cases and zero returns 2007 to 2009) in THOR-GP was between 67% and 75%. However, this routine reporting is a relatively simple and non-time consuming process, so it was surmised that the proportion of GPs sending patient postcode data (used in Method A) would be lower than this. Therefore, a second method of characterising the denominator, based on practice postcodes (and thus required no new data to be provided from participating GPs) was also developed (Method B). The area/population for which patient postcode information was received from GPs was named Area One; both methods were applied to practices in this area. Method B was used for the remaining practices (Area Two) (Figure 4.1). Patient and practice postcode data were subsequently processed, and sent to statistical units (Office of National Statistics (ONS) and the General Register Office for Scotland (GROS)) to be linked to Census area information for analysis by occupational and industry. Due to differences in Census area classification, it was necessary to separate the postcode information into two groups; postcodes from England & Wales (ONS), and Scottish postcodes (GRO-Scotland).

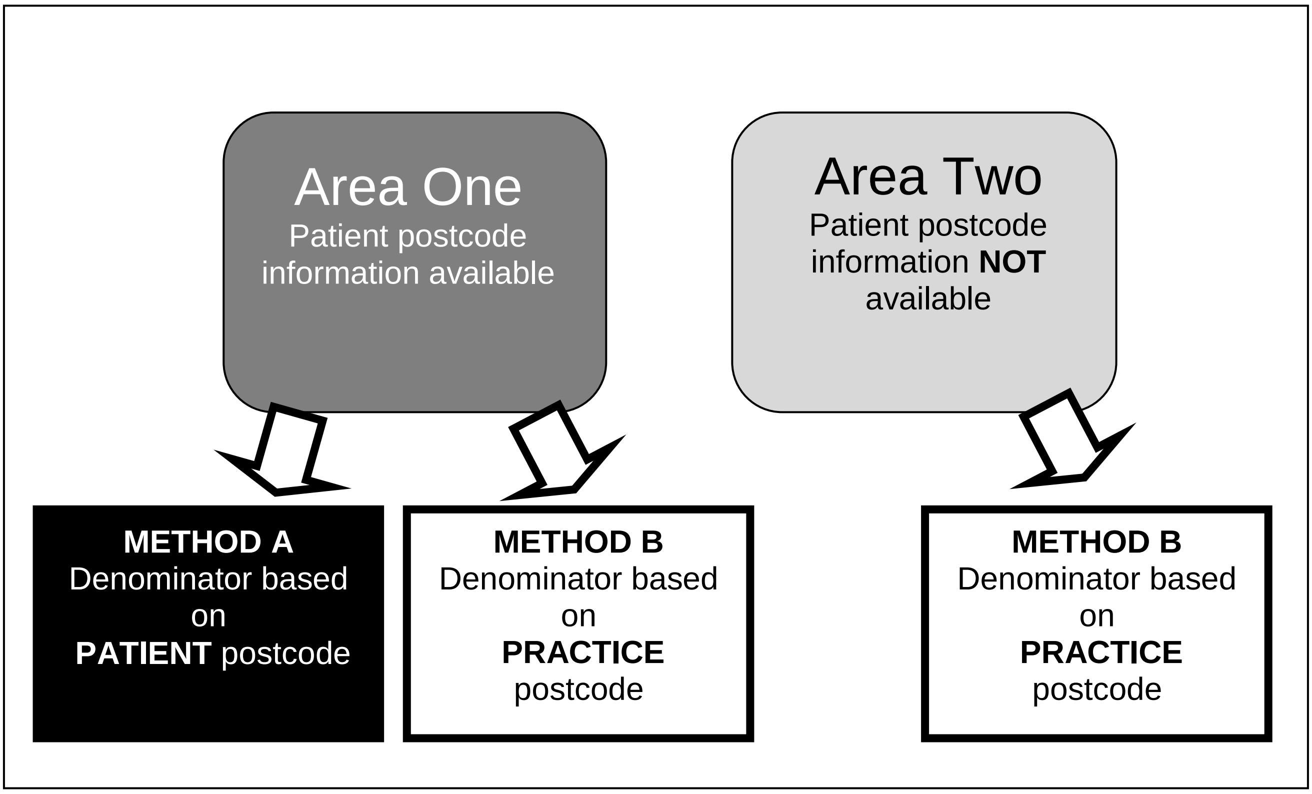

Figure 4.1. Methods used to characterise THOR-GP population areas

4.2.1.1 Method A – Population denominator estimated using patient postcode

Previous research has shown that population characteristics based on smaller units within the Census 2001 data hierarchical classification (Figure 4.2) produce more accurate results (175;195). Therefore, patient postcodes were linked to their corresponding Output Areas (OAs); the smallest areas in the hierarchy with an average population of approximately 300 residents (178). Lists of OAs so identified were sent to ONS and GROS with a request for populations within each OA to be broken down by Standard Industrial Classification of Economic Activities (SIC 2003). There was considerable variation in the number of patients within each OA; for OAs geographically near the practice, the majority of the population was registered with the THOR-GP practice while other OAs had only one patient registered with the practice, therefore OA data were weighted (according to the number of patients residing within each OA). In addition to SIC, the data gave numbers of those not of working age (16 to 64 (199)) and for those of working age but not in employment. This enabled these sections of the population to be excluded from the denominator. The populations from each OA were combined by ONS to give employment characteristics of the total population of Area One.

4.2.1.2 Method B – Population denominator estimated using practice postcode

For THOR-GP practices where patient postcode data were not available (Area Two), an area within the Census geographical hierarchy of similar population size to the average practice list in GB was chosen. The average practice list size was estimated as approximately 6,000 patients for England & Wales and 5,000 for Scotland (179) . The nearest geographical area in magnitude to this is the Middle Layer Super Output Area (MLSOAs) for England/Wales and the Intermediate Geography (IG) area for Scotland. All of the MLSOAs and IG area codes associated with the practice postcodes were compiled, and sent to either ONS or to GROS to be broken down by SIC.

The data for each geographical area (OA or MLSOA/IG) included the whole population, whereas THOR-GP numerator data are based on cases of work-related ill-health reported by participating GPs. Therefore the population denominator should only include the population of those of working age, who were also in employment. In addition, 8 (five in Area One, three in Area Two) of the participating GP practices had two THOR-GP reporters; for these practices, OAs (Method A) and MLSOAs or IG areas (Method B) were included twice in the lists sent to ONS or GROS.

4.2.2 Estimating the size of the population

In theory, Method A produces an accurate figure for the total size of the population as data are derived from information which has a postcode entry for every patient in the practice's population. However, this is not expected for Method (B) (based on practice postcodes) as it is based on the size of the MLSOA or IG area within which the practice is located. Therefore the total size of the practice populations was estimated from lists which provide the numbers of patients registered with GB practices (180;182;200). These lists give the total number of patients; therefore this was adjusted to include only patients of working age who were also employed. According to ONS data, 64% of the population is of working age; of those, 71% are employed, therefore the employed population estimated as 45% of the total population (183;201).

Not all GPs in THOR-GP practices participated in the scheme. Therefore it was necessary to estimate the proportion of the practice study population covered by participating GPs. For example, a practice may have four GPs of whom only one reports to THOR-GP; additionally these four GPs will undertake a different number of clinical sessions per week. All participating GPs were therefore sent a questionnaire asking how many sessions they undertook each week, and how many sessions all the GPs in their practice undertook in total; this gave an estimate of the proportion of consultations covered by the THOR-GP participants, which was then used to adjust the population sizes derived above.

4.2.3 Comparison of population employment using practice and patient postcodes

The industrial distribution of the two methods was compared using a Pearson Chi squared test. Given the large sample size a formal test of significance can often give a small p value even if there is only a slight difference in the distribution. It was therefore decided in advance, that a difference of 5% or less in the numbers by industry for Method B versus Method A was acceptable i.e. the two populations were considered to be similar in their distribution. The rationale was that this would mean that any resulting ratio of incidence rates calculated using Method B compared to that using Method A would be in the range (0.95-1.05).

4.2.4 Calculating incidence rates

In order to calculate incidence rates of work-related ill-health, the one year annual average of estimated cases reported to THOR-GP in 2006 to 2008 was divided by the THOR-GP denominator and multiplied by 100,000 to give an incidence rate per 100,000 persons per annum.

Data received from ONS and GRO-Scotland were classified using SIC 2003. In 2009 the LFS started using the updated industrial classification of SIC 2007. For compatibility with this denominator information (from 2009) THOR-GP numerator data were also coded using this updated SIC classification. This caused problems associated with matching 2009 (SIC 2007 classified) numerator data to SIC 2003 classified denominator data. Therefore, the numerator used to calculate incidence rates was the one year average of data collected from 2006 to 2008. This methodology was used to avoid complications arising from incompatible SIC codes, to produce more robust data by using a three year average and to use data as contemporary as possible with the denominator information collection period (2007 to 2009) in terms of the participating GPs.

The collection of patient postcode information and subsequent data processing was a lengthy process. Therefore, prior to the collection (and subsequent characterisation) of THOR-GP denominator data, an alternative interim method (LFS denominator method) of calculating incidence rates was developed. This involved extrapolating up the numerator data to represent national figures. This method and the THOR-GP population denominator method are described in detail in Chapter Two of this thesis. Briefly, the data (for the LFS denominator method) were adjusted by reporter response rate and part-time practice, this adjusted numerator (i.e. all incident case reports) was then multiplied by the number (full-time equivalent) of GB GPs. This estimate of GB cases was divided by the number of persons employed according to the LFS and multiplied by 100,000 to give incidence rates per 100,000 persons employed per annum.

These two methods of calculating incidence rates from THOR-GP were compared by calculating the incidence rate ratio for each industrial section (LFS/THOR-GP denominator methods)

4.2.5 Comparing THOR-GP denominator with GB population

Early analysis had suggested that the distribution of GPs participating in THOR-GP are nationally representative (135;202) However, just 1% of GB GPs participate in the scheme; therefore the registered population of the participating GPs' practices may differ in demography and employment to the national population. The THOR-GP population was compared to that of the whole of GB by age and gender, and by the distribution of industrial employment. The THOR-GP population was characterised using the most recently available Census data (2001); therefore the employment distribution of the THOR-GP population was compared to contemporary LFS data and also LFS information from 2006 to 2008 (contemporary with the numerator).

In order to ensure the incidence rates calculated using this THOR-GP denominator data represent the GB population, it was necessary to apply weighting. Firstly, this was undertaken to adjust for differences in the distribution of the THOR-GP population with the contemporary (2001) GB population. Secondly, the THOR-GP population was adjusted to compensate for changes in the employment of the national population between 2001 and 2006 to 2008 (and therefore make it contemporary to the numerator). These weightings were applied by multiplying the THOR-GP population by the ratio of % for LFS 2001/THOR-GP population and then by the ratio of % for LFS 2006 to 2008/LFS 2001. Working examples of this weighting methodology are illustrated in Table 4.1.

Table 4.1. Method used to adjust the THOR-GP population to represent the GB 2006 to 2008 population

Industry	**Agriculture**	**Construction**
THOR-GP population	2415	10723
% of total THOR-GP population	1.48	6.56
GB population LFS 2001	349344	1923863
% of total GB population LFS 2001	1.30	7.17
GB population LFS 2006 to 2008	366191	2268090
% of total GB population LFS 2006 to 2008	1.30	8.06
Ratio of % - LFS 2001/THOR-GP	1.30/1.48 = 0.88	7.17/6.56 = 1.09
THOR-GP population adjusted for differences with GB population	2415 x 0.88 = 2125	10723 x 1.09 = 11688
Ratio of % - LFS 2006 to 2008/LFS 2001	1.30/1.30 = 1.00	8.06/7.17 = 1.12
THOR-GP population adjusted for differences between GB employment between 2001 and 2006 to 2008	2125 x 1.00 = 2125	11688 x 1.12 = 13091

4.3 Results

Of the 236 GPs participating between 2007 and 2009, 108 (46%) GPs returned patient postcode information. Table 4.2 shows the number of GPs in Area One (patient postcodes) and Area Two (no patient postcodes), and the number of patients in the Area One populations. The average practice size in this study population is larger than the national average of 6,000 (England/Wales) and 5,000 (Scotland). The number of patients is unknown for Area Two.

Table 4.2. GPs and patients included in Areas 1 and 2 of the THOR-GP population

	England/Wales		Scotland	
	Area 1	Area 2	Area 1	Area 2
Number of GPs	87	119	21	9
Number of practices	82	116	21	9
Number of patients	792,150	?	145,920	?
Mean number of patients per practice	9660	?	6949	?

4.3.1 Distribution by industry

Overall, the distribution of the population of Area One for both England/Wales (Table 4.3) and Scotland (Table 4.4) based on patient and practice postcodes, follow a similar pattern. As expected (due to the large sample size), Chi squared tests showed that the proportional distribution by industry were significantly different (P<0.001). However, as shown in Table 4.3, the majority (13/17) of the industrial sections for England/Wales are within 5% of each other (ratio of % for Method B to Method A in range 0.95-1.05) and were therefore judged to be similarly distributed. The industrial distributions of the Scottish Area One population using the two methods were less comparable with only 8/17 industrial sections with a less than 5% difference (Table 4.4).

4.3.2 Estimating the size of the population

As illustrated in Tables 4.3 and 4.4, and summarised in Table 4.5, Method B (based on the MLSOA or IG area of the practice postcode) underestimates the size of the population of Area One compared to Method A (patient postcode). The size of the population was also estimated using published data on practice list size (adjusted by 45% to estimate the employed population) (180-182); this resulted in a population size very close to the Method A total, and has subsequently been used in the absence of patient level postcode information.

Participating GPs were asked to complete a questionnaire about clinical sessions; 200/236 (85%) responded. The total number of sessions undertaken by THOR-GPs was 1399 (mean of 6.9 sessions per week), while the total number of clinical sessions undertaken by participating GPs' practices was 8076. Therefore THOR-GPs see an estimated 17% of the total clinical sessions. The size of the Area Two population was estimated using practice list size information and added to the Area One population. This was then multiplied by 0.17 to give the final figure for the study population denominator (Table 4.6).

Table 4.3. THOR-GP populations for Area 1 (Method A and B) and Area 2 (Method B) by industrial section, England/Wales

ENGLAND/WALES		AREA 1					AREA 2		TOTAL POPULATION (AREA 1 + AREA 2)	
		Patient postcode (Method A)		Practice postcode (Method B)		Ratio of %	Practice postcode (Method B)		Area 1 (Method A) plus Area 2 (Method B)	
INDUSTRIAL SECTION		Number of persons	%	Number of persons	%	Method B /Method A	Number of persons	%	Number of persons	%
A	Agriculture, hunting & forestry	5057	1.37	3528	1.16	0.85	5661	1.41	10718	1.39
B	Fishing	69	0.02	64	0.02	1.00*	120	0.03	189	0.02
C	Mining & quarrying	1341	0.36	948	0.31	0.86	1210	0.3	2551	0.33
D	Manufacturing	54105	14.63	45619	15.06	1.03*	57314	14.28	111419	14.45
E	Electricity, gas & water supply	3439	0.93	2665	0.88	0.95*	2679	0.67	6118	0.79
F	Construction	24564	6.64	19423	6.41	0.97*	25083	6.25	49647	6.44
G	Wholesale & retail	61578	16.65	50483	16.66	1.00*	64991	16.2	126569	16.41
H	Hotels & restaurants	16964	4.59	14684	4.85	1.06	21116	5.26	38080	4.94
I	Transport, storage & communication	24583	6.65	20666	6.82	1.03*	30510	7.6	55093	7.15
J	Financial intermediation	18185	4.92	14608	4.82	0.98*	18457	4.6	36642	4.75
K	Real estate, renting & business	44661	12.08	37243	12.29	1.02*	53117	13.24	97778	12.68
L	Public administration & defence	24332	6.58	18579	6.13	0.93	24556	6.12	48888	6.34
M	Education	30965	8.37	25055	8.27	0.99*	31697	7.9	62662	8.13
N	Health & social work	42037	11.37	34281	11.31	0.99*	43123	10.75	85160	11.04
O	Other community, social & personal service	17586	4.76	14846	4.9	1.03*	21058	5.25	38644	5.01
P	Private households	246	0.07	213	0.07	1.00*	411	0.1	657	0.09
Q	Extra-territorial	98	0.03	94	0.03	1.00*	154	0.04	252	0.03
	Total	**369812**	**100**	**302999**	**100**	**1.00**	**401257**	**100**	**771069**	**100**

Ratio of % (Method B/ Method A) < 0.05

Table 4.4. THOR-GP populations for Area 1 (Method A and B) and Area 2 (Method B) by industrial section, Scotland

SCOTLAND		AREA 1					AREA 2		TOTAL POPULATION (AREA 1 + AREA 2)	
		Patient postcode (Method A)		Practice postcode (Method B)		Ratio of %	Practice postcode (Method B)		Area 1 (Method A) plus Area 2 (Method B)	
INDUSTRIAL SECTION		Number of persons	%	Number of persons	%	Method B /Method A	Number of persons	%	Number of persons	%
A	Agriculture, hunting & forestry	1558	2.33	852	1.90	0.82	494	2.33	2052	2.33
B	Fishing	201	0.30	294	0.66	2.20	89	0.42	290	0.33
C	Mining & quarrying	891	1.33	1006	2.25	1.69	142	0.67	1033	1.18
D	Manufacturing	9021	13.51	5585	12.48	0.92	2686	12.70	11707	13.31
E	Electricity, gas & water supply	784	1.17	463	1.03	0.88	380	1.80	1164	1.32
F	Construction	5553	8.31	3512	7.85	0.94	1512	7.15	7065	8.03
G	Wholesale & retail	9934	14.87	6458	14.43	0.97*	2586	12.22	12520	14.24
H	Hotels & restaurants	4158	6.23	2905	6.49	1.04	939	4.44	5097	5.80
I	Transport, storage & communication	4535	6.79	2989	6.68	0.98*	1166	5.51	5701	6.48
J	Financial intermediation	3046	4.56	1956	4.37	0.96*	1279	6.05	4325	4.92
K	Real estate, renting & business	7061	10.57	5079	11.35	1.07	2354	11.13	9415	10.71
L	Public administration & defence	4584	6.86	3016	6.74	0.98*	1985	9.38	6569	7.47
M	Education	4401	6.59	3092	6.91	1.05*	1736	8.21	6137	6.98
N	Health & social work	7753	11.61	5209	11.64	1.00*	2568	12.14	10321	11.74
O	Other community, social & personal service	3274	4.90	2329	5.20	1.06	1220	5.77	4494	5.11
P	Private households	28	0.04	18	0.04	1.00*	19	0.09	47	0.05
Q	Extra-territorial	9	0.01	3	0.01	1.00*	2	0.01	11	0.01
	Total	**66792**	**100.00**	**44766**	**100.00**	**1.00**	**21157**	**100.00**	**87949**	**100.00**

Ratio of % (Method B/ Method A) < 0.05

Table 4.5. Population size of Area 1 estimated using Method A and B and practice list information

	Method A Patient postcode	Method B Practice postcode	Employed population estimated from practice list information
England/Wales	369812	302999	372811
Scotland	66792	44766	66637
GB Total	436604	347765	439448

Table 4.6. Total study population adjusted for THOR-GP coverage

	Area 1 (Patient postcode)	Area 2 (Employed population estimated from Published list sizes	Total population (Area 1 + Area 2)	Total population covered by participating GPs (Population x 0.17)
England & Wales	369812	503175	872987	148408
Scotland	66792	21070	87862	14937
GB Total	436604	524245	960849	163344

If the proportionate industrial distribution of the population using the practice postcode MLSOA or IG area is accepted as sufficiently close to the use of the 'gold standard' patient postcode method, the size of each industrial section in Area Two can be estimated by applying the proportionate distribution to the corrected overall population size; the results are shown in Table 4.7. Of note, the population for Area Two had to be adjusted up from 401,257 to 503,175 for England/Wales, while for Scotland (Area Two contained only nine GPs) the population size was adjusted down (albeit minimally) from 21,157 to 21,070.

4.3.3 Incidence rates

Incidence rates of work-related ill-health calculated using the LFS denominator method were higher than rates calculated using the THOR-GP population denominator. The incidence rate ratio (LFS/THOR-GP denominator methods) was 1.32 for total cases (average rate ratio of all the 17 industrial sections was 1.22)

(Table 4.8). The rates for industrial sections followed a similar pattern for both methods; rates were highest for those working within fishing and mining and quarrying industries. However, as suggested in the LFS user guide, estimates based on fewer than 20 respondents (or cases in this situation) are potentially unreliable, which includes these industries. Figure 4.2 compares the incidence rates from the two methods without these potentially unreliable industrial sections.

For both methods, agricultural and construction industries had the highest rates of work-related ill-health, while real estate, renting and business has the lowest. However, rates calculated using the THOR-GP denominator method are unadjusted for any differences in industrial distribution of the GB population.

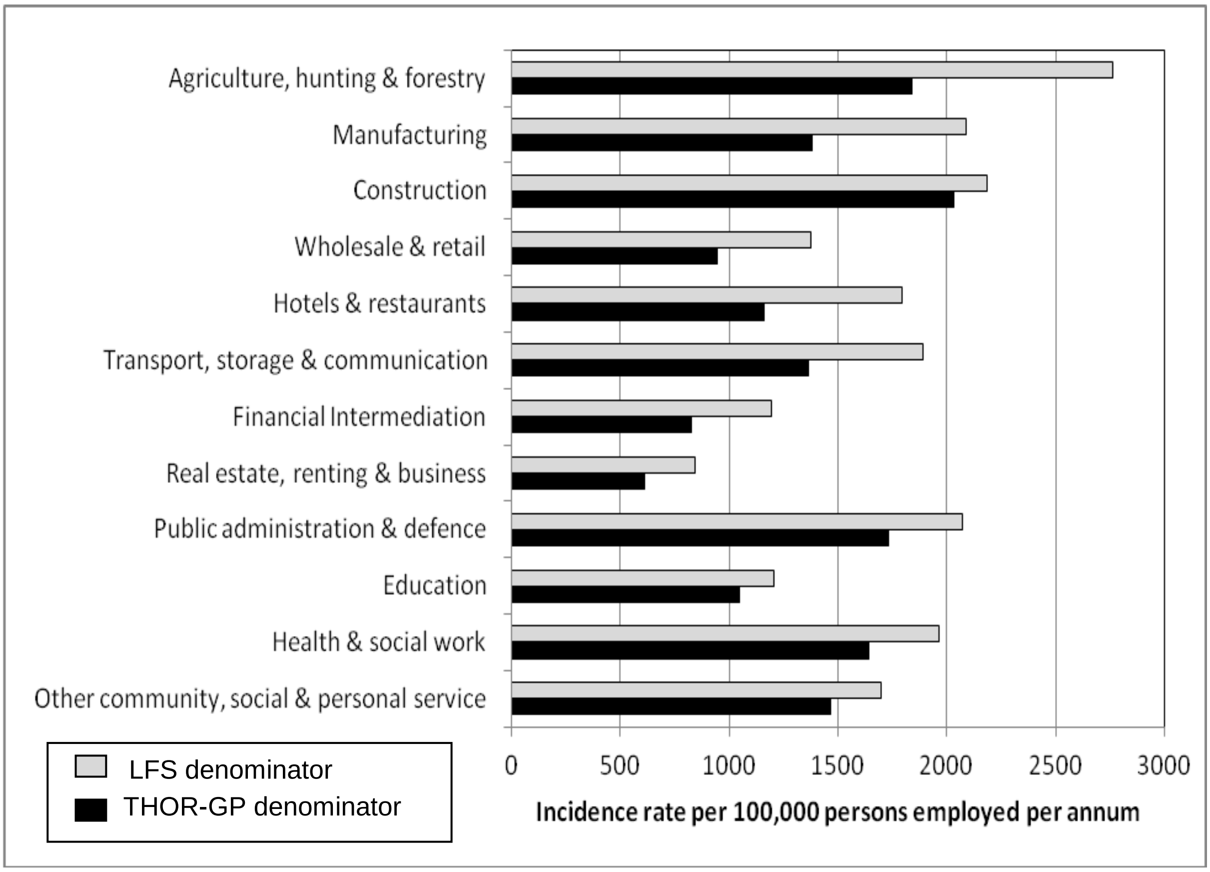

Figure 4.2. Incidence per 100,000 persons employed per annum calculated using THOR-GP population denominator and LFS denominator methods

Table 4.7. Area 1 population, Area 2 unadjusted and adjusted for population size and total study population

INDUSTRIAL SECTION		ENGLAND/WALES				SCOTLAND				TOTAL STUDY POPULATION	
		AREA 1	AREA 2			AREA 1	AREA 2				
		Number of persons	Number of persons	%	Number of persons adjusted to population size	Number of persons	Number of persons	%	Number of persons adjusted to population size	Number of persons	Number of persons x 0.17
A	Agriculture, hunting & forestry	5057	5661	1.41	7099	1558	494	2.33	492	14206	2415
B	Fishing	69	120	0.03	150	201	89	0.42	89	509	87
C	Mining & quarrying	1341	1210	0.30	1517	891	142	0.67	141	3891	661
D	Manufacturing	54105	57314	14.28	71872	9021	2686	12.70	2675	137673	23404
E	Electricity, gas & water supply	3439	2679	0.67	3359	784	380	1.80	378	7961	1353
F	Construction	24564	25083	6.25	31454	5553	1512	7.15	1506	63077	10723
G	Wholesale & retail	61578	64991	16.20	81499	9934	2586	12.22	2575	155586	26450
H	Hotels & restaurants	16964	21116	5.26	26479	4158	939	4.44	935	48537	8251
I	Transport, storage & communication	24583	30510	7.60	38259	4535	1166	5.51	1161	68539	11652
J	Financial intermediation	18185	18457	4.60	23145	3046	1279	6.05	1274	45650	7760
K	Real estate, renting & business	44661	53117	13.24	66609	7061	2354	11.13	2344	120675	20515
L	Public administration & defence	24332	24556	6.12	30793	4584	1985	9.38	1977	61686	10487
M	Education	30965	31697	7.90	39748	4401	1736	8.21	1729	76843	13063
N	Health & social work	42037	43123	10.75	54076	7753	2568	12.14	2557	106424	18092
O	Other community, social & personal service	17586	21058	5.25	26407	3274	1220	5.77	1215	48482	8242
P	Private households	246	411	0.10	515	28	19	0.09	19	808	137
Q	Extra-territorial	98	154	0.04	193	9	2	0.01	2	302	51
	Total	369812	401257	100.00	503175	66792	21157	100.00	21070	960849	163344

Note: Figures may not add exactly due to rounding

Table 4.8. Incidence per 100,000 persons employed per annum calculated using THOR-GP population denominator and LFS denominator methods

INDUSTRIAL SECTION		Number of cases 2006 to 2008 (1 year average)	Incidence rate per 100,000 persons employed per annum		Incidence rate ratio LFS/THOR-GP denominator methods
			THOR-GP denominator method	LFS denominator method	
A	Agriculture, hunting & forestry	29	1840	2763	1.50
B	Fishing	3*	4668	7219	1.55
C	Mining & quarrying	11*	2520	3615	1.43
D	Manufacturing	213	1379	2091	1.52
E	Electricity, gas & water supply	19*	2127	3221	1.51
F	Construction	144	2030	2185	1.08
G	Wholesale & retail	165	947	1377	1.45
H	Hotels & restaurants	63	1163	1793	1.54
I	Transport, storage & communication	105	1365	1892	1.39
J	Financial intermediation	42	827	1193	1.44
K	Real estate, renting & business	83	611	842	1.38
L	Public administration & defence	120	1734	2072	1.19
M	Education	90	1048	1208	1.15
N	Health & social work	196	1641	1966	1.20
O	Other community, social & personal service	80	1465	1699	1.16
P	Private households	2*	2205	511	0.23
Q	Extra-territorial	0*	0	0	0.00
	Total	**1365**	**1266**	**1674**	**1.32**

*<20 cases per annum

4.3.4 Comparing THOR-GP denominator with the GB population

The age and gender distribution of the THOR-GP population is very similar to that of the GB population. The median age of the THOR-GP population was 40 years and 49% were males. In 2007, the median age of the GB population was 39 and 49% were male (203).

Tables 4.9 and 4.10 show the THOR-GP population for England & Wales and for Scotland, and how the distribution compared to the respective populations according to LFS data for 2001 and 2006 to 2008 (one year average). The THOR-GP population (based on Census 2001 data) is more similarly distributed to the employment of the GB population in 2001 (for both England & Wales and Scotland) with the % rate ratio of 5/17 of the industrial sections falling within the range of 0.95 – 1.05. More (7/17) of the % rate ratios for the industries fall within this ‘acceptable’ range when data from the different countries are combined to give GB population figures (Table 4.11). It is interesting to note the employment changes between the two time periods with the fall in the proportion of the population employed in manufacturing (from 16.19% to 12.49%) and the increase in public sector employment such as health & social care (11.11% to 12.22%) and education (8.00% to 9.17%).

These changes in employment (and therefore the population denominator within each industry) will affect the resulting incidence rates, i.e. an increase in the population denominator will decrease incidence rates and vice versa. Therefore the size of the THOR-GP population within each industry was weighted to represent the GB population in 2006 to 2008. Prior to these adjustments, construction had the highest rate of work-related ill-health; however after adjustment, agricultural workers were shown to have the highest rate (Table 4.11 and Figure 4.4). This is in part due to the THOR-GP population having a slightly higher proportion of its population employed in agriculture compared to the GB population in 2001, and also due to the increase in the GB population employed in the construction industry between 2001 and 2006 to 2008. The weighting has decreased the size of the THOR-GP population employed in agriculture and increased the number of construction workers, therefore incidence rates are influenced accordingly. The proportion of the population employed in public sector industries is very similar for the THOR-GP and GB populations in 2001, however rates in these sectors have decreased because of the increase in the proportion of the population employed in these industries between 2001 and 2006 to 2008.

Table 4.9. THOR-GP population and LFS populations for England & Wales 2001 and 2006 to 2008

ENGLAND WALES		THOR-GP POPULATION (ENGLAND & WALES)		ENGLAND & WALES LFS 2001			ENGLAND & WALES LFS 2006 to 2008 (1 year average)		
INDUSTRY		Number of persons	%	Number of persons	%	Ratio of % (LFS/THOR-GP)	Number of persons	%	Ratio of % (LFS/THOR-GP)
A	Agriculture, hunting & forestry	10718	1.39	306195	1.25	0.90	325998	1.27	0.91
B	Fishing	189	0.02	6902	0.03	1.50	6001	0.02	1.17
C	Mining & quarrying	2551	0.33	66498	0.27	0.82	62534	0.24	0.74
D	Manufacturing	111419	14.45	4037548	16.47	1.14	3261081	12.72	0.88
E	Electricity, gas & water supply	6118	0.79	169002	0.69	0.87	178233	0.70	0.88
F	Construction	49647	6.44	1747483	7.13	1.11	2056948	8.02	1.25
G	Wholesale & retail	126569	16.41	3757506	15.32	0.93	3803254	14.83	0.90
H	Hotels & restaurants	38080	4.94	1034964	4.22	0.85	1086656	4.24	0.86
I	Transport, storage & communication	55093	7.15	1753495	7.15	1.00*	1754132	6.84	0.96*
J	Financial intermediation	36642	4.75	1119183	4.56	0.96*	1110994	4.33	0.91
K	Real estate, renting & business	97778	12.68	2903173	11.84	0.93	3148200	12.28	0.97*
L	Public administration & defence	48888	6.34	1535908	6.26	0.99*	1797208	7.01	1.11
M	Education	62662	8.13	1958768	7.99	0.98*	2362610	9.21	1.13
N	Health & social work	85160	11.04	2694405	10.99	1.00*	3066748	11.96	1.08
O	Other community, social & personal service	38644	5.01	1298935	5.3	1.06	1480365	5.77	1.15
P	Private households	657	0.09	112858	0.46	5.11	128484	0.50	5.57
Q	Extra-territorial	252	0.03	17812	0.07	2.33	13639	0.05	1.77
	Total	**771069**	**100.00**	**24520635**	**100.00**	**1.00**	**25643085**	**100.00**	**1.00**

Ratio of % (LFS/THOR-GP) < 0.05

Table 4.10. THOR-GP population and LFS populations for Scotland 2001 and 2006 to 2008

SCOTLAND		THOR-GP TOTAL POPULATION (SCOTLAND)		SCOTLAND LFS 2001			SCOTLAND LFS 2006 TO 2008 (1 year average)		
INDUSTRY		**Number of persons**	**%**	**Number of persons**	**%**	**Ratio of % (LFS/THOR-GP)**	**Number of persons**	**%**	**Ratio of % (LFS/THOR-GP)**
A	Agriculture, hunting & forestry	2052	2.33	43149	1.88	0.81	40192	1.61	0.69
B	Fishing	290	0.33	9191	0.4	1.21	6740	0.27	0.82
C	Mining & quarrying	1033	1.18	37189	1.62	1.37	42402	1.70	1.44
D	Manufacturing	11707	13.31	304582	13.25	1.00*	252839	10.15	0.76
E	Electricity, gas & water supply	1164	1.32	24122	1.05	0.80	25183	1.01	0.77
F	Construction	7065	8.03	176380	7.67	0.96*	211143	8.47	1.06
G	Wholesale & retail	12520	14.24	333169	14.49	1.02*	336729	13.52	0.95*
H	Hotels & restaurants	5097	5.8	126140	5.49	0.95*	131511	5.28	0.91
I	Transport, storage & communication	5701	6.48	157414	6.85	1.06	160182	6.43	0.99*
J	Financial intermediation	4325	4.92	103855	4.52	0.92	112462	4.51	0.92
K	Real estate, renting & business	9415	10.71	200299	8.71	0.81	238664	9.58	0.89
L	Public administration & defence	6569	7.47	179358	7.8	1.04*	200530	8.05	1.08
M	Education	6137	6.98	187732	8.17	1.17	217014	8.71	1.25
N	Health & social work	10321	11.74	286161	12.45	1.06	371983	14.93	1.27
O	Other community, social & personal service	4494	5.11	125987	5.48	1.07	137304	5.51	1.08
P	Private households	47	0.05	3997	0.17	3.40	6494	0.26	5.21
Q	Extra-territorial	11	0.01	0	0	0.00	52	0.00	0.21
	Total	**87949**	**100.00**	**2298725**	**100.00**	**1.00**	**2491423**	**100.00**	**1.00**

Ratio of % (LFS/THOR-GP) < 0.05

Table 4.11. THOR-GP population and LFS populations for GB 2001 and 2006 to 2008 and incidence rates per 100,000 persons employed per annum adjusted for GB and 2006 to 2008 industrial distribution

GREAT BRITAIN		THOR-GP population		GB 2001		GB 2006 to 2008		Ratio of %					GB incidence rate per 100,000 persons employed per annum (2006 to 2008)
INDUSTRY		Number of persons	%	Number of persons	%	Number of persons	%	LFS 2001/ THOR-GP	LFS 2006 to 2008/ THOR-GP	LFS 2006 to 2008/ LFS 2001	THOR-GP population adjusted to GB distribution	THOR-GP population adjusted to 2006 to 2008 distribution	
A	Agriculture, hunting & forestry	2415	1.48	349344	1.30	366191	1.30	0.88	0.88	1.00*	2121	2121	2095
B	Fishing	87	0.05	16093	0.06	12740	0.05	1.20	1.00*	0.83	104	87	4644
C	Mining & quarrying	661	0.40	103687	0.39	104936	0.37	0.98*	0.93	0.95*	644	611	2726
D	Manufacturing	23404	14.33	4342130	16.19	3513920	12.49	1.13	0.87	0.77	26442	20399	1582
E	Electricity, gas & water supply	1353	0.83	193124	0.72	203415	0.72	0.87	0.87	1.00*	1174	1174	2453
F	Construction	10723	6.56	1923863	7.17	2268090	8.06	1.09	1.23	1.12	11720	13175	1652
G	Wholesale & retail	26450	16.19	4090675	15.25	4139983	14.71	0.94	0.91	0.96*	24914	24032	1042
H	Hotels & restaurants	8251	5.05	1161104	4.33	1218167	4.33	0.86	0.86	1.00*	7075	7075	1356
I	Transport, storage & communication	11652	7.13	1910909	7.13	1914315	6.80	1.00*	0.95*	0.95*	11652	11113	1432
J	Financial intermediation	7760	4.75	1223038	4.56	1223457	4.35	0.96*	0.92	0.95*	7450	7107	903
K	Real estate, renting & business	20515	12.56	3103472	11.57	3386864	12.04	0.92	0.96*	1.04*	18898	19666	637
L	Public administration & defence	10487	6.42	1715266	6.40	1997737	7.10	1.00*	1.11	1.11	10454	11598	1568
M	Education	13063	8.00	2146500	8.00	2579624	9.17	1.00*	1.15	1.15	13063	14973	914
N	Health & social work	18092	11.08	2980566	11.11	3438731	12.22	1.00*	1.10	1.10	18141	19953	1488
O	Other community, social & personal	8242	5.05	1424922	5.31	1617669	5.75	1.05*	1.14	1.08	8666	9384	1286
P	Private households	137	0.08	116855	0.44	134978	0.48	5.50	6.00	1.09	754	822	369
Q	Extra-territorial	51	0.03	17812	0.07	13691	0.05	2.33	1.67	0.71	119	85	0
	Total	163344	100.00	26819360	100.00	28134507	100.00	1.00	1.00	1.00	163344	163344	1266

***Ratio of % (LFS/THOR-GP) < 0.05**

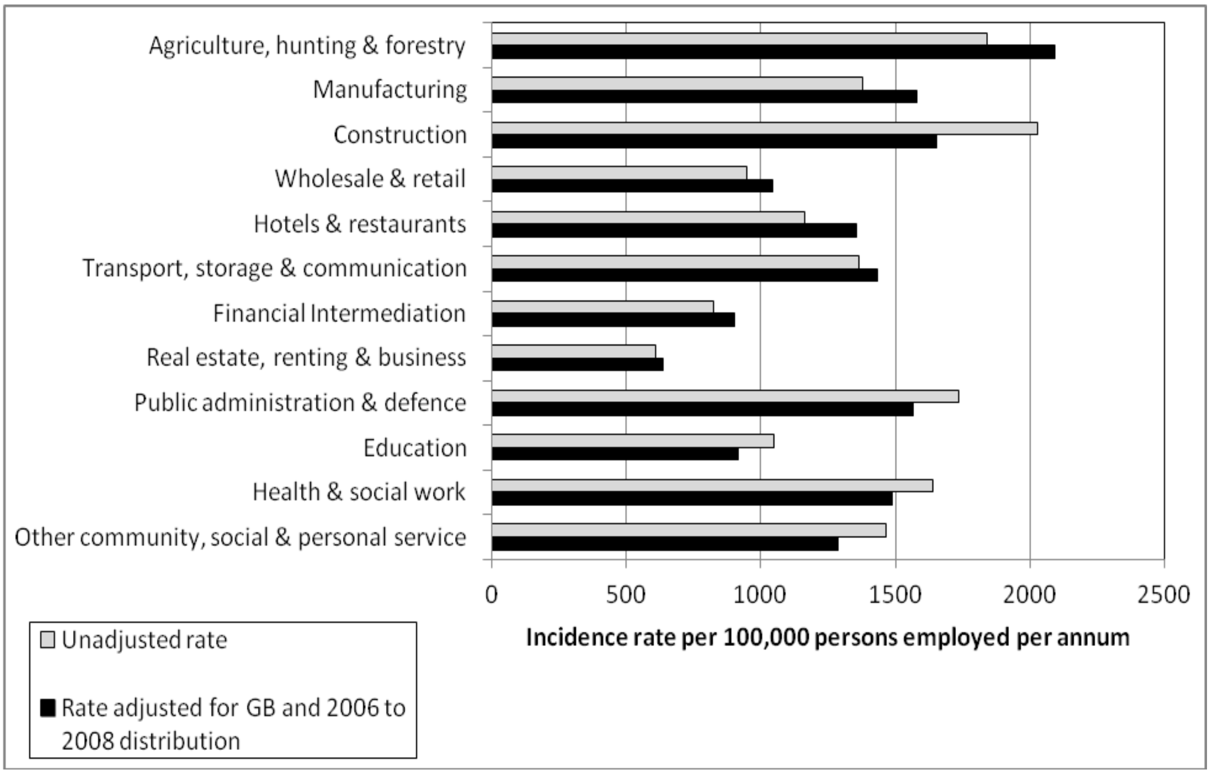

Figure 4.3. Incidence per 100,000 persons employed per annum calculated using THOR-GP population denominator unadjusted and adjusted for GB and 2006 to 2008 industrial distribution

4.4 Discussion

4.4.1 Statement of principal findings

This study has shown how rates of incidence of work-related ill-health within the GB population can be calculated using data from general practice. Characterising THOR-GP's population denominator using both patient and practice postcodes help validate the methodology to be used in the absence of patient based information. The MLSOA/IG areas of the practice postcode estimate well (particularly for England/Wales (MLSOA)) how the population is employed (in terms of industry), however use of practice postcode on its own is not reliable for estimating the size of the population. Estimation of the size of the working population can be based on published data on practice list size together with a correction factor. These methods can be used to estimate the size and employment of the THOR-GP population in the absence of gold standard patient based postcode information without having a great affect on the resulting incidence rate calculations.

Results presented here have also shown how the THOR-GP population compares to that of GB. The age and gender mix of populations are very similar, however there was some variation by industrial distribution (based on Census 2001 data), particularly in comparison to LFS data contemporary with the 2006 to 2008 numerator data. The THOR-GP population denominator was weighted to make it representative of the GB population.

4.4.2 Strengths and weaknesses of the study with reference to other work

The population denominator for THOR-GP was defined as the employed patients registered with participating GPs' practices which includes attendees and non-attendees at GP surgeries. Other studies have used alternative denominators to calculate incidence rates in practice-based studies, such as the number of consultations, yearly or quarterly contact or the 'attending population'. The practice population is often considered the best source of population denominator information (204;205), and is used in the General Practice Research Database (GPRD) which is widely used in the study of incidence rates (206). It is likely that this may overestimate the population denominator (and therefore reduce rates of incidence) as patients may appear on a practice list that are no longer using the practice. A study conducted within 16 inner London practices found an 'active patient' denominator to be more accurate (207). Patients were removed from the 'active patient' list if they had died, moved away or for other 'administrative reasons' (no recorded practice contact, blank notes etc). As a result of this process, 25% of patients were removed from the practice list denominator. However, this study involved input from researchers who scrutinised records of 2331 patients, and wrote to those who had no practice contact for a year; these methods were beneficial for the specific aims of this study, but are clearly not practical in the majority of studies using a practice-based denominator.

Other studies using denominator methods based on attending or consulting patient numbers exclude the population not consulting (estimated as 20-30% in any single year (205;208)) and subjects are systematically, not randomly selected, leading to biases such as gender and ethnicity (209;210). In a Canadian publication 'Primary Care's Denominator Problem' (205), Anderson states that the attending population should be used when answering questions the use of practice services and studying physicians activities and workload. However, the practice population should be used when answering questions about the practice population and events (in this case the incidence of work-related ill-health) within that group. In addition, it would also have been difficult to get information on attending patients from these GPs whereas information on the number of patients registered with practices is publically available (180-182).

The THOR-GP population studied here benefited from its large sample size and GB-wide distribution, with 108 GPs returning postcode lists of patients registered with their practice. Other studies comparing population characterisation (using socioeconomic deprivation) based on practice and patient postcode have varied in the number and distribution of the practices included in their analysis. Strong *et al* compared deprivation scores based on the Lower Layer Super Output Areas (LLSOA) of practice and patient postcodes (198), and also to scores derived from a GIS model (174), of 38 practices in Rotherham. Researchers conceded that their results were from a small number of practices from within one Primary Care Trust (PCT) which may differ in patient distribution to other areas of the UK. McLean *et al* used practice postcode based deprivation scores to explore associations with prevalence rates and quality of care outcomes for all of England and Scotland and compared these to patient based deprivation scores. Patient based postcode data were only available for Scotland, therefore only these practices were compared. Results of this study of THOR-GP practices has illustrated how population data based on practice postcode may vary from practices in England and Wales (197). Another study by Griffin *et al* was based on 226 practices in Bedfordshire and Herefordshire. This found that MLSOAs should be used in preference to LLSOAs in the absence of 'gold standard' patient based information, as this was nearer to the average practice population size for England and Wales. This study benefited from the large number of practices involved, however this may also have problems with applicability to the national population (175). Other researchers (174;197;198) have used the LLSOA of the practice on which to generate deprivation scores, while this study (as recommended by Griffin) used the larger MLSOA area. Unlike these other studies, this research has not only concentrated on the characterisation of the population by industrial sectors but also on estimating the size of the population in the absence of patient based data.

As illustrated in the results, the Census data (recorded every 10 years) shows that the nature of employment of a population is likely to have changed, particularly with the timing of this study where the most recent available data are from 2001. The LFS is a quarterly survey of UK employment, and is therefore much more up to date; however the LFS is based on a small sample of the population (55,000 households (211) and is not attached to the small geographical units used in the Census data. In order to estimate incidence rates of work-related ill-health in GB (as opposed to rates just within the THOR-GP population) weighting has been applied. This adjusted the THOR-GP denominator population for any differences in employment between this study population and the GB population, and also for differences in the employment of the GB population between 2001 and 2006 to 2008. The methods described here resulted from a gradual iterative development process, often with the next step in the methodology derived from the results of previous work undertaken. This also meant that lessons were learnt on how earlier development stages could have been improved. As illustrated with the weighting procedure, attempts have been made for all data used in calculations to be as contemporaneous as possible, however there may be apparent discrepancies associated with data used in calculations representing different time periods. For example, there may be problems associated with the lack of availability of contemporary practice list size information; more recent (than 2006 to 2008) list size data was used in these calculations and published information shows an increase in the average list size from year to year (179). In addition, ONS figures used to calculate the employed proportion of the practice population were taken from 2010 estimates; it would have been preferable to use data between 2006 and 2008. Data for 2008 shows a smaller proportion (38%) of the population were not of working age, and employment rates were higher (25% of working age population unemployed). The employed population of the practice would therefore have been calculated as 47% of the practice population as opposed to the 45% used here (based on 2010 data) (184;212).

There may be other errors associated with using Census information, as practice populations may be spread over a wide area (195); patients are more likely to use the nearest practice in rural areas (213) while residents within the same urban area are registered with a variety of general practitioners (214). Basic comparisons of the proportional distribution of GPs who participate in THOR-GP with all GB

GPs (by geographical region), suggest that THOR-GPs provide a fairly representative sample, however, an urban/rural classification suggests that the THOR-GPs' practices are more likely to be located in areas with an urban classification (202). This may be because GPs are only eligible to participate in THOR-GP if they have been trained to diploma level (DipOccMed) in occupational medicine reflecting where occupational health advice might be more frequently sought, moreover it is estimated that only 4% of UK GPs have this training (140;141). Due to their interest in occupational medicine, the THOR-GPs are also likely to differ compared to other GPs in the number of clinical general practice sessions undertaken each week as 85% of THOR-GPs undertake sessions in clinical occupational medical practice (215). In addition, almost half (47%) the GP participants work in training practices (215) and have larger than average practice lists, as indicated by the average number of patients registered with the 108 THOR-GPs' practices.

In this study (and in other studies using geographical area based census data), the outcomes are based on ecological methods, i.e. individuals registered with participating practices may not necessarily be employed as the Census area data suggests. For example, if the only registered patients living within an OA were all unemployed, a representation of the employment of that OA would be included in the industrial breakdown of the final population. Also, a substantial number (28%) of the practices included in the study had branch surgeries, but only the MLSOA/IG area of the main practice was used in population estimates from practice postcode. However, the inclusion of branch surgeries was found to have little effect on results comparing social deprivation scores in other work (198). There may also be some inaccuracies incurred due to the doubling up of the MLSOAs where there were two participating THOR-GPs in a single practice. GPs in a practice are unlikely to have an equal share in the patient workload; however this was applied to a very small sample of the participating practices. As well as the effect of clinical sessions on the share and distribution of the patient workload between GPs in a practice, this may also be influenced by GP specialisation.

4.4.3 Meaning of the study: possible explanations and implications for clinicians and policy makers

Patient level population data are difficult to access, however this study describes a method (using the MLSOA or IG area of the practice postcode) that can be used to characterise the employment of a population in the absence of 'gold standard' patient based data. Agreement of the practice and patient based methods was better at estimating the employment distribution of a population in England and Wales than in Scotland. This is likely to be due to a number of factors such as the rural nature of the Scottish landscape, the smaller number of practices involved and the smaller population in the average IG area (than in the MLSOA). The practice postcode based method (using MLSOAs and IGs) was not able to accurately estimate the size of the population; however this work shows how population size can be estimated using other published sources.

This study has shown how to estimate denominators, which can be used in combination with incident cases of work-related ill-health reported by GPs in order to enable the calculation of national incidence rates. As previously stated, it is important to calculate incidence rates of work-related ill-health in order to establish which sectors of the workforce are most at risk. Other surveillance schemes collect work-related ill-heath data in the UK, and although of value, these are based on patient self-reports (216) or cases submitted by hospital specialists (44). These schemes therefore have issues of data based on non-medical opinions or biases due to illness severity, triage and referral patterns. Data reported from general practice (and resulting incidence rates) are not only based on trained medical opinions but are also based on a wider population.

4.4.4 Unanswered questions and future research

Population data provided by ONS and GROS are not only broken down by industry (as analysed in this study), but also by occupation. The Standard Occupation Classification has 353 job codes and therefore requires separate in-depth analysis. This will be of additional interest, as it is linked to social deprivation scores, therefore enabling further comparisons with other studies.

Chapter Five: Comparisons of work-related ill-health reported by GPs with other data sources

Chapter 5.1: Comparison of work-related ill health reporting by occupational physicians and general practitioners

Hussey L, Turner S, Thorley K, McNamee R, Agius R. **Comparison of work-related ill health reporting by occupational physicians and general practitioners.** Occup Med, 2010: 60, 284-300. (Appendix 19)

Note: The text shown here may have been subject to minor edits in the final published version.

5.1.1 Abstract

Background The provision of occupational health (OH) services to the UK population is limited and concentrated in certain industries. Occupational physicians (OPs) therefore see a different subset of the population than general practitioners (GPs) and their recognition of work-related ill health may differ.

Aims To examine how reports submitted by OPs and GPs compare and to discuss how biases may affect diagnostic and demographic differences.

Methods The Health & Occupation Reporting network collects information on work-related ill health. OPs and GPs report case details, including demographic information, occupation, industry and suspected agent/task/event. Differences in reporting patterns were assessed.

Results Musculoskeletal and mental ill-health reports made up over 80% of reports to both schemes although the likelihood ratio (LR) showed OPs were 78% more likely to report a psychological case than GPs. OPs were also more (18%) likely to report a female case. Health & social care was the industry most frequently reported by both groups; however, this was in greatly differing proportions (OPs 38%, GPs 14%). When LRs were adjusted for industry, this reduced the likelihood of an OP reporting cases of mental ill health (to 40%) and found them 10% less likely to report females than GPs.

Conclusions OP and GP reporting patterns highlight the variation in OH provision and its influence on the data provided. OPs are best placed to report on health and work relationships; however, as some sectors have poor access to OH services, reports from suitably trained GPs will help inform about this ‘blind spot’.

5.1.2 Introduction

The provision of occupational health (OH) services to the UK workforce is widely understood to be very limited. One study estimated that just 12% of the working population had access to an occupational physician (OP) (9), whereas another estimated the coverage of OH services at 34% (191). The number of OPs working in the UK has been estimated as five per 100,000 employees (5). These services are often concentrated in certain industries such as health & social care, while employees in sectors such as agriculture have poor access (9).

In comparison, all of the UK population should have access to a general practitioner (GP), with GPs usually being the first port of call for all types of ill-health including those with an occupational cause. Estimates suggest that more than 90% of patients consult their GP within a five-year period (51).

A number of studies have compared the work of OPs and GPs, examining areas such as communication (217) and interaction (218) between doctors, and comparisons in case management (93). However, a search of the published literature did not reveal any information on how differences in patient access and type of practice influenced the nature of the work-related ill-health presented to these physicians.

The Health & Occupation Reporting network (THOR) (44) collects data on work-related ill-health seen by a range of physicians including GPs, OPs and clinical specialists. THOR is therefore in a unique position to compare cases presented to, and subsequently reported by, physicians as cases of work-related ill-health.

The objective of this study was to examine how reports of work-related ill-health submitted by GPs to The Health & Occupation Reporting network in General Practice (THOR-GP) (135) compare with those submitted by OPs to the

Occupational Physicians Reporting Activity (OPRA) scheme (189), and to assess how biases in the coverage of OH services in the UK affect diagnostic and demographic differences.

5.1.3 Methods

OPRA and THOR-GP are surveillance schemes that perform an observatory function by collecting data on work-related ill-health. OPRA has collected data from OPs since 1996, while THOR-GP was established in 2005 to collect information from GPs trained to the level of Diploma of the Faculty of Occupational Medicine (DOccMed). Both schemes follow similar data collection methods that have been described previously (135;189), with OPs using both paper based (report card) and electronic (internet based) reporting methods, and GPs exclusively using an internet based 'web form'. Reporters comprise a mix of 'core' participants who submit cases every month, and 'sample' participants who report for one randomly assigned month per year. Cases submitted by 'sample' reporters are multiplied by 12 and added to the 'core' reporting subtotals to give estimated annual totals. Both OPs and GPs are given similar clinical guidance for case submission, and instructed that any report should be a new case of work-related ill-health, as seen in their clinics. Clinicians are asked to make a judgement on the work-relatedness of the case by assessing whether (or not) the condition would have occurred in the absence of a work exposure. Cases are also considered appropriate for reporting if a work exposure substantially aggravated a pre-existing condition.

Details reported include demographic information (age, gender and postcode area) diagnosis/symptoms, occupation, industry and suspected causal agent/task/event. GPs provide additional information on sickness absence related to the condition and on patient referrals to clinical specialists or other health services. Physicians are asked to return a blank report if they have seen no relevant cases in any reporting month.

Actual cases (not estimated totals) reported to THOR-GP and OPRA from 2006-2007 (the first two full calendar years of THOR-GP data collection) were analysed using SPSS (version 15). Differences in GPs' and OPs' reporting patterns by diagnosis and gender were examined using Mantel-Haenszel likelihood ratios (LRs), which were subsequently stratified and adjusted by industry. LRs were calculated using Stata (version nine) by dividing the proportion of OPs' cases by the proportion of GPs' cases.

5.1.4 Results

On average 276 GPs reported to THOR-GP per year (2006-2007), and 433 OPs reported to OPRA. The majority of GPs were 'core' reporters, while most in OPRA participated on a 'sample' basis. The 'core':'sample' ratio in THOR-GP was 9:1, while in OPRA this was 1:9, resulting in 266 GPs and 68 OPs reporting each month. GPs returned 2872 cases (2923 diagnoses) of work-related ill-health (0.4 cases/reporter/month) whereas OPs returned 3360 cases (3381 diagnoses) (2.1 cases/reporter/month). The mean age of cases reported by GPs was significantly younger; GPs 40.3 years, OPs 43.7 years ($p<0.001$). Differences were shown particularly in the proportions of younger patients; GPs reported 15% of cases aged 16-25 years whereas OPs reported just 6% (Figure 5.1.1).

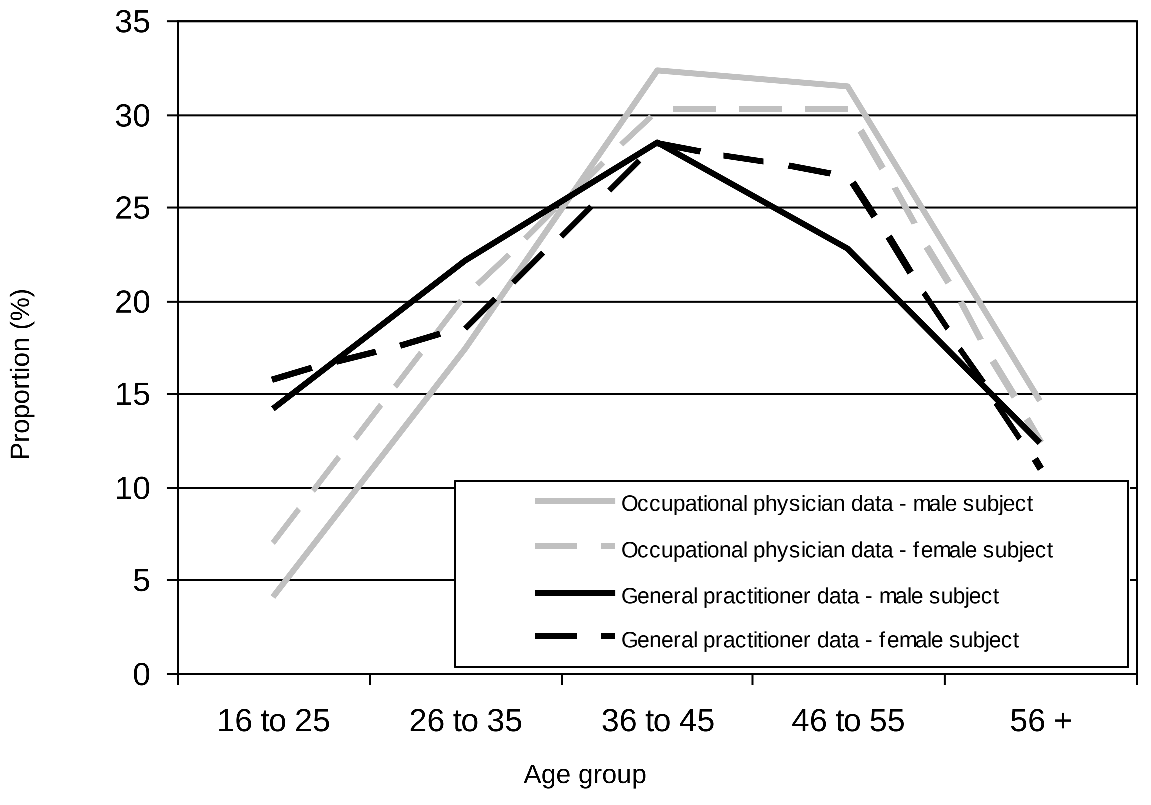

Figure 5.1.1. Cases of work-related ill-health by age group and gender reported by occupational physicians (OPRA) and general practitioners (THOR-GP) 2006 to 2007

Reports to both schemes were predominantly cases of musculoskeletal and mental ill-health, making up over 80% of the diagnoses. However, the majority of GP cases were musculoskeletal whereas OP reports were more frequently mental ill-health (Table 5.1.1). The LR (1.78) showed that the likelihood of a case report involving a mental ill-health diagnosis was 78% higher for OPs than GPs.

Table 5.1.1. Diagnostic groups and gender reported by occupational physicians (OPRA) and general practitioners (THOR-GP) 2006/2007

Diagnoses	Occupational Physicians			General Practitioners		
	Total	Males	Females	Total	Males	Females
	n (%)	n (% within diagnosis)	n (% within diagnosis)	n (%)	n (% within diagnosis)	n (% within diagnosis)
Musculoskeletal	1130 (33)	632 (56)	498 (44)	1558 (53)	966 (62)	592 (38)
Mental ill-health	1802 (53)	741 (41)	1061 (59)	869 (30)	361 (42)	508 (58)
Skin	218 (7)	115 (53)	103 (47)	268 (9)	154 (57)	114 (43)
Respiratory	109 (3)	59 (54)	50 (46)	87 (3)	67 (77)	20 (23)
Audiological	49 (2)	46 (94)	3 (6)	17 (1)	13 (76)	4 (24)
Other diagnoses	73 (2)	41 (56)	32 (44)	124 (4)	86 (69)	38 (31)
Total diagnoses	3381 (100)	1634 (48)	1747 (52)	2923 (100)	1647 (56)	1276 (44)
Total cases	3360	1619 (48)	1741 (52)	2872	1618 (56)	1254 (44)

For musculoskeletal diagnoses, both OPs and GPs reported most cases as disorders of the hand/wrist/arm (GPs n=404 [26%], OPs n=397 [35%]) and lumbar spine/trunk (GPs n=465 [30%], OPs n=294 [26%]). Both groups of physicians reported similar proportions of skin (GPs 9%, OPs 6%) and respiratory disease (GPs 3%, OPs 3%); the majority of cases within these categories being contact dermatitis and asthma or 'other respiratory disease' respectively. Most of the 'other respiratory disease' cases were rhinitis, or symptoms such as wheeze and breathlessness not reported specifically as asthma. Noise-induced hearing loss made up most of the audiological reports. Cases not classified within the five major diagnostic categories, such as ocular diagnoses, injuries and infections were included within the 'other' category.

OPs reported 52% of cases in females overall, whereas GPs reported 44% (Chi squared $p<0.001$). The LR for reporting of female cases by OPs compared to GPs was 1.18 (i.e. 18% higher for OPs than GPs). A higher proportion (%) of case reports for males was noted in all diagnostic categories apart from mental ill-health for both OPs' and GPs' reporting (Table 5.1.1).

Case reports were analysed by employment sector using the Standard Industrial Classification (SIC) (164), and compared with employment information for the UK workforce using Labour Force Survey (LFS) data from 2006-2007 (190) (Figure 5.1.2). Both GPs and OPs returned cases most frequently from health & social care, but in greatly differing proportions (GPs 14%; OPs 38%). GPs reported higher proportions in construction and retail, while the converse was found for public administration & defence and education. Cases reported from each industry were analysed by diagnostic category (Table 5.1.2), with both GPs and OPs reporting the highest proportions of mental ill-health in industries such as health & social care, education and public administration & defence. Both groups of physicians also showed similarities in reporting patterns for musculoskeletal cases, with the highest proportions found in construction and retail sectors.

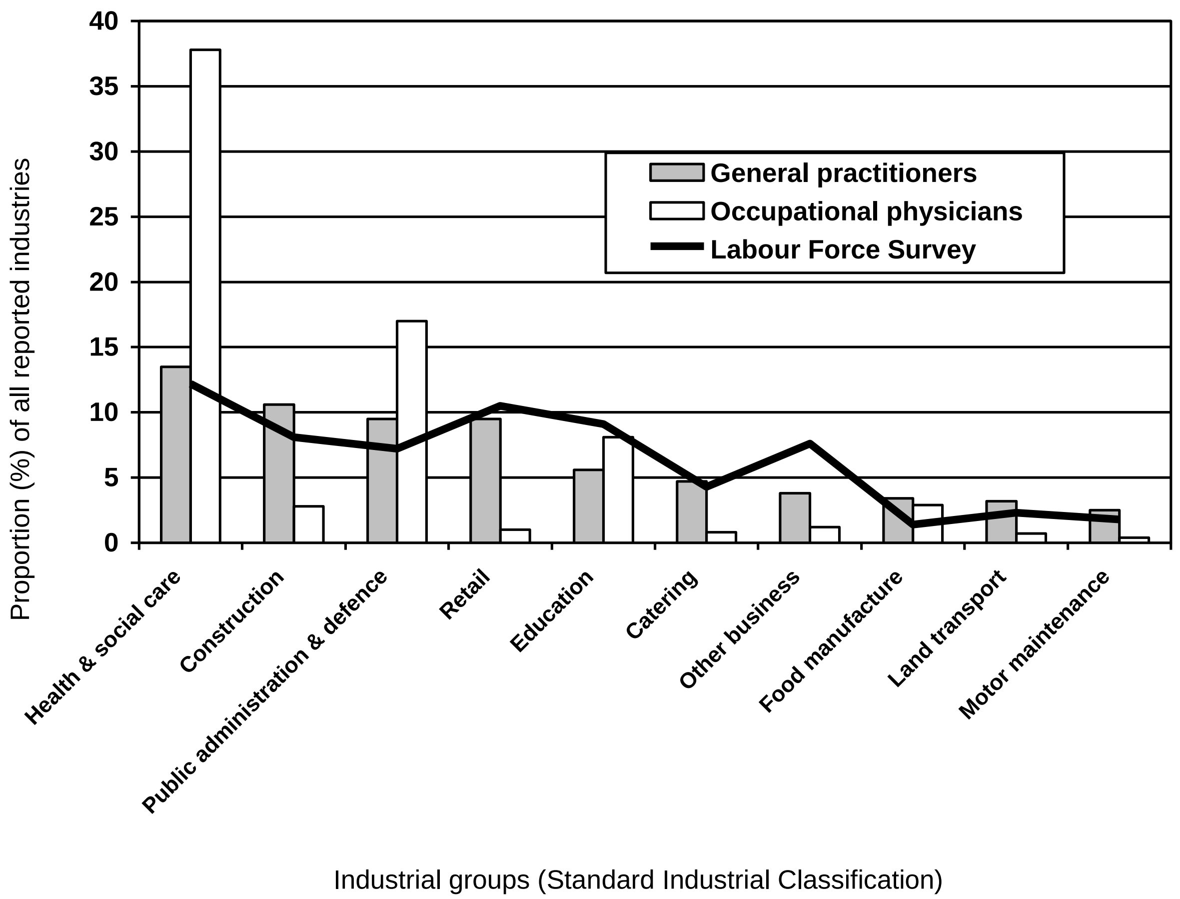

Figure 5.1.2. Cases of work-related ill health by industry reported by occupational physicians (OPRA) and general practitioners (THOR-GP) in 2006 to 2007, compared to Labour Force Survey data

The LR (1.78 overall) for OPs' reporting of mental ill-health diagnoses was analysed further to investigate whether this could be explained by differences in OPs' industrial coverage (Table 5.1.3). After stratification by industry, the combined LR was 1.40 (95% CI; 1.31, 1.49), showing that OPs' cases are 40% more likely to be mental ill-health diagnoses, even after adjustment for sector of employment.

Table 5.1.2. Diagnoses reported by occupational physicians (OPRA) and general practitioners (THOR-GP) by industry 2006/2007

Diagnostic category	Health & Social care n (%)	Construction n (%)	Public administration & defence n (%)	Retail n (%)	Education n (%)	Other industries n (%)
Occupational Physicians						
Musculoskeletal	324 (26)	74 (78)	194 (34)	18 (53)	32 (12)	483 (43)
Mental ill-health	802 (63)	7 (7)	345 (60)	15 (44)	215 (79)	421 (38)
Other	144 (11)	14 (15)	32 (6)	1 (3)	24 (9)	215 (19)
Total	1270 (100)	95 (100)	571 (100)	34 (100)	271 (100)	1119 (100)
General Practitioners						
Musculoskeletal	166 (43)	240 (79)	112 (41)	168 (62)	39 (24)	825 (56)
Mental ill-health	187 (48)	23 (8)	120 (44)	84 (31)	104 (65)	351 (24)
Other	34 (9)	42 (14)	40 (15)	21 (8)	17 (11)	299 (20)
Total	387 (100)	305 (100)	272 (100)	273 (100)	160 (100)	1475 (100)

Similar analysis was also carried out to assess the effect of employment sector on case reporting by gender (Table 5.1.3). Although the likelihood of OPs reporting female cases is 18% higher (LR 1.18) than it is for GPs, after adjustment for employment sector the combined LR is 0.90 (95% CI; 0.86, 0.95), showing that OPs are 10% less likely to report females than GPs.

Table 5.1.3. The likelihood ratio of occupational physicians (OPRA) reporting cases of work-related mental ill-health and cases in females compared to general practitioners (THOR-GP) by industry (with 95% confidence intervals) 2006/2007

Industry	**% of mental ill-health reported by occupational physicians**	**% of mental ill-health reported by general practitioners**	**LR (95% confidence intervals)**	**% of female cases reported by occupational physicians**	**% of female cases reported by general practitioners**	**LR (95% confidence intervals)**
Health & social care	63%	48%	**1.31** (1.17,1.46)	76%	83%	**0.92** (0.87,0.97)
Construction	7%	8%	**0.98** (0.43,2.21)	1%	6%	**0.19** (0.03,1.40)
Public administration & defence	60%	44%	**1.37** (1.18, 1.59)	41%	40%	**1.03** (0.87,1.23)
Retail	44%	31%	**1.43** (0.94,2.18)	65%	54%	**1.20** (0.92,1.58)
Education	79%	65%	**1.22** (1.07,1.39)	56%	75%	**0.75** (0.65,0.86)
Other industries	38%	24%	**1.58** (1.40,1.80)	32%	37%	**0.89** (0.80,0.95)
Mantel-Haenszel combined			**1.40** (1.31,1.49)			**0.90** (0.86,0.95)

5.1.5 Discussion

Most cases of work-related ill-health reported by OPs and GPs were musculoskeletal and mental ill-health diagnoses. However, these two diagnostic categories differed in their reported proportions; OPs more frequently reporting mental ill-health diagnoses whereas GPs' reports were most frequently musculoskeletal. More detailed analysis showed marked differences within these categories with respect to age, gender and employment. Over a third of OPs' reports were from heath & social care whereas industries reported by GPs showed (proportionally) greater similarities to the employment patterns identified by the LFS. The differences in OPs' and GPs' reporting patterns for diagnostic category and gender appear to be linked to the industries from which the cases were derived, resulting in reporting differences for mental ill-health diagnoses and female cases.

Work-related ill-health reporting patterns in OPRA reflect the variation in OH provision for patients. THOR-GP may therefore give a more accurate picture of the overall burden of work-related ill-health in the UK. However, OPs might, by virtue of their level of specialist training, give more specific diagnoses and assessments. Therefore, the potential importance of data from both OPRA and THOR-GP makes a comparison of information highly relevant to OH practitioners, as it presents both occupational ill-health cases identified by OPs and OH services and those which are not. Without an increase in the provision of OH services, work-related ill-health which does not present to OPs becomes the responsibility of GPs, very few of whom have specialist occupational medical training.

Data collected within OPRA and THOR-GP originate from surveillance methods that are practical, uniform, and rapid. They allow early identification of new workplace hazards (perhaps from emerging industrial sectors) for which interventions can be identified before large numbers of employees have sustained harm to health. Participants in both schemes are recruited from sources such as specialist registers and participation lists from a postgraduate distributed learning course (146), producing a wide distribution of reporters throughout the UK who provide data from a range of geographical areas. Work is in progress to characterise the denominators of both schemes and preliminary analysis of the industrial employment of the THOR-GP population has shown it to be proportionally very similar to that of the whole of the UK (135).

Unlike other data sources providing estimates of the burden of work-related ill-health (such as the self-reported work-related illness data gathered by the LFS (31)), OPRA and THOR-GP reporting relies on medically qualified practitioners with training in occupational medicine. These reporters have skills and knowledge to provide objective evidence-based decisions, enabling them to consider work and its attribution in relation to ill-health.

However, there are limitations to these surveillance methods, including case definition. Reports to OPRA and THOR-GP are based on physicians' opinions about the work-relatedness of the condition (158), and although reporting guidelines (44) are available on the schemes' websites, opinions are likely to differ. Studies within THOR have examined intra and inter-group determinants of diagnostic labelling and attribution for work-related musculoskeletal conditions (158), asthma (219) and mental ill-health (220). Diagnostic labelling was not found to differ between OPs and clinical specialists for musculoskeletal disorders, occupational asthma and mental ill-health diagnoses, while investigations of attribution found that rheumatologists and psychiatrists use similar criteria to OPs when assessing work-relatedness. The mental ill-health study (220) has since been repeated for THOR-GP reporters and the study found that GPs also classified psychiatric diagnoses in a similar way to OPs and psychiatrists (221).

The mental ill-health study (220) concluded that differences in reporting patterns resulted from the case mix presenting to OPs and psychiatrists, rather than different reporting preferences. Essentially, as a large part of an OP's work involves assessment of fitness for work, and as mental-ill health diagnoses are the largest contributor to work-related sickness absence (79% of mental ill-health cases are certified unfit for work by their GPs compared to 42% of those with musculoskeletal diagnoses) (135), a greater proportion of employees with psychological problems associated with work are likely to require OH involvement than those with other diagnoses.

Additionally, as THOR-GP reporters are trained to DOccMed level they may differ from other GPs, not only in the cases that they see, but also in their reporting preferences and patterns. THOR-GPs may also differ from other GPs in their working timetables (and therefore tasks) within their general practices. Ongoing work to understand the THOR-GP and OPRA denominators will enable a study of the demographics of patients registered with THOR-GP practices and the population served by OPs, which is essential to assess possible biases and make valid comparisons in incidence rates.

There are slight differences in the reporting methodology between OPRA and THOR-GP including combined postal/card-based and electronic reporting in OPRA and (solely) electronic reporting in THOR-GP, and the differences in the 'core':'sample' reporting ratios. This method for sampling physicians' practice was established to try to minimise reporter fatigue (11) and encourage participation; its merits and disadvantages are currently being formally investigated in a randomised control trial examining 'core' and 'sample' reporting behaviour (160). However, any variations in monthly case reporting are less likely to be a methodological problem for categories of commonly presenting work-related ill-health, in comparison to rarer occupational diseases.

It is unsurprising that OPs reported more cases per reporter per month, as the relationship between work and health is at the heart of their day-to-day practice. Little information has been published about the proportion of clinical practice that is work-related, but one estimate from a general clinic in the USA reported that 39% of patients believed their ill-health to be work-related (84). Other studies based on GPs' opinions have estimated a work-related cause in 7% (80) and 16% (89) of patients. A further study researching beliefs in assessing the work-relatedness of musculoskeletal disorders found that OPs estimated 44% of their clinical cases to be work-related, whereas rheumatologists thought only 7% were work-related (158).

GPs' reports for musculoskeletal disorders were proportionally highest within male dominated professions (such as construction), while mental ill-health cases were proportionally highest in industries such as health & social work where females make up approximately 75% of the workforce (190). These sectors differ in the type of hazards to which workers are exposed, with high physical demands within the construction industry and exposure to psychological stressors (31) and increased awareness of mental ill-health issues amongst healthcare workers. The bias in the distribution within UK industry of OH services is therefore likely to result in increased reports of mental ill-health from OPs. As in this study, a predominance of work-related psychological ill-health in females has been found in self-reports of work-related ill-health (31), in studies of GP consultations (222) and in older OPRA data (189). In comparison, work based on psychiatrists' reporting indicated that males had higher rates of mental ill-health than females (43).

Although some of the differences in reporting between OPRA and THOR-GP are likely to be an effect of industrial coverage, after adjusting for this OPs are still shown to report higher levels of mental ill-health than GPs. This suggests differences in case mixes or reporting thresholds. OPs are likely to raise the issue of work with patients with mental ill-health problems more frequently than GPs (even those with DOccMed training) and take a more extensive work-related history, whereas GPs may focus on the presenting systems. One study assessed consultations with sick-listed patients with mental ill-health problems treated by both an OP and a GP, and found that OPs discussed working conditions in 43% of consultations compared to 28% for GPs' consultations (93). However, this difference may be lower in THOR-GP due to participants having some training in occupational medicine (223). Another factor to take into account is an individual patient's behaviour and description of symptoms; for example a patient who felt that a work-related issue was causing psychological problems may consider which physician the patient felt was in a better position to offer assistance. Differences in referral patterns between OPs and GPs may also have an influence on the results; for example a GP may omit reporting a case as work-related if the patient is being referred for diagnostic or aetiological assessment, and such omissions may vary by diagnostic category. Results from THOR-GP show that respiratory and audiological cases are far more frequently referred than mental ill-health and musculoskeletal diagnoses (224). Further work on referral patterns is in progress.

Analysis of raw data showed that GPs reported more cases in males (and OPs reported slightly more in females), however, after adjustment for employment sector OPs were more likely to report males than GPs. This predominance of male case reports may be primarily due to the gender distribution of the UK workforce (54% males) (190), which is corroborated by a survey (in progress) of the workforce covered by OPs reporting to THOR. Of note, these results are contrary to other sources of data; the incidence of female self-reported work-related ill-health is higher than for males (31), and morbidity statistics from general practice found that females had a much higher consultation rate than men (61% of total [all cause] consultations) (222).

THOR-GP highlights the value of work-related ill-health data collected from general practice in estimating incidence, measuring trends and studying determinants of work-related ill-health. Although OPs are best placed to report on the relationship between work and health and therefore provide valuable information about work hazards and the causes of ill-health in the workplace, some sectors of the UK's workforce have poor access to OH services, and reports from GPs help to inform about this 'blind spot'. It is recognised that there is a lack of vocational occupational medical training in general medical education (56;145) which may lead to the work aspects of a patient's ill-health being unrecognised, however as all participants in THOR-GP are trained to DOccMed level, a work-related case should be recognised as such.

Within each THOR-GP case report, reporters also include information on suspected agents/tasks/events, certified sickness absence, and referrals to other health practitioners. The observatory function of THOR is further increased by this additional information, enabling 'triangulation' of the information provided by GPs, OPs and clinical specialists to build a better picture of work-related ill-health in the UK. These data will assist in the identification of occupations and industries, diagnoses and exposures that result in sickness absence, and also in the investigation of the burden of work-related ill-health in primary and secondary care and in corroboration of self-reported work-related ill-health.

Chapter 5.2: Comparison of work-related ill-health data from different GB sources

Hussey L, Carder M, Money A, Turner S, Agius R. **Comparison of work-related ill-health data from different GB sources.** Occup Med, 2013: 63 (1), 30-37. (Appendix 20)

5.2.1 Abstract

Background A number of data sources help inform policy decisions regarding the risk of work-related ill-health.

Aims To compare self-reported and medically reported data from multiple sources and discuss their benefits and limitations in providing estimates of work-related ill-health incidence in Great Britain (GB).

Methods Sources included The Health & Occupation Reporting network (THOR & THOR-GP) and the survey of Self-reported Work-related Illness (SWI). Results from SWI and THOR from GPs, rheumatologists, psychiatrists, dermatologists and respiratory physicians (2006-2009) were compared. THOR-GP data also included patient referrals information.

Results Overall incidence rates were highest when calculated from self-reported data, and lowest from clinical specialists. SWI rates were higher than GP rates for mental ill-health (SWI 790, GP 500 per 100,000 persons employed) and 'other' diagnoses (SWI 368, GP 41), whereas incidence rates for musculoskeletal (SWI 670, GP 684) and skin diagnoses (SWI 38, GP 152) were higher from GPs. Very few cases of musculoskeletal and mental ill-health were referred to clinical specialists (<1%). Skin (15%) and respiratory (26%) cases were referred more frequently. Case mix varied by data source.

Conclusions SWI is more inclusive than THOR-GP; however reports are unsubstantiated by medical opinion. Clinical specialist reports are subject to biases such as severity and referral patterns. GP data benefits from its inclusion of less severe cases than reports from secondary care and may give a better reflection of the incidence of diseases with a work-related aetiology unrecognised by self-reporting individuals.

5.2.2 Introduction

The collection of data on work-related ill-health is essential to identify the determinants of risks to health that affect different sectors of the workforce. This information helps to direct and evaluate policy decisions aimed at reducing the risk of work-related ill-health and sickness absence. In the United Kingdom (UK) as a whole, sources of data include the surveillance schemes within The Health & Occupation Research network (THOR specialist schemes and THOR-GP) (44) and for Great Britain (England, Scotland and Wales, excluding Northern Ireland) (GB), the survey of Self-reported Work-related Illness (SWI) (27) (Table 5.2.1). These schemes collect data at different levels of the 'work-related ill-health pyramid' (Figure 5.2.1), which is an adaptation of the public health 'Burden of illness pyramid' (50).

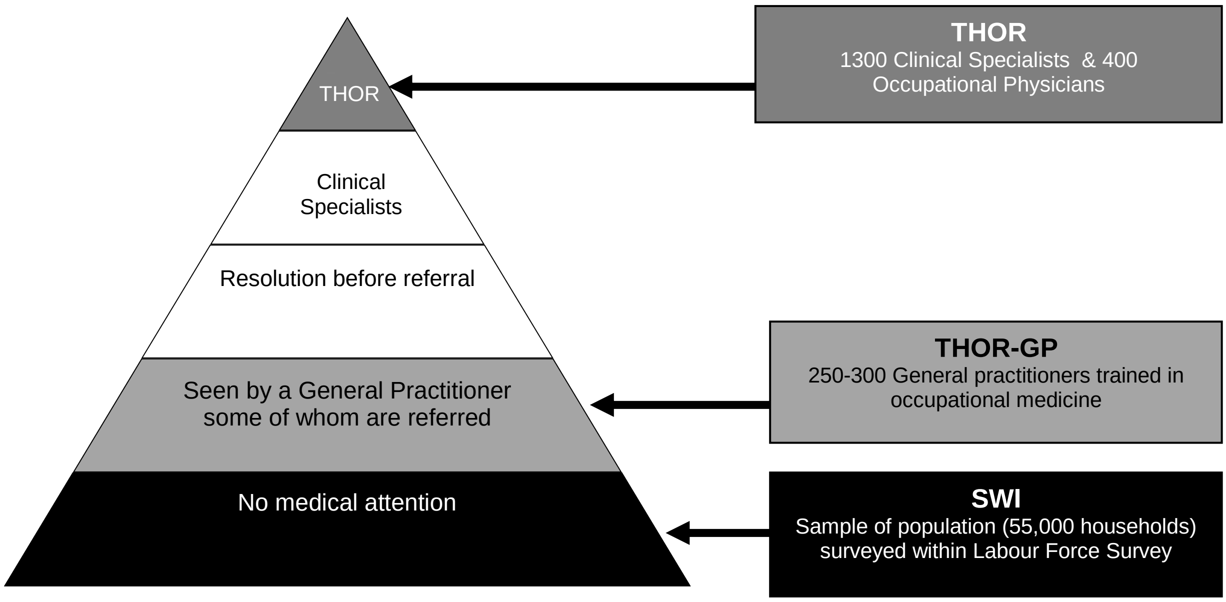

Figure 5.2.1. Work-related health surveillance pyramid (2009)

Each scheme has its strengths and weaknesses and gives reliable estimates for particular aspects of work-related ill-health (e.g. for rates by industry or specific diseases). The SWI is likely to be more inclusive as cases do not require consultation with a medical practitioner; therefore incidence rates may differ from those where work-relatedness is based on medical opinions (29;225). THOR-GP reports comprise opinions from general practitioners (GPs) trained to diploma level in occupational medicine (DOccMed), who are theoretically well placed to judge the work-relatedness of a case. Other THOR reports rely on submissions from specialists in their particular field of medicine.

Clinical specialists and GPs participating in THOR and THOR-GP (Table 5.2.1) report in two tiers of time sampling, some doctors reporting every month of the year (‘core’ reporters), and others in one randomly selected month per year (‘sample’ reporters) (160). Participants submit demographic information, diagnosis/symptoms, occupation, industry and suspected causal agent/task/event, for any cases presenting to them, that they believe were caused or aggravated by work. GPs also report information on sickness certification and patient referrals. This information is reported either electronically (via an on-line webform) or by postal reporting card using well established methods (40-43;135). SWI data collection procedures are fully described elsewhere (211), but in brief individuals sampled as part of the Labour Force Survey (LFS) are interviewed about any ill-health or injury they believe was related to work in the 12 month period prior to the survey, and published results reflect averages over this period spanning two calendar years (211). The SWI only includes the episode considered the most serious by the responder. In contrast, within THOR/THOR-GP any number of diagnoses can be included in co-morbid cases.

Table 5.2.1. SWI, THOR-GP and THOR schemes

SCHEME NAME	NAME IN FULL	REPORTS FROM	YEARS IN OPERATION	DATA REPORTED
SWI	Survey of Self reported Work-related Illness	Individuals sampled as part of the LFS	2001 to present, data presented as an average of 12 months spanning 2 years	All categories of work-related ill-health & injury
THOR-GP	The Health & Occupation Reporting network in General Practice	GPs trained to Diploma level in occupational medicine	June 2005 to present	All categories of work-related ill-health
SWORD	Surveillance Of Work-related Respiratory Disease	Chest physicians	1989 to present	Work-related respiratory disease
EPIDERM	Occupational Skin Surveillance	Dermatologists	1993 to present	Work-related skin disease
MOSS	Musculoskeletal Occupational Surveillance Scheme	Rheumatologists	1997 to 2009	Work-related musculoskeletal disorders
SOSMI	Surveillance of Work-related Stress and Mental Illness	Psychiatrists	1999 to 2009	Work-related mental ill-health

The schemes are nationwide. SWI has a formalised geographically stratified sampling strategy to ensure national coverage (211). THOR recruits eligible specialists nationally (although regional participation may vary). Most THOR-GPs are recruited from a UK-wide distance learning course and early assessment has shown them to be nationally representative (135;202). However, not all eligible specialists participate in THOR, and only around 4% of UK GPs undertake DOccMed training and are therefore eligible to participate in THOR-GP (140;141). Incidence rates are therefore estimated and subject to assumptions and caveats (49;202).

In this study, we aimed to build a comprehensive picture of work-related ill-health in GB by comparing reports from the SWI, THOR-GP and THOR's clinical specialist schemes (from rheumatologists, psychiatrists, dermatologists and respiratory physicians). Comparing data from these sources (including patient referral information from THOR-GP) will help to provide further detail of the burden across different providers of health care services and the relationship between data reported from primary and secondary care.

5.2.3 Method

To compare information for full calendar years over the same time period, we analysed data on all cases of work-related ill-health reported from 2006 to 2009 inclusive. So, for the purpose of this comparison, we averaged SWI data from 2006/2007, 2007/2008 and 2008/2009 to cover the same period as THOR data. As SWI does not include data from Northern Ireland, cases from this part of the UK were omitted from THOR and THOR-GP data to limit the comparison to GB rates.

THOR-GP and SWI collect data on all types of work-related ill-health which can be categorised into five diagnostic groups; musculoskeletal, mental ill-health, skin, respiratory and 'other' (audiological, infections, neurological, cardiovascular etc.). THOR-GP includes injury data, but in the SWI this information is excluded by the interviewer and forms the basis of the Work-place Injuries Survey. So to compare the two schemes, we omitted injury data (approximately 13% of GP cases) from THOR-GP. Cases reported by THOR-GPs are coded as a disease or injury by

THOR-GP researchers. For example, a case could be classified as ‘back pain’ (and therefore assigned to a musculoskeletal category) or as a ‘back injury’ (and therefore not included in this analysis). To avoid diagnostic misclassification, we adopted a system for defining disease or injury used by the World Health Organisation (163) and methods used to record work-related ill-health and injury in community clinics (80). These methods stated that ‘an injury is the result of a single traumatic event where the harm or hurt is immediately apparent’ and ‘a disease results from repeated or long-term exposure to an agent or event’.

We calculated incidence rates from THOR-GP and the corresponding THOR specialist scheme using similar methods (49;202) and compared these to THOR-GP referral rates. We calculated annual estimates by multiplying cases from ‘sample’ reporters by 12 and adding these to those submitted by ‘core’ reporters. We then adjusted these numerator data for reporters’ response rates and an estimated participation rate of eligible GB physicians, to extrapolate data to estimate a numerator for the national population. We adjusted THOR-GP data for GPs’ part-time practice. In a previous study we estimated the number of physicians eligible to report to THOR i.e. practising in GB and seeing patients of working age (49). We used this to calculate GB incidence rates, rather than just cases reported to THOR.

The SWI numerator is adjusted by the sampling fraction to give estimated figures for GB . For all sources of numerator data, we used LFS information as the denominator to calculate incidence rates. With long-latency diseases such as mesothelioma and skin neoplasia there may be data incompatibility relating to the use of contemporary (2006 to 2009) LFS denominator data to estimate the working GB population, rather than using lagged population data, but at present, it is not clear what the ‘optimum’ lag period should be.

Having calculated incidence rates, we compared referral patterns and case mix by diagnosis from the different groups of reporters. Diagnostic/anatomical sub-division for SWI data was only possible for musculoskeletal disorders. We also compared incidence rates from THOR specialists to referral rates from THOR-GP to hospital consultants by calculating incident rate ratios.

Multicentre Research Ethics Committee approval has been granted to THOR (Reference number MREC 02/8/72)

5.2.4 Results

The overall incidence rate for work-related ill-health was highest when calculated from self-reported data, and lowest from clinical specialists' reports (Table 5.2.2). Comparing SWI incidence rates with THOR-GP rates showed variation by diagnostic category. SWI had higher rates for mental ill-health, respiratory and in particular 'other' diagnoses (nine times higher than GP rates), whereas THOR-GP incidence rates were higher than SWI rates for musculoskeletal and skin diagnoses.

Participation rates differed by medical speciality (chest physicians 73%, dermatologists 69%, rheumatologists 39% and psychiatrists 10%). The incidence rate for mental ill-health required the most adjustment because of the low participation rate of eligible GB psychiatrists.

Clinical specialists' rates for the four diagnostic categories were all fairly similar to each other, except for mental ill-health (as reported by psychiatrists), which was proportionately higher.

GPs referred 7% of cases to clinical specialists. Only a very small proportion of musculoskeletal and mental ill-health THOR-GP cases were referred to rheumatologists or psychiatrists, but skin and respiratory cases had higher rates of referral to secondary care (Figure 5.2.2). Most of the skin and respiratory cases were contact dermatitis and asthma and the rates of referral for these diagnoses alone were 15% and 17% respectively.

We report incidence rates calculated from clinical specialists' schemes adjusted and unadjusted for the GB cases that are assumed missing due to the non-participation of eligible physicians (Figure 5.2.2). The adjusted specialists' incidence rates were higher than referral rates for all diagnostic categories, apart from skin disease. The incidence rate ratio (adjusted clinical specialists incidence rate/referral rate) for mental ill-health was much higher than for other diagnoses (rate ratios: mental ill-health 20.8, musculoskeletal 4.8, respiratory 1.5, skin 0.6).

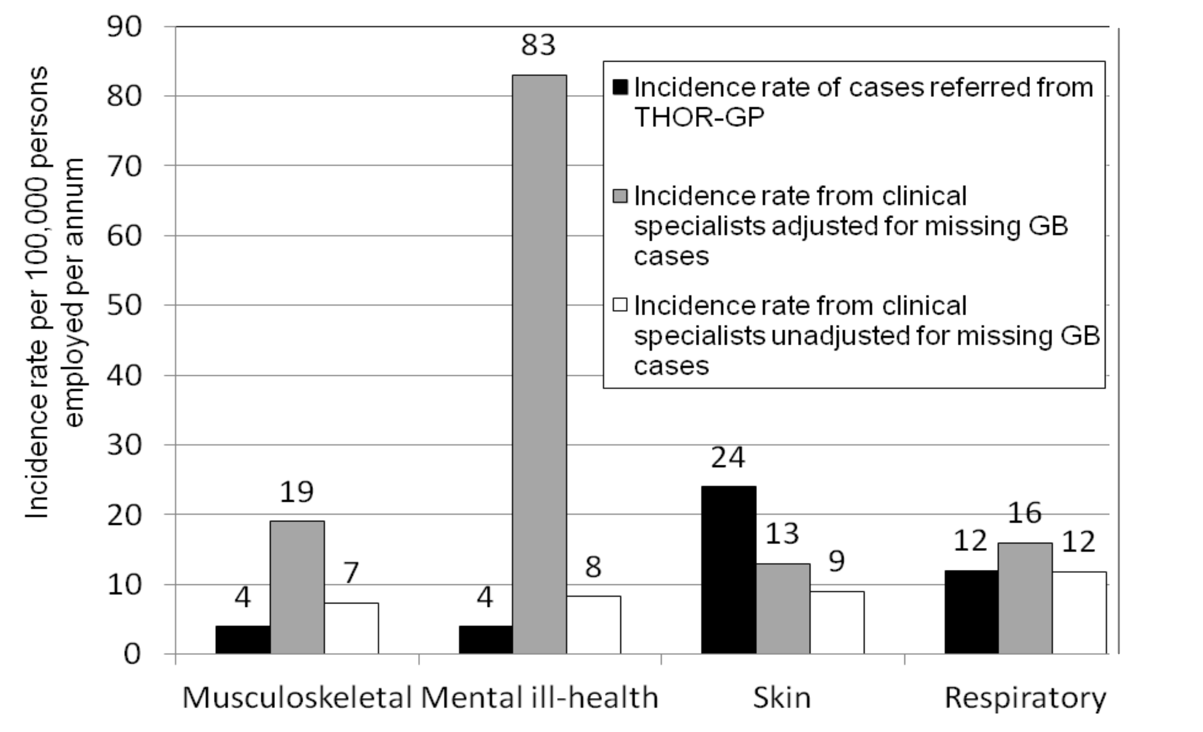

Figure 5.2.2. Incidence referral rates of THOR-GP cases and specialist reported incidence rates (adjusted and unadjusted for missing GB cases) THOR-GP, MOSS, SOSMI, EPIDERM & SWORD 2006 to 2009.

Referrals for skin and respiratory disease were mainly to secondary care specialists, but musculoskeletal and mental ill-health cases were frequently referred to community based health professionals (Table 5.2.3). More musculoskeletal cases were referred to orthopaedic surgeons than to rheumatologists.

Table 5.2.4 shows a proportional breakdown of cases and the case mix within each data source. SWI reports comprised a high proportion of back pain (41%), but this decreased with higher levels of the surveillance pyramid (28% in THOR-GP; 9% in rheumatologists' reports). Case mix also differed between reporting schemes for other diagnostic categories; most cases of mental ill-health were reported by GPs as 'stress' whereas psychiatrists reported more cases of anxiety/depression and PTSD. Most skin diagnoses reported by both GPs and dermatologists were contact dermatitis. Twenty-six per cent of cases reported by dermatologists were skin neoplasia but these cases only constitute 1% of GP reports. Half of the respiratory cases reported to THOR-GP were asthma or asthma-related symptoms. Most cases reported by chest physicians were long-latency diseases such as mesothelioma and non-malignant pleural disease.

Table 5.2.2. GB incidence rates based on self-reports and reports from GPs and clinical specialists 2006 to 2009. SWI, THOR-GP and THOR (MOSS, SOSMI, EPIDERM & SWORD)

	SELF-REPORTS (SWI)[16]			GENERAL PRACTITIONERS (THOR-GP)			CLINICAL SPECIALISTS (THOR)		
Diagnostic group	**Number of cases 2006 to 2009 (annual average)**	**Estimated number of GB cases**	**Incidence rate per 100,000 persons employed**	**Number of cases 2006 to 2009 (annual average)**	**Estimated number of GB cases**	**Incidence rate per 100,000 persons employed**	**Number of cases 2006 to 2009 (annual average)**	**Estimated number of GB cases**	**Incidence rate per 100,000 persons employed*****
Musculoskeletal	*	200000	670	578	191209	684	1543	5274	19
Mental ill-health	*	236000	790	423	139888	500	1526	23121	83
Skin	*	11000	38	128	42463	152	2194	3654	13
Respiratory	*	16000	54	32	10595	38	2496	4514	16
Other	*	112000	368	35	11423	41	***	***	***
Total	*****	**575000**	**1920**	**1171****	**387715****	**1387****	**7759**	**36563**	**131**

*'Number of cases' not published for SWI
**Number of cases smaller than sum of diagnostic groups as some cases are co-morbid
***Clinical specialist rate shown adjusted for estimated missing GB cases
****No THOR equivalent clinical specialist scheme for 'other' diagnoses

Table 5.2.3. THOR-GP patient referrals (actual cases 2006 to 2009)

TYPE OF REFERRAL	MUSCULO-SKELETAL n (%)	MENTAL ILL-HEALTH n (%)	SKIN n (%)	RESPIRATORY n (%)
Not referred	1461 (75)	1244 (85)	349 (84)	74 (70)
THOR clinical specialty (Rheumatology, psychiatry, dermatology, respiratory physician)	13 (1)	12 (1)	62 (15)	28 (26)
Other clinical specialty e.g. orthopaedics, neurologists etc.	109 (6)	12 (1)	0 (0)	1 (1)
Community based health professionals (e.g. physiotherapy, counselling services)	296 (15)	151 (10)	0 (0)	0 (0)
Occupational health services	22 (1)	25 (2)	3 (1)	0 (0)
Other	46 (2)	15 (1)	0 (0)	3 (3)
Total	**1947 (100)**	**1459 (100)**	**414 (100)**	**106 (100)**

Table 5.2.4. Musculoskeletal, mental ill-health, skin and respiratory diagnoses reported to SWI, THOR-GP and THOR (2006 to 2009)

	SELF-REPORTS (SWI)[16] Estimated number of GB cases* n(%)	GENERAL PRACTITIONERS (THOR-GP) Estimated number of cases 2006 to 2009 n(%)	CLINICAL SPECIALISTS (THOR) Estimated number of cases 2006 to 2009 n(%)
MUSCULOSKELETAL ANATOMICAL SITE			
Upper limb or neck	90000 (45)	1450 (60)	4988 (80)
Back	81000 (41)	676 (28)	543 (9)
Lower limb	29000 (15)	229 (9)	567 (9)
Other	–	75 (3)	164 (3)
Total musculoskeletal diagnoses	200000 (100)	2430 (100)**	6526 (100)**
MENTAL ILL-HEALTH DIAGNOSIS			
Anxiety/depression	–	714 (42)	4077 (63)
Stress	–	964 (57)	416 (6)
Post Traumatic Stress Disorder	–	11 (0.7)	649 (10)
Other	–	11 (0.7)	1338 (21)
Total mental ill-health diagnoses	236000 (100)	1700 (100)**	6480 (100)**
SKIN DIAGNOSIS			
Contact dermatitis	–	422 (82)	5911 (66)
Infection	–	57 (11)	34 (0.4)
Neoplasia	–	4 (1)	2280 (26)
Other	–	32 (6)	694 (8)
Total skin diagnosis	11000 (100)	515 (100)**	8919 (100)**
RESPIRATORY DIAGNOSIS			
Asthma/asthma symptoms	–	65 (50)	1200 (12)
Long latency disease	–	18 (14)	7000 (69)
Rhinitis	–	13 (10)	90 (1)
Other	–	35 (27)	1892 (19)
Total respiratory diagnosis	16000 (100)	131 (100)**	10182 (100)**

*Numbers of cases not published, therefore GB estimates used

**Total diagnoses are greater than number of cases in 5.2.2 as some cases are co-morbid

5.2.5 Discussion

Incidence rates for work-related ill-health decreased with increasing medical specialisation, but this was not uniform across all diagnostic categories. Incidence rates for mental ill-health, respiratory and 'other' diagnoses were highest from self-reported data, but GP rates were highest for musculoskeletal and skin diagnoses. Dermatological and respiratory cases were referred to clinical specialists proportionally more often than musculoskeletal and psychological cases. Case-mix varied from the three levels of the work-related ill-health reporting pyramid.

THOR reporting by clinical specialists and GPs is easily compared, as data collection is similar (40-43;135), but SWI data are collected differently (211). SWI data may be subject to recall bias, as individuals are asked to report episodes from the previous 12 months. Also, approximately a third of the LFS interviews are collected by proxy (i.e. partner, sibling etc), which may affect the accuracy of the data (211). THOR-GPs generally submit cases electronically when they see patients, but postal reports submitted by specialists at the end of a monthly reporting period may be more subject to recall bias.

Estimates from smaller numbers of reports (skin and respiratory cases) may be less reliable than musculoskeletal and mental ill-health cases which are reported more frequently to both THOR-GP and SWI (27;135).

The reporting schemes collect data from different sub-groups of the population so it is unsurprising that incidence rates vary. SWI incidence rates are higher, and likely to capture more and less severe cases. Most cases reported by clinical specialists are likely to be more severe and to have been referred by GPs. However, SWI rates for musculoskeletal and skin problems are lower than GP rates. Previous research suggests that workers over-attribute arm pain to a work-related cause (33). Our results show higher rates for GP-diagnosed musculoskeletal disorders, despite GPs probably seeing patients who believe their symptom severity warrants medical attention and therefore capturing fewer cases. SWI responders may be less aware of the potential for work-related allergens and exposures and work-related aggravation of pre-existing conditions, such as dermatitis/eczema or asthma/asthma-related symptoms. GPs with occupational health training should be more aware of work-related risk factors, and clinicians participating in THOR/THOR-GP are more likely to be interested in work-related health.

SWI only includes the episodes considered most severe, and individuals may have differing opinions about work attribution from a GP with training in occupational medicine. Additionally, patients may consider episodes more serious if they resulted in a period of absence from work. Previous THOR-GP studies on work-related sickness absence have shown that 79% of mental ill-health cases were issued with a sick note compared to 42% of musculoskeletal diagnoses and 15% of skin cases (135).

The SWI rate for ‘other’ self-reported work-related ill-health is nine times greater than the GP rate. Individuals may assign a work-related cause to ill-health (such as cardiovascular problems) whereas GPs attribute these to other non-work-related factors (such as diet, exercise and family history); therefore such cases are rarely reported to THOR-GP.

The variation in GP rates of referral by diagnostic category have been discussed elsewhere (226). In accordance with clinical guidance, musculoskeletal and mental ill-heath cases were rarely referred to hospital specialists, compared to skin and respiratory diagnoses where referral is recommended for patch or challenge testing in specialist clinics (227-230). If cases referred by GPs made up incident cases in secondary care, the incidence rates should be similar, (and therefore an incident rate ratio of 1). Indeed, the incidence rate ratio was lowest for these (skin and respiratory) diagnostic categories with more objective measures of impairment. For skin disease, the referral rate was higher than the specialist referral rate. Cases making up specialist incidence rates are unlikely to originate from THOR-GPs (approximately 1% of GB GPs), but rather from GPs without occupational medicine training. Guidance (228) advises that a diagnosis of occupational contact dermatitis (82% of THOR-GP skin cases) should be confirmed objectively (by patch test) and not just based on a compatible occupational history. Perhaps occupational health ‘trained’ GPs are more aware of this guidance and therefore more likely to refer patients for testing.

The high incidence rate ratio for mental ill-health may be due to our method (under investigation) for adjusting for GB unreported cases. It is difficult to estimate the number of psychiatrists eligible to participate in SOSMI compared to other clinical specialties (43;49). Some psychiatry sub-specialties are ineligible for SOSMI participation (e.g. child and old-age psychiatry) and these are difficult to quantify.

Only 9% of rheumatologists’ cases were back pain. This is unsurprising with the increased use of back pain services and triage processes in recent years (231;232). Very few work-related musculoskeletal disorders reported to THOR-GP were referred to rheumatologists; more were referred to orthopaedic surgeons. Inflammatory diseases such as arthritis are more likely to be referred to rheumatologists, and may be more difficult to attribute to work.

Psychiatrists reported a very different case mix from GPs. Studies (220;221) within THOR have shown that reporting patterns between reporter groups resulted from a different clinical case mix rather than different diagnostic labelling, reflecting chronicity/illness severity, with cases of ‘stress’ treated within primary care in accordance with NICE guidance (227). Cases considered more severe, such as post traumatic stress disorder (PTSD) were more likely to be referred to secondary care, with guidance recommending ‘treatment should be provided on an individual outpatient basis’ (233).

The diagnostic differences between skin and respiratory cases reported from primary and secondary care are related to severity. Very few cases of long-latency disease such as skin neoplasia and mesothelioma are reported by GPs, but these make up a large proportion of the cases reported by dermatologists and respiratory physicians.

This study highlights that the highest rates of work-related ill-health (and sickness absence) (135;138) in the community and in GP clinics result from musculoskeletal disorders and mental ill-health, but that very few cases are referred to secondary care. Moreover, in cases such as work-related contact dermatitis and asthma, where testing in specialist clinics is recommended, a large proportion of cases reported by GPs with DOccMed training, were not referred. The referral rate for other GPs is unknown. It may not be possible to establish what is the ‘true’ incidence of work-related ill-health in GB using these data sources, as they measure different levels of disease severity with different tools, i.e. level of medical specialty and associated accuracy in the assessment of work-relatedness and diagnosis. However, this paper highlights the strengths and weaknesses of the schemes, and how comparison of data reported from SWI, THOR-GP and THOR clinical specialists helps build a more comprehensive picture of work-related ill-health, and the relationship between self-perceived ill-health and ill-health recognised in primary and secondary care.

Chapter Six. Work-related sickness absence as reported by general practitioners in the UK

Hussey L, Turner S, Thorley T, McNamee, Agius R. **Work-related sickness absence as reported by UK general practitioners.** *Occupational Medicine* **2012;62:105-111.** (Appendix 21)

Note: The text shown here may have been subject to minor edits in the final published version.

6.1 Abstract

Background Issues surrounding sickness absence are of interest due to growing awareness of the costs to employers and the UK economy, a greater understanding of the interaction between health and work, and increasing evidence that work is beneficial to physical and mental well-being. The Health & Occupation Reporting network in General Practice (THOR-GP) is a national source of information on work-related sickness absence.

Aim To assess the factors influencing work-related sickness absence in the UK

Method GPs report cases of work-related ill-health via an on-line web form. Sickness absence information reported with each case was compared by demographic information, diagnosis/symptom and employment factors.

Results Between 2006 and 2009, THOR-GP received 5683 case reports of work-related ill-health; the majority (53%) were of musculoskeletal diagnoses and almost a third (31%) were mental ill-health diagnoses. Over half (56%) of cases reported had associated sickness absence. Diagnosis had a highly significant influence on the occurrence of any associated sickness absence. 81% of mental ill-health cases were reported to result in sickness absence compared to 50% of musculoskeletal cases. Public sector employees incurred sickness absence more frequently than those from the private sector. Industries with the highest mental ill-health incidence rates had

sickness absence episodes most frequently. Within employment groups levels of sickness absence were inversely proportional to the level of self-employment.

Conclusions These data reported by GPs with vocational training in occupational medicine may help to inform policy decisions targeting work-related exposures and the management of sickness absence, thereby reducing the UK burden of work-related sickness absence.

6.2 Introduction

Issues surrounding sickness absence have become of increased interest in recent years. This is due to raised awareness of costs to employers and to the UK economy (estimated at £17 billion in 2009) (14;15), and as a result of greater understanding of the relationship between work and health, alongside increasing evidence that work is good for physical and mental well-being (16). In 2008 these issues surrounding work and health were highlighted in the review of the health of Britain's working age population (22), which recommended the introduction of a 'fit note', whereby a general practitioner (GP) may recommend which work tasks a patient is able to undertake, rather than signing them off work altogether.

In the UK, rates of sickness absence and its determinants are published by various sources, using different methods of calculation and presentation of results, which can make comparisons difficult. The Confederation of British Industry (CBI) estimated 6.4 days were lost per employee, resulting in 180 million days lost in 2009 (15). Labour Force Survey (LFS) data found that 3% of employees took at least one day off work per year, resulting in 5.8 million days lost (120). Other estimates include a GP based study that calculated the sickness absence rate at 101.67 certificates per 1000 person years (23).

There is little published information on the underlying determinants of work-related sickness absence on which to inform policy decisions on workplace interventions. However, one source of data is the survey of Self reported Work-related Illness (SWI) (31). This survey reported 29.3 million days lost (1.24 days per worker) in 2008/2009, and presents sickness absence by diagnosis, gender, industry and region. Publications on work-related sickness absence have also concentrated on psychosocial and physical factors affecting absence from work (234;235).

Another national source of information on work-related sickness absence is The Health & Occupation Reporting network in General Practice (THOR-GP) (159). Since 2005, 250 to 300 GPs trained to Diploma level in Occupational Medicine (DOccMed), have reported cases of work-related ill-health and associated sickness absence seen in general practice clinics.

This paper aims to analyse how work-related sickness absence reported to THOR-GP prior to the introduction of the 'fit note' (and subsequent change in data collected) varies demographically, diagnostically and by employment, thereby assessing which factors influence the burden on sickness absence (due to work-related ill-health) in the UK.

6.3 Method

THOR-GP has by design between 250 and 300 GPs participating at any one time. This number of GPs was originally based on a power calculation of the numbers needed to detect a 15% change in incident cases of work-related ill-health over two years using a two-sided test, based on a Normal approximation to the Poisson distribution with continuity correction. The primary source of recruitment is the alumni of the DOccMed course at the University of Manchester; information on other DOccMed GPs qualified elsewhere is not so easily available, however, when identified, these GPs are also approached to participate in the scheme. THOR-GP reporters submit details via an on-line web form of any cases they see in their general clinical practice which they believe (using their training to assess the occupational history given by the patient) to have been caused or aggravated by work. Case details include demographic information, diagnosis/symptoms, occupation, industry and suspected causal agent/task/event (135;136). With each case reported, GPs are asked whether sickness certification was issued, and if so, for how long. GPs also report whether there was any absence prior to the consultation, and may also submit details of further certified sickness absence (issued for a previously reported case) should a patient return at the end of the initial certification period, giving a longitudinal view of the absence period.

Sickness absence associated with cases reported to THOR-GP from 2006 to 2009 was analysed to evaluate demographic (gender and age), diagnostic and employment factors that determine work-related sickness absence. Employment factors included industry (coded and analysed using the Standard Industrial Classification), self-employment (236) and whether an industry operates largely within the public or private sector. Industries were classified as ‘mostly public’ and ‘mostly private’ according to Office of National Statistics (ONS) data (185;237). Sickness absence information was analysed using Chi-squared tests. Data were also compared to incidence rates within each industry using Spearman’s correlation coefficient, which was also used to test correlations with levels of self-employment. Estimated incidence rates using THOR-GP data were adjusted for GPs’ response and participation, using LFS data as the denominator (202). Data were analysed using SPSS (version 15).

Multicentre Research Ethics Committee approval has been granted to THOR (Reference number MREC 02/8/72)

6.4 Results

Between 2006 and 2009, an average of 282 GPs were asked to report each month, with a response rate of 58%. During this period, THOR-GP received 5683 case reports of work-related ill-health; most (3080, 53%) were musculoskeletal diagnoses and almost a third (1779, 31%) were mental ill-health. The remainder were 560 (10%) skin cases, 137 (3%) respiratory and 240 (4%) ‘other’ diagnoses such as injuries and infections. Over half (56%) of these 5683 cases had associated sickness absence totalling 77,254 days. The sickness absence data were positively skewed with the number of days most frequently reported as seven, 14, 21 and 28, consistent with GPs tending to recommend and report the sickness absence periods in weeks (Figure 6.1). The mean for each sickness absence case was 24.3 days; the median was 15.

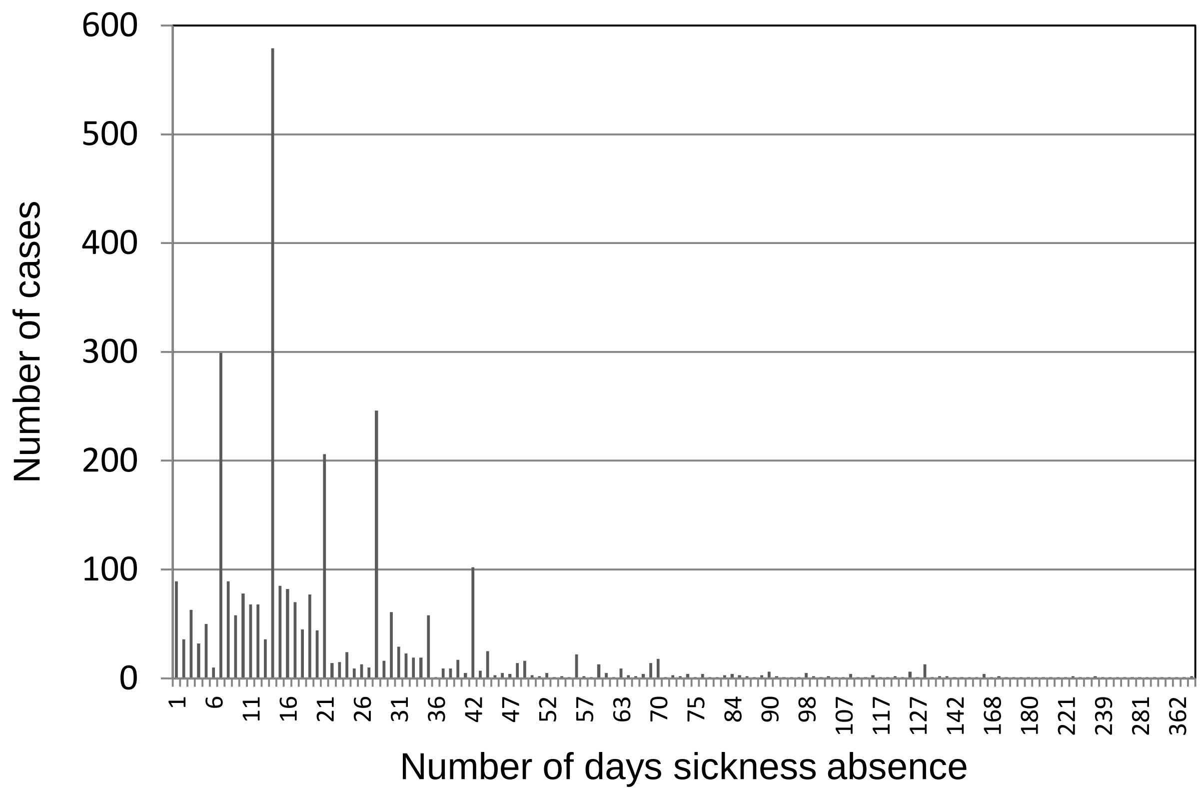

Figure 6.1. Frequency distribution of sickness absence days reported with each case of work-related ill-health THOR-GP 2006 to 2009

The majority of THOR-GP cases were male (3117 cases, 55%). Over half (54%) of these male cases had associated sickness absence; this is significantly lower than for female cases (59%) (Chi-square=12.2, df=1, p<0.001). Female cases on average also had more sickness absence days reported (females 25.1, males 23.5); however median scores were the same (15 days) for females and males.

Diagnosis was the main determinant having a significant (Chi-square=8.6, df=5, p=<0.001) influence on the sickness absence associated with a case. Sickness absence was associated with 81% of work-related mental ill-health cases compared to 50% of musculoskeletal cases (Table 6.1). Mental ill-health cases also had longer periods away from work.

Table 6.1. Sickness absence associated with THOR-GP cases reported 2006 to 2009 by diagnostic category, musculoskeletal anatomical site and mental ill-health diagnosis

	Number of cases	**Cases with associated sickness absence n (%)**	**Mean number of days certified per sickness absence case**	**Median number of days certified per sickness absence case**
All musculoskeletal	3080	1542 (50%)	18.7	14.0
Upper limb	1504	590 (39%)	19.2	14.0
Spine/back	1137	706 (62%)	18.2	14.0
Lower limb	396	224 (57%)	19.5	14.0
Other	165	93 (56%)	18.8	12.0
All mental ill-health	1779	1441 (81%)	30.6	20.0
Anxiety/depression	730	568 (78%)	34.8	21.0
Stress	979	824 (84%)	27.8	20.0
Other	80	56 (70%)	33.7	14.0
Skin	560	103 (18%)	17.0	14.0
Respiratory	137	36 (26%)	30.6	14.0
Other	239	113 (47%)	27.7	19.0
All cases	5683	3180 (56%)	24.3	15.0

Cases within the youngest age group had time away from work less frequently than older workers and shorter periods of absence; the number of days per case also increased with age (Figure 6.2).

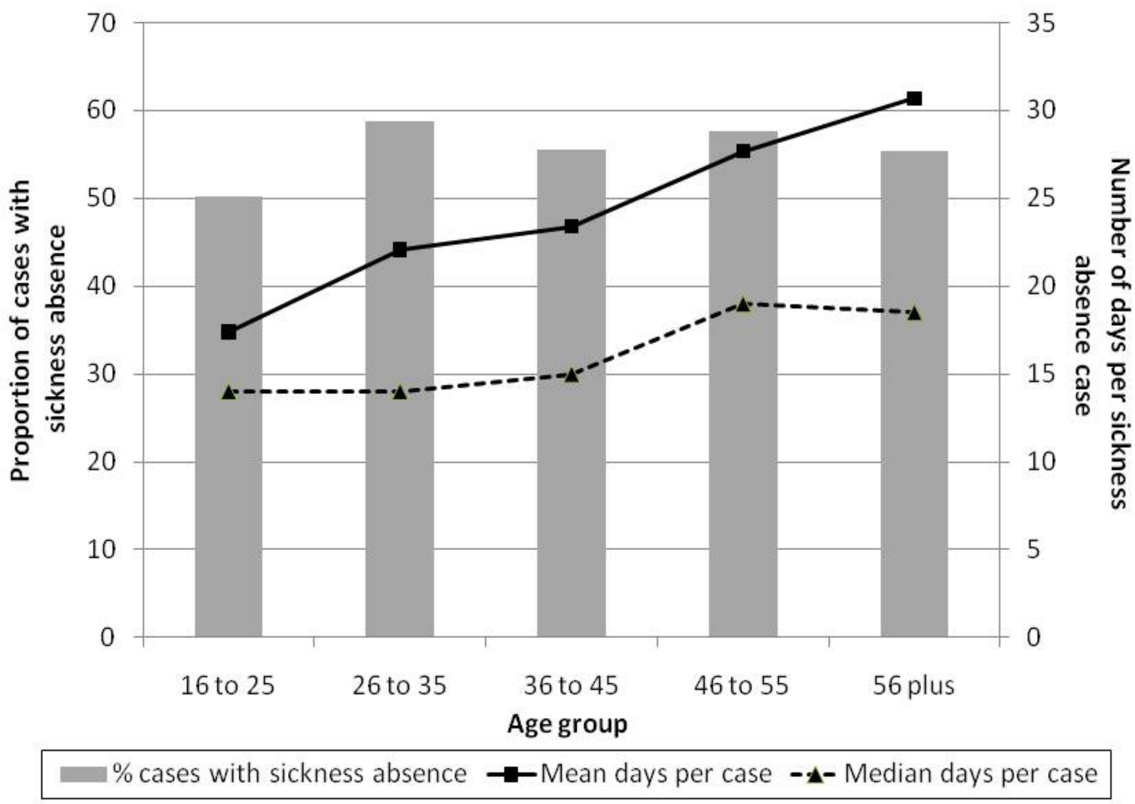

Figure 6.2. Proportion of cases with sickness absence episodes and mean/median number of days per sickness absence case by age group. THOR-GP 2006 to 2009

Industrial divisions were classified into ‘mostly public’ and ‘mostly private’ sectors. The ‘mostly public’ industrial sectors, plus financial intermediation, had the highest proportions of cases (and longest periods) with associated sickness absence (Table 6.2). These industries were the sectors with the highest work-related mental ill-health incidence rates (Figure 6.3). However, the relationship between industrial sector and sickness absence is not solely explained by diagnosis; there are still differences between the sectors even after stratifying by type of ill-health. Although the ‘mostly public’ sectors remain amongst those industries most likely to have sickness absence, for both musculoskeletal and mental ill-health, cases reported from transport, storage & communication were most likely to have time away from work.

Table 6.2. Sickness absence and incidence rates per 100,000 persons employed, THOR-GP cases reported 2006 to 2009 by industrial division

Industrial Division	All cases				Musculoskeletal				Mental ill-health			
	Number of cases	Incidence rate per 100,000 person employed	Cases with associated sickness absence n (%)	Number of days certified per sickness absence case	Number of cases	Incidence rate per 100,000 person employed	Cases with associated sickness absence n (%)	Number of days certified per sickness absence case	Number of cases	Incidence rate per 100,000 person employed	Cases with associated sickness absence n (%)	Number of days certified per sickness absence case
Education*	360	1118	259 (72)	35.6	94	292	51 (54)	23.2	244	758	202 (83)	38.6
Public administration & defence*	469	1873	332 (71)	25.8	199	797	120 (60)	17.9	238	953	203 (85)	31.2
Financial intermediation	179	1157	125 (70)	26.4	52	336	21 (40)	13.4	125	808	201 (82)	29.2
Health & social care*	771	1801	505 (66)	26.2	314	734	167 (53)	17.5	370	864	312 (84)	31.1
Transport, storage & communication	434	1819	281 (65)	23.3	286	1199	181 (63)	17.6	107	448	93 (87)	34.6
Retail & wholesale	692	1337	394 (57)	18.8	411	794	219 (53)	16.8	200	387	157 (79)	21.9
Real estate & business	389	924	202 (52)	21.8	217	515	95 (44)	20.4	143	339	102 (71)	23.9
Manufacturing	860	1904	441 (51)	25.4	527	1167	274 (52)	19.4	148	328	115 (78)	37.2
Construction	627	2223	284 (45)	23.2	468	1660	217 (46)	24.1	46	163	34 (74)	24.9
Hotels & restaurants	290	1875	112 (39)	16.5	147	950	58 (40)	11.7	52	336	43 (83)	23.9
Agriculture, hunting & fishing	143	3064	55 (39)	17.2	97	2078	42 (43)	16.2	9	193	5 (56)	25.4
Other community, social & personal services	340	1675	131 (39)	15.2	199	980	76 (38)	14.2	59	291	44 (75)	18.1

***'Mostly public' sector industries**

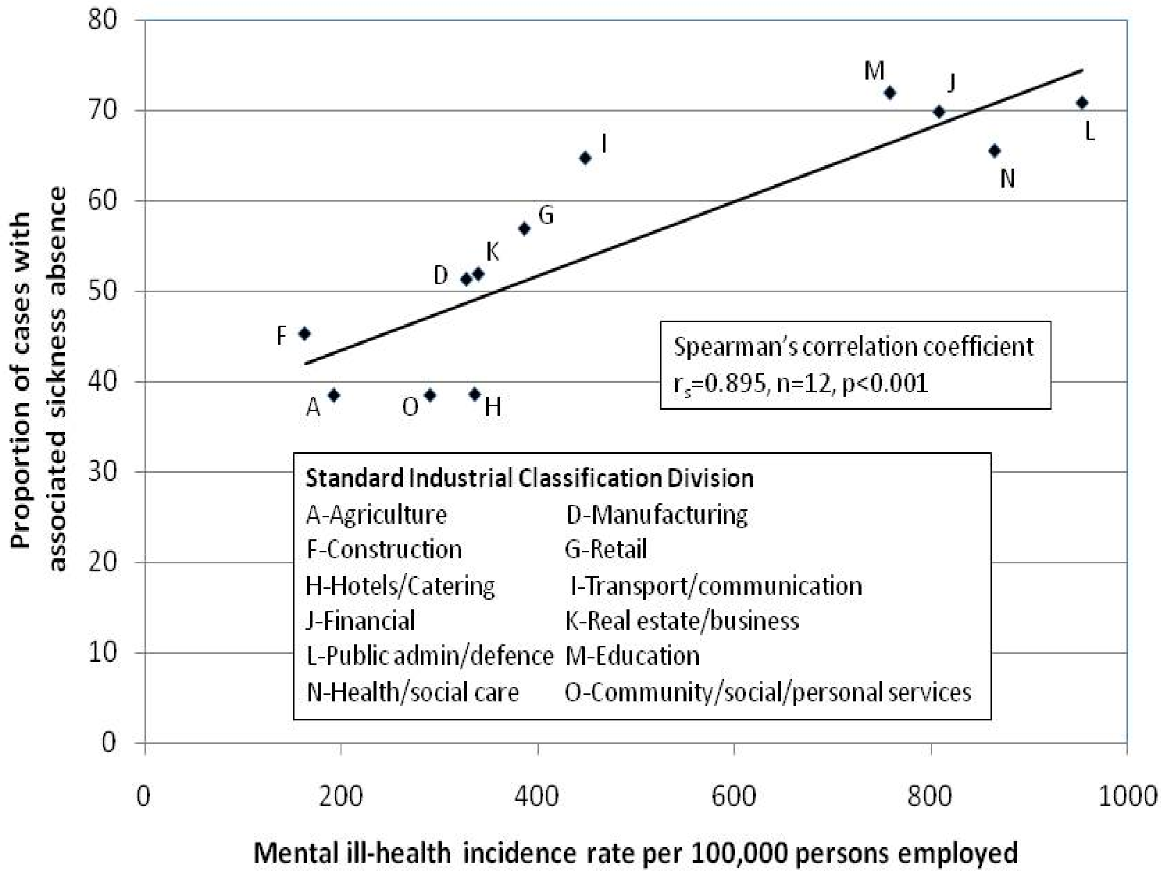

Figure 6.3. Proportion of cases within an industrial division with associated sickness absence by mental ill-health incidence rate per 100,000 persons employed. THOR-GP 2006 to 2009

The higher the proportion of the workforce within an industrial sector that is self-employed, the lower the proportion of cases reported with sickness absence (Figure 6.4).

6.5 Discussion

Over half the work-related ill-health cases reported to THOR-GP (2006 to 2009) had associated sickness absence. Females had sickness absence more frequently than males, and for longer periods of time. Cases aged 16-25 years had time away from work less frequently and the length of absence increased with age. Diagnostic category was the predominant determinant influencing sickness absence; mental ill-health cases were more likely to have sickness absence and for longer time periods, as a result, cases from industries with high work-related mental ill-health incidence rates were most likely to have associated sickness absence.

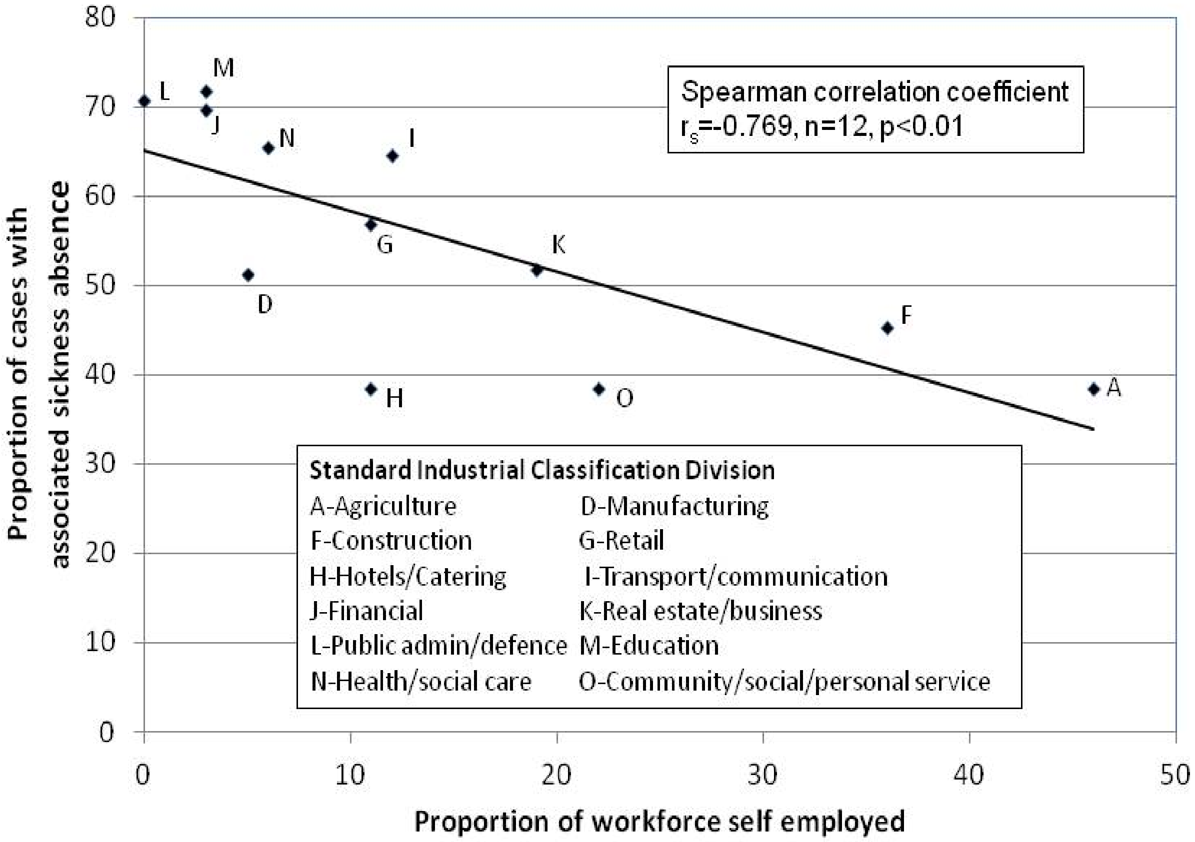

Figure 6.4. Proportion of cases within an industrial division with associated sickness absence by the proportion of workforce self-employed. THOR-GP 2006 to 2009

'Mostly public' sectors and finance had the highest proportions of sickness absence, and also the longest periods of absence, largely due to a high incidence of mental ill-health. Sickness absence remained high in these industries after stratification by diagnostic category. However, employees within transport, storage & communication were absent from work most frequently for both musculoskeletal and mental ill-health diagnoses. Cases from sectors with high proportions of self-employment had fewer sickness absence episodes.

THOR-GP is based on surveillance methods, and its strengths and weaknesses have been considered previously (135). Reporters are distributed UK-wide, and shown to be geographically representative (202). However, THOR-GP reporters' behaviour may differ from other GPs, as they are trained to DOccMed level, and it is estimated that only 4% of UK GPs have this training (140;141). Research (19) has also shown that, like many THOR-GP reporters, GPs working part-time in occupational medicine certified shorter periods of absence.

The majority of THOR-GP sickness absence data is reported at the time of the initial or follow-up consultations. GPs can report subsequent certified absence via the web form, however, it is unlikely that all GPs provide this data, especially with long-term sickness, therefore, data are continuously audited. A year retrospectively, GPs are asked how long the patient was away from work in total; analysis has shown that the data presented here could be underestimated by 60%. Although these results may not give a complete longitudinal picture of the absence period, they compare the frequency of episodes between different employment sectors. Even if incomplete, the length of time away from work can be compared, as there is no obvious reason why GPs would bias data by reporting subsequent sickness absence certificates issued to a patient employed in one sector over another.

Gender differences are likely to be partially explained by the relationship between sickness absence and diagnosis. Absence episodes are more frequent in females who have higher proportions of mental ill-health reports (135).

Industrial divisions were categorised as ‘mostly public or ‘mostly private’ sectors (185;237), but some sectors are more ‘public’ than others. Public administration & defence employees are almost all within the public sector; however healthcare and education include private hospitals and schools. The ‘mostly private’ sectors also vary; transport, storage & communication will include public sector Royal Mail employees and agriculture includes Forestry Commission workers.

Incidence rates estimated from THOR-GP have been correlated with sickness absence data. These rates are published by HSE as part of their annual statistical publication (224) however they are subject to certain caveats (202).

Most published literature relates to ‘all cause’ sickness absence, as opposed to solely work-related absence. The main comparator is therefore SWI information; these self-reported data also show higher rates in females compared to males, and for psychological diagnoses (31). Higher rates have been described in females for ‘all cause’ episodes of sickness absence (23;120), however, Shiels *et al* found that sickness absence episodes in males were significantly longer (110).

Two of these studies also reported increased rates with age, and with mental health diagnoses (23;110).

The 'mostly public' and finance sectors had more sickness absence episodes. However, after stratification, financial sector employees were no longer amongst those most likely to have time off, suggesting results were due to high incidence rates of mental ill-health within that sector. In contrast, cases from the 'mostly public' sectors remain amongst those most likely to have sickness absence therefore illustrating that the high frequency of episodes is not an effect of the type of ill-health reported.

This is also the case for employees in transport, storage & communication; workers with either diagnosis had time away from work more frequently than others. A closer inspection of these THOR-GP reports, showed that post & telecommunication (including Royal Mail) workers took sickness absence most frequently (72% of cases) and that mental ill-health sickness absence episodes were particularly high for road/rail drivers (91%); often due to traumatic events.

SWI figures also show high rates of sickness absence in healthcare, public administration & defence and transport, storage & communication (31). 'All cause' sickness absence is also reported as being highest in the public sector (15;238). It has been suggested that increased public sector rates could be attributed to under-reporting in the private sector. This is not the case within THOR-GP as reports originate from GPs, not employers (14;239). Sickness absence may be higher amongst public sector workers as they are exposed to psychological rather than physical stressors (240).

Results described here suggest issues of employee motivation influence absence from work. Public service organisations are likely to have more generous sickness absence policies than those in the private sector. Also, results here show that industries with higher proportions of self-employment have fewer episodes of sickness absence. A self-employed worker is likely to be more financially motivated to work. It is interesting to note that a survey of 11,000 employees found that a third of all sick leave was taken on a Monday, and sickness absence rates were highest in January (241). Studies have shown how personal characteristics influence the frequency of sick leave episodes (242).

THOR-GP data demonstrate patterns in work-related sickness absence by diagnosis and industry. Cases of work-related ill-health often have associated sickness absence as the GP may be strongly influenced by the patient and will consider their role as patient advocate and keep the patient away from the attributed exposure (18). Work-related mental ill-health, although difficult to diagnose specifically and probably multifactoral in causation, has been increasing in reported incidence which may reflect a reduction in the stigma associated with psychological ill-health (43). This, along with personal factors such as employee motivation may cause long periods of absence, ultimately resulting in permanent worklessness (243).

These data are reported by GPs with vocational training in the issues surrounding work and health who are well placed to provide data on the sickness absence caused by problems at work. THOR-GP data highlights the higher sickness absence rates found in the ‘mostly public’ industries with high levels of psychological work demands. Increased awareness of these issues may help inform policy decisions targeting work-related exposures, and thereby contribute to reducing the work-related sickness absence burden in the UK.

Chapter Seven: Discussion

7.1 Thesis objectives and main findings

7.1.1 Incidence and nature of work-related related ill-health as determined in general practice

The first objective of this thesis was to investigate the nature of work-related ill-health that is seen (and subsequently reported) by GPs in their clinical general practice. Chapter Three summarises how this objective was addressed in the peer-reviewed publication ‘Work-related ill-health in general practice, as reported to a UK-wide surveillance scheme’ (135). This chapter describes THOR-GP’s methodology and results from the first two full calendar years of data collection (2006 to 2007). Results showed that just over half the cases were musculoskeletal and almost a third were mental ill-health diagnoses; cases of skin, respiratory and other diagnoses (including conditions such as injuries and infectious disease) were reported in much smaller proportions. A more detailed diagnostic breakdown of a larger dataset (2006 to 2009) is shown in Section 5.2 in the peer-reviewed publication ‘Comparison of work-related ill-health data from different GB sources’ (137). Here, results showed that 60% of musculoskeletal cases were diagnoses of upper limb and neck problems and 28% were reports of lower back pain. The majority of mental-ill health diagnoses were reported as work-related stress (57%), while 82% of skin disease was contact dermatitis and half of the respiratory disease reports were asthma (or asthma related symptoms). GPs reported relatively few cases of long latency disease such as skin neoplasia and mesothelioma.

Chapter 3 continues by describing how analysis by gender showed that males make up the majority of case reports for all diagnostic categories, except for mental ill-health diagnoses where reports in females predominate. This is also illustrated in the peer-reviewed publication ‘Comparison of work-related ill-health reporting by occupational physicians and general practitioners’ (136) (Section 5.1); the gender distribution by diagnoses is tabulated to give a comparison with cases reported by OPs. Diagnostic case mix also showed a wide variation between industrial sectors; cases reported from industries with more physical demands (such as construction) were predominately musculoskeletal, whereas sectors such as education had proportionally more mental ill-health case reports.

Chapter Three and Section 5.1 illustrated the industries from which cases are most frequently reported. Health & social care, construction, public administration and defence and retail sectors were reported in the largest proportions, however, the number of cases reported by industry will likely be a reflection of the number of people employed in that sector. For example, as the health & social care sector is the largest employer in the UK, it is unsurprising that it generates the largest number (14%) of reported cases. In order to make the data more meaningful, incidence rates are required and calculated by dividing incident cases reported within a certain time period by an appropriate denominator.

As described in the Methods chapter (2.7) and Chapter Four, two different methods for calculating incidence rates from THOR-GP data have been used. One of these was based on calculating the number of cases reported per GP, and extrapolating this by multiplying by the number of GPs in GB to estimate national figures. This method was used before the population within THOR-GP practices was established. This GB extrapolated numerator and LFS denominator data were used to calculate rates of incidence in Section 5.2 and Chapter Six. In Section 5.2 incidence rates for work-related ill-health reported by GPs were calculated by major diagnostic category. The rate of musculoskeletal disorders was highest at 684 per 100,000 persons per annum, followed by mental ill-health with an incidence rate of 500 per 100,000 persons per annum. Rates for skin, respiratory and 'other' diagnoses were 152, 38 and 41 per 100,000 persons per annum respectively. In Chapter Six 'Work-related sickness absence as reported by UK general practitioners' (138), incidence rates of work-related ill-health (one year average (2006 to 2009)) were shown by industry, not only for all cases (where agriculture and construction were shown to have the highest rates) but also for musculoskeletal disorders and mental ill-health. Musculoskeletal incidence rates were also highest in agriculture and construction workers, but for mental ill-health, rates were highest amongst those working (largely) within the public sectors of health and social care, public administration and defence and education. In the private sector, mental ill-health rates were shown to be high in financial intermediation.

This preliminary method of calculating incidence rates, which was used in the absence of THOR-GP practice information, required the numerator data to be adjusted by a number of factors which were likely to result in an accumulation of errors. Moreover, this method presumed that the THOR-GP population was representative of the GB/UK population as a whole. Chapter Four shows how the size of the THOR-GP population denominator was estimated and also how it was characterised by industrial employment. This information was then used to calculate incidence rates of work-related ill-health within this THOR-GP population and (with weighting applied to the data) the GB population as a whole. In addition, it described how a practice population can be characterised in the absence of patient based data using the postcode of the practice. Overall, the incidence rates based on the THOR-GP population denominator were 32% lower (average of 22% across the 17 industrial sectors) than those estimated by LFS denominator data, suggesting that incidence rates calculated using the interim LFS method may have been over-estimated. However, LFS data (contemporary to the 2001 Census data used for the study) showed that the population covered by THOR-GP was similar to the GB population in its age, gender and employment distribution. Therefore, the difference in incidence rates found by using LFS data or THOR-GP practice data as denominators, was of a similar order across industrial sectors. Incidence rates calculated using the THOR-GP denominator method were calculated by using the employed population (according to Census 2001 Data) of patients registered with participating GPs practices. Chapter Four illustrates how these incidence rates can be adjusted to represent the GB population by the application of weights based on ratios of percentages. The THOR-GP population was first adjusted for any differences in employment between the THOR-GP and GB populations, and then adjusted again to allow for any changes in the employed population of GB between 2001 and 2006 to 2008. In accordance with results based on the LFS denominator, this THOR-GP population denominator method showed that rates of work-related ill-health were highest amongst agricultural and construction workers.

7.1.2 Comparison of work-related ill-health with other data sources

The second objective was to compare GPs' reports of work-related ill-health to other surveillance schemes, to assess their strengths and weaknesses and to determine whether comparisons can validate national estimates of incidence. The first paper addressing these issues (Section 5.1) examined the cases reported by GPs and compared them to cases submitted to OPRA by OPs. The provision of occupational health services in the UK is limited and known to be biased towards certain industries (9), and this peer-reviewed publication showed how this affects the nature of work-related ill-health that is seen and subsequently reported by OPs. Both GPs and OPs reported cases most frequently from the health and social care sector, however OPs reported cases in these workers in a greater proportion (GPs 14%, OPs 38%). OPs also returned few reports from industries such as construction and retail; sectors frequently reported to THOR-GP. Data from OPs are of value because of OPs' specialist knowledge of the relationship between work and health; however a comparison with LFS data showed that reports from GPs cover a greater spectrum of industries which is more in line with the employment of the UK population, suggesting a surveillance scheme based on reports from GPs may give a more accurate un-biased picture of work-related ill-health in the UK.

Three surveillance schemes studied in Chapter Five collected data on all work-related ill-health diagnoses, i.e. GP, OPs and (as described in Section 5.2) the SWI. All of these schemes showed that the majority of cases were made up of musculoskeletal disorders and mental ill-health diagnoses. However, there were some differences in cases mix within these diagnostic categories, e.g. SWI reported larger proportions of back pain than GPs and OPs. Apart from these musculoskeletal and psychological diagnoses, skin disease made up the largest proportion of the remaining reports from GPs and OPs, whereas individuals self-reporting to the SWI more frequently reported respiratory and 'other' diagnoses. Differences were likely to result from the assessment and attribution of work-relatedness by GPs and OPs, or due to individuals not consulting (with conditions such as lower back problems) but reporting when given the opportunity (e.g. in the SWI).

OPs reported larger proportions of mental ill-health diagnoses, whereas GPs, submitted over half their cases as musculoskeletal disorders. Section 5.1 investigated whether these differences in reporting patterns were a result of OP reports being concentrated towards certain industries. This paper (and Chapters Three and Six) showed that certain industries have higher proportions/incidence rates of mental ill-health than others. These ‘mostly public’ sector industries were amongst those most likely to be covered by occupational health services; therefore this will affect the type of ill-health most frequently reported by OPs. However, after stratification by industry, it showed that although some of the difference in reporting could be explained by industrial bias, OPs were still more likely to report mental ill-health diagnoses than GPs. This may be partly explained by OPs’ having a different knowledge base of the workplace or employers’ referrals influencing the attribution of work-relatedness to a case. This again suggested the value of a surveillance scheme for work-related ill-health reported by GPs; they are the patients’ first port of call when an individual feels unwell, whereas employees may consult OPs for other reasons such as health surveillance or fitness for work assessment.

OPs reported more cases in females (52%) compared to GPs (42%). As for diagnosis, cases were similarly stratified by industry to assess the effect on gender. Employees working in larger industries such as healthcare and education (which operate largely within the public sector) have better access to occupational health services; it has been estimated that 99% of NHS trusts in England and Wales have access to occupational health support (244). Healthcare (80%) and education (73%) have higher proportions of female employees (173) therefore it is unsurprising that female cases predominate in OP reports. However, the use of combined Mantel-Haenszel LRs in Section 5.1 shows that the gender mix of OP reports result from the industrial bias of occupational health services and these physicians are actually more likely to report cases in males.

Section 5.2 not only compared data reported from GPs and self-reports, but also information collected by THOR’s clinical specialist schemes. Incidence rates from three different levels of the ‘work-related ill-health surveillance pyramid’ showed that the highest incidence rates were found in self-reports (from the SWI), and the lowest incidence rates from clinical specialists. This was unsurprising as SWI is more inclusive, as it captures less severe cases as well as those considered by the individual to warrant a medical opinion, and therefore a visit to their GP. Clinical specialist schemes only capture more severe cases (or those with undefined diagnosis or causation) that have been referred to secondary care, but provide detailed information on the diagnostic categories (i.e. skin and respiratory) less frequently reported by GPs. This paper also described diagnostic differences in GP referral patterns, showing how more subjective diagnoses such as musculoskeletal and mental ill-health diagnoses were less likely to be referred to secondary care, compared to skin and respiratory disease. Reports from GP and clinical specialists had a very different case mix, largely as a result of severity and referral patterns.

It can be concluded from Sections 5.1 and 5.2, that it may not be possible to find a single best estimate of incidence as the schemes (THOR, THOR-GP and SWI) collect data from physicians that see different types of patients and therefore do not encompass the same case mix or disease severity of work-related ill-health. Despite the benefits of diagnostic and occupational health expertise, reports from general practice could be considered a better option for the collection of work-related ill-health surveillance data when compared to reports from clinical specialists and OPs as it is more inclusive and less prone to bias. GPs reporting to THOR-GP also have vocational training in occupational medicine and therefore more accurate in their assessment of the work-relatedness of a case. Reports from GPs may have been less inclusive than those from the SWI, therefore national incidence rates may be underestimated; however self-reported data are likely to be unsubstantiated by medical opinion.

7.1.3 Work-related sickness absence as reported by general practitioners

The third objective was to examine factors influencing sickness absence that is associated with work-related ill-health, as certified by GPs. Chapters Three and Six showed how the sickness absence reported by GPs is influenced by various factors (such as patient’s age, gender, diagnosis and employment). Chapter 3 described how half the reported cases were issued with sickness certification, and how this varied by diagnostic category. Mental ill-health diagnoses were issued with sickness certification much more frequently than other diagnoses, with over three-quarters of cases having medically certified time away from work. Other diagnoses were issued with medically certified sickness absence less frequently; musculoskeletal disorders (42%), and in particular, skin diagnoses with just 15% of cases 'certified sick'. Musculoskeletal disorders were the most frequently reported (53% of diagnoses) however mental ill-health (30% of diagnoses) was responsible for 56% of the days absence certified. Musculoskeletal disorders were responsible for 36% of sickness absence days certified. Although psychological and musculoskeletal conditions were responsible for the most medically certified sickness absence, these conditions were seldom referred to secondary care (Section 5.2).

Chapter 6 investigated further the factors influencing sickness absence. Female cases had associated sickness absence more frequently than males and were absent from work for longer periods, in addition the length of absence increased with age. Results illustrated how mental ill-health diagnoses were responsible for the highest rates of sickness absence and how this influenced rates within certain industries. Case reports of patients working in industries operating within the public sector, and one non-public sector industry (financial intermediation), were issued with sickness certification most frequently and had the longest periods of sickness absence, largely due to the high incidence of mental ill-health diagnoses. However, even after stratification by diagnosis, rates of absence in the 'mostly public sector' remained highest. Results also showed that the higher the proportion of self-employment within an industry, the lower the sickness absence rates. These results suggest that sickness absence is influenced by organisational issues (such as sickness absence policies) and also by employee motivation (e.g. being self-employed).

This analysis of work-related sickness absence has been able to show how factors such as demography, diagnosis and employment influence the likelihood of an individual being issued with sickness certification. It has also shown how the length of absence varies by these factors; however, the length of absence reported to THOR-GP is known to be underestimated (through retrospective sickness absence data audits). Most of the sickness absence information is reported at the time of the initial consultation, and although participating GPs have the facility to report subsequent certificates (when issued), GPs are unlikely to continue to do this, especially in the case of long-term sickness absence. The retrospective audits of sickness absence cases suggest that the length of sickness absence is underestimated by 60%.

7.2 Strength and weaknesses of work with reference to other studies

The review of the literature highlighted a lack of published research on the work-related ill-health as determined by GPs. This thesis has been submitted in 'alternative format' in order to publish data as soon as information became available and help fill this knowledge gap, or 'blind spot' as work-related ill-health in general practice has been previously described (53;54). Additionally, each chapter is succinct and focuses on a specific area of research, which were devised to address the aims of the thesis. Each paper has a complete 'story', which is relevant to the readership of the targeted journal, and is structured to comply with publishers' requirements. To give a complete picture of work-related ill-health as seen by GPs, it may be useful to show analyses by every diagnostic, industrial or demographic variable collected by THOR-GP. However, this type of in-depth analysis is not possible within this thesis format as it would be too lengthy (and likely not of interest) for editors and journal readers. Nevertheless this thesis demonstrates how data from THOR-GP can be used to illustrate the important aspects of work-related ill-health presented in general practice clinics, which has been assessed as being work-related by a GP. Importantly, although there have been a number of studies asking patients for their opinions on the work-relatedness of their ill-health (84;85), very little information (particularly in the UK) is based on GPs opinions and actual case reports.

This thesis also demonstrated how incident cases, reported by GPs, can be used to calculate incidence rates of work-related ill-health in GB/UK. Rates have been shown for major diagnostic categories and industrial sectors, and these methods can be applied to any disease, occupation or demographic group, as long as there are a sufficient number of cases.

7.2.1 THOR-GP data collection methods

THOR-GP collects data using surveillance methods. Epidemiological surveillance has been described by Thacker *et al* as 'the systematic collection, analysis and dissemination of health data for the planning, implementation and evaluation of public health programmes' (245). Some of the strengths and weaknesses of surveillance methods have been discussed in Section 5.1, including the practicalities of data collection, and how continual submission of case information can help with early identification of hazards and workforces at risk, allowing interventions to be put in place.

7.2.1.1 THOR-GP participants

GPs participating in THOR-GP have all been trained to diploma level in occupational medicine; therefore they should all have a better understanding of the relationship between work and health than other GPs. It has been well documented that there is a lack of occupational medical training for GPs and it is estimated that only 4% of GPs hold a qualification in occupational medicine (140;141). This may therefore mean that a work-related cause or attribution will go unrecognised, with a lack of the right questions being asked, resulting in inadequate knowledge of a patient's occupational history (56;86-88;246). Research has shown that GPs without this training are less likely to ask patients about work-related issues than those that have (18;52;247). As a result, reports from these 'trained' GPs should give a truer (and possibly higher) estimate of the incidence of work-related ill-health seen in general practice; although this is yet to be tested. A study that aimed to determine the work-related ill-health presenting to five GPs in a community health centre in Australia, found that most of the cases of work-related disease were diagnosed by just one of the five GPs who had a specialist interest in work-related conditions. The authors felt this suggested that occupational disease was under diagnosed by the other doctors in the practice (80). In addition to improved estimates of incidence, it was hoped that these 'trained' GPs would be more willing to participate in THOR-GP due to their affiliation with the subject; research has shown that a high level of interest in a research topic is an important factor in a GPs decision to participate in research (155;248) . However, the use of these participants may cause problems with external validity. It is known that these GPs differ to others with regards to their training in occupational medicine; however these GPs (and their patients) may also differ in their behaviour and other demographic factors which may cause difficulty in making the data nationally representative.

Three-quarters of THOR-GP participants are male, compared to the national picture where approximately half of GPs are female (percentage of the GP workforce who are female (2010/11); England 45%, Scotland 53%, Wales 42% (249-251)). This is likely due to a preference for this area of medicine amongst male physicians, as suggested by the gender mix of students undertaking the DOccMed course at the University of Manchester (146). This may cause bias in the gender demographic of cases reported to THOR-GP. As illustrated in Chapter Three, more cases were reported in males (56.3%), despite higher rates in females consulting for all causes (rather than solely work-related ill-health) (209); however results may be influenced by a preference for females to be seen by a female GP. A higher proportion of female GP participants may have resulted in more female case reports. Although this gender preference will be more of an issue for certain (e.g. gynaecological) conditions which are less likely to have a work-related cause/aggravation, research has suggested this preference extends beyond these reasons for consultation (252) and that patients find a health professional of the same gender more easy to talk to (253). There may also be other biases associated with a patient's selection of a particular GP. It is possible that a patient who suspects they have a condition related to work would preferentially select a GP with an interest and specialist training in this area of medicine. The incidence rate calculations take into account the proportion of the population registered with THOR-GPs' practices that is seen by the participating GPs, therefore if patients are preferentially choosing to consult a THOR-GP this would falsely inflate the incidence rates within this, and GB working populations. However, this is unlikely as often a patient will (apart from where there are GP gender issues) accept the soonest available appointment, and be unaware of the training undertaken by GPs in their practice. Studies conducted within general practice clinics in Australia and Singapore found no evidence to show that patients visiting the clinics with work-related ill-health problems preferentially chose to consult with the 'trained' GP (80;91).

THOR-GP benefits from the fact that reporters are distributed throughout the UK. Appendix 22 illustrates how the participating GPs are distributed by Government region compared to all GPs in GB, while Chapter Four has illustrated how similarly the THOR-GP patient population is distributed by age, gender and employment with the population of GB. Many of the studies investigating work-related ill-heath as determined by GPs, and those of GP reported sickness absence, are based on practices within a specific area (19;23;24;52;71;80;82;83;128;129). This may lead to biases as acknowledged in the publications by Wynne-Jones *et al* (23) and Shiels *et al* (24); both studies were conducted in areas with higher proportions of lower socioeconomic classes, which may influence sickness absence rates. The link between social class and health status has long been established (254) with lower job status associated with a greater prevalence of morbidity such as cardiovascular and respiratory disease, lower self-perceived health status and increased health-risk behaviours such as smoking, diet and exercise (255). As well as social class, the work-related ill-health presented in general practice is also likely to vary with regional differences in the type of employment (and the associated occupational exposures). Job status and associated social class may have an effect on the type of physical and psychological stressors experienced in the workplace with problems associated with higher job demands more frequent in higher social classes and low job control more frequently associated with lower social classes (256).

The primary source of recruitment was the alumni of the occupational medicine diploma course at the University of Manchester; this recruitment source was chosen due to information accessibility and the hope that these physicians may have an affinity with the University due to previous contact. Studies examining barriers to GPs' participation in research have found improved contact between GPs and researchers helped with the level of participation in research (152;248); therefore it was considered that GPs who had previously engaged with COEH would be more willing to participate. It was interesting to note, therefore, that the proportion of COEH diplomates (35.6%) who agreed to participate in the scheme was not (as anticipated) greater than the non-COEH GPs (36.7%). Analysis (in Section 2.1.1.9) suggests that there was likely to be very little effect of participation bias. Comparisons between those who agreed to participate and those that did not showed that the two groups of physicians did not differ significantly by gender, age (year of full registration) or geographical distribution.

7.2.1.2 Case reports

The success of THOR-GP relies on maintaining the good will of the participating GPs so that they continue to participate. It is important therefore, to ask for as much information as possible in order to make the data fit for purpose, without over-burdening the reporters. Participants are provided with guidance on how and what to report, however GPs decide for themselves whether a case is eligible for reporting, and opinions may differ. Apart from clinical decisions about diagnosis, the main rules for reporting a case to THOR-GP aim to ensure submissions are **incident** cases of **work-related** ill-health reported by the **general practitioner** who is **participating** in the scheme. GPs are frequently reminded of these criteria; however it is always possible that GPs do not strictly adhere to these rules when reporting cases.

7.2.1.2.1 Case criteria

A case is eligible to report to THOR-GP if the GP considers it to be caused or aggravated by the patients' work environment. In many countries, programmes registering occupational diseases used as a source of information for preventative policy require occupational and other specialist physicians to report cases from a predefined list. In the USA, the Centre for Disease Control and Prevention defines a reportable case (described as a sentinel health event (SHE)) in terms of the potential for the prevention of the disease through intervention. SHEs are defined as 'a disease, disability which is occupationally related and whose occurrence may provide the impetus for epidemiologic and industrial hygiene studies or serve as a warning signal that materials substitution, engineering control, personal protection, or medical care may be required'. Physicians report cases from a list of 50 conditions that are linked to the workplace. This is similar to systems in Europe that derive their data from compensation information, and therefore also have strict criteria on what constitutes an occupational disease; often, these schemes do not include more subjective work-related conditions such as psychological problems (257;258). In THOR-GP and (other THOR schemes) the diagnosis and work-relatedness of the case is decided by the physicians' clinical judgement. An occupational physician (who is also an OPRA reporter) undertook a review of the published literature and guidance offered to physicians reporting to THOR (259). Dr Gallagher found that almost all the literature represented work based on a consensus of opinion and that there is no globally agreed gold standard definition for the term 'occupational diseases'. Authoritative consensus-based diagnostic guidelines do exist for several conditions e.g. occupational asthma and occupational dermatitis (228;260), however, for less specific conditions, particularly occupational musculoskeletal diseases and mental ill-health, widely accepted diagnostic guidance is less apparent.

Despite possible differences in opinions in diagnosis and attribution of work-related causation, all THOR-GPs have been trained to recognise work-related problems. In addition, the lack of strict case criteria and a predefined list of reportable diseases mean the scheme is able to collect data on conditions that may not be included in compensation schemes such as the IIDB in the UK. Previous work with rheumatologists reporting to THOR found that physicians agreed that the most suitable criteria for defining work-relatedness was the probability that exposure at work 'more likely than not' caused the condition (158). Guidance on the THOR-GP website (159) suggests that GPs may consider whether the disease would have occurred in the absence of a work exposure, whether the work exposure was a major factor in causation or whether a workplace exposure made a substantial difference to the severity of a pre-existing illness. In addition to this guidance, data quality assurance measures were used to check the information reported by GPs for possible errors. For example, if a GP reports any cases with diagnoses (such as diabetes) or attributed causation (such as family bereavement) that are considered by researchers unlikely to be related to work, the GP was contacted for clarification.

7.2.1.2.2 Incident cases within general practice

Another essential criterion for THOR-GP eligibility was for the reported case to be incidence, not prevalent. A potential limitation of the study was that it was difficult to ascertain whether cases reported were truly incident. It is likely that a patient will make more frequent visits to a GP than to other types of physicians reporting within THOR, possibly for further sickness certification. Therefore a GP may report a case in their reporting month that they first saw in clinic with the same problem in a previous month (i.e. harvesting). This would produce an overestimate in rates as such a case is prevalent, rather than incident. This is more likely to happen with sample reporting, where reporters submit cases for one randomly assigned month a year, as opposed to core reporters who report on a continual basis. However, sample reporting was introduced to try to minimise the effects of reporter fatigue, which could lead to an underestimate in incidence. Reporter fatigue can be manifested in a number of ways, e.g. non-response, submitting a 'false' zero return (i.e. GPs report that they have not seen any relevant cases, when they have done so), or ultimately leaving the scheme. A study conducted by McNamee *et al* (160) used a randomised cross-over trial to examine differences in core and sample reporter behaviour between two groups of occupational physicians reporting to OPRA. Results showed that the rate ratio for sample versus core reporting was 1.26, illustrating that sample reporters reported 26% more cases. In addition, core reporters' rates declined gradually over the year, consistent with reporter fatigue. Early indications suggest there may be a greater disparity in core and sample reporting rates within THOR-GP; however this has yet to be quantified. In THOR-GP, sample reporting was introduced in 2007 with a small proportion of participants reporting at this reduced frequency (2%). The proportion of 'sample' reporters increased each year until 2011 where all THOR-GPs were reporting by this method. Data analysis for this thesis included cases reported between 2006 and 2009; consequently there were relatively few sample reporters in the scheme (at the most 12% in 2009). Therefore, any problems associated with over reporting of prevalent cases were likely to be minimal.

THOR-GP started collecting data in June 2005; however this thesis does not include analysis of data collected in the first seven months pilot period of reporting. During this period data collection methods were still being refined; in addition, the omission of the 2005 data meant that the dataset included just whole calendar years and it also reduced the effect of harvesting. Analysis within THOR on time trends in the reporting of incident cases of work-related ill-health uses multi-level modelling to estimate the true trend in reporting without the 'noise' of factors that may affect the number of cases reported (e.g. number of reporters participating and reporter type (i.e. core or sample)) (261). Harvesting is more likely to have an effect in a participating physician's first month(s) of reporting, and this analysis has shown that for THOR schemes (including those reported to by OPs, respiratory physicians and dermatologists), investigations have suggested harvesting occurs during the first month that a reporter actively reported to a scheme. However, for THOR-GP this harvesting period of increased case reporting was found to be longer (five months).

Similarly, Lewis *et al* (206), found that including data from patients who had recently registered with practices participating in the GPRD, overestimated incident rates, as many of the cases were actually prevalent. This situation could occur when a patient has had symptoms for a while, and has sought a new GP for treatment, sickness certification or a second opinion. A similar situation could occur in THOR-GP as (mostly) one GP reports from a practice; therefore a patient with work-related ill-health could be seen initially by a non-THOR-GP and return to be seen by the participating GP. This case is prevalent to the practice (and within the practice (and therefore THOR-GP) population) but the GP may report it as incident.

THOR-GPs are also asked to report cases from their general practice clinics; however as approximately three-quarters of reporters work within occupational medical practice for part of their week, some case reports may originate from these occupational sessions. A case may appear to be ineligible (and the reporter contacted for clarification) if multiple cases originate from a GP which are all employed in the same industry; this may indicate that cases originate from the GPs occupational health practice. Additionally, cases reported with high numbers of sickness absence days may indicate that the case is not incident; (suggesting sickness absence has been issued by the participating (or another GP) prior to the case being reported and is therefore prevalent.

At the end of each reporting month, participating GPs were asked to submit a zero return if they had not seen any cases reportable to THOR-GP. This established that the GP was actively participating in the scheme; as shown in Table 2.4, approximately 40% of reporters did not respond during their reporting month each year. The response rate influenced the resulting incidence rate calculations; in both the LFS and THOR-GP denominator incidence rate calculation methods, the numerator data is adjusted by the response rate, giving an estimation of the incidence rate if all participating GPs had reported. This presumed the non-responsive GPs would have responded in a similar way to respondents, therefore the results could be affected by non-response bias. It was important to achieve the best response possible; however, attempts to improve response rates amongst GPs (e.g. automated chase-up emails and remuneration) may have resulted in inflated zero returns. An increase in the response rate due to inflated zeros would result in a reduction in incidence rates as it is presumed more reporters are actively participating and therefore the numerator would require a smaller adjustment. Table 2.4 showed that after the introduction of the automated email (in 2006) a third of GPs used this method to submit zero returns, however this did not initially reduce the level of non-response (in 2007). The proportion of non-response decreased in 2008 and 2009, but this likely resulted from the red carding procedure used to remove persistent non-responders from the list of active reporters. Financial reporting incentives may have also resulted in inflated zero returns. A submission of a zero return requires less effort than reporting case information and both actions result in remuneration, however research has shown that physicians submit zero returns for other reasons, such as reporter fatigue and in response to repeated chase-ups (262). As stated in the methods section, THOR-GP data collection continued beyond the scope of this thesis. Due to funding issues, from 2010 the scheme had to rely on GPs voluntary participation and continues without offering financial reporting incentives. This did not have any detrimental effect on the reporting response rates (62% in 2010).

7.2.2 Results

7.2.2.1 Work-related ill-health presented in General Practice

Despite results not being presented in the form of incidence rates, other studies can be compared to THOR-GP data in terms of the mix of work-related ill-health diagnoses that present to GPs. The majority of studies investigating work-related ill-health (as determined by GPs) found musculoskeletal cases to be the most frequently reported diagnostic category (57;79;80;83). Work-related psychological problems were not always included in the categories of ill-health reported, particularly in older studies (80). However, the most recent relevant evidence

(2009 to 2010), published by the Australian BEACH project, shows that (after musculoskeletal conditions) psychological problems are the second most frequently reported category of work-related diagnoses (79). However, direct comparisons of specific diagnoses are difficult, as diagnostic categorisation is not always compatible. For example, the BEACH project uses classifications such as ‘acute stress reaction’ and ‘acute internal knee damage’. THOR-GP cases are often reported as ‘stress’ and knee problems can be selected from the data (e.g. including cases reported with diagnoses such as ‘knee pain’ or ‘prepatellar bursitis’), however it is not clear whether the BEACH Project and THOR-GP use the same classification criteria. The BEACH data do not separate skin and respiratory disease as separate categories (unlike THOR-GP). In terms of BEACH categories that could be directly compared to THOR-GP data, proportions of musculoskeletal disorders are similar (BEACH 57.1%, THOR-GP 52.5%), however almost a third (29.5%) of THOR-GP cases are psychological whereas these conditions make up only 10.9% of BEACH cases. A much larger proportion (BEACH 32.0%, THOR-GP 18.0%) of the work-related cases is made up of ‘other’ diagnoses (including injuries and skin and respiratory disease). In the Australian study, 4.3% of the ‘other work-related problems’ are ‘check-ups and immunisation/vaccinations’ which are not included in THOR-GP as these consultations are not eligible as an incident case of work-related ill-health. GP consultation data from Australia and the UK do not suggest patients in the UK consult more for mental ill-health problems in general. Patient consultation rates by major diagnostic category for all cause (i.e. not solely work-related) conditions are very similar. For example (with rates shown as a rate per 100 encounters), respiratory diagnoses were the most frequent reason for consultation (Australia 22.8, UK 30.7), followed by musculoskeletal disorders (Australia 15.4, UK 15.2), and skin disease (Australia 14.8, UK 14.6). Mental ill-health consultation rates for Australia and UK were 8.5 and 7.3 respectively (222;263). Differences could be explained by the employment of the population, i.e. if the THOR-GP study population had higher proportions of the population employed in industries shown to have higher rates of work-related mental ill-health (such as industries operating largely within the public sector). The GPs participating in BEACH are distributed throughout Australia, and although the Australian population has a slightly smaller proportion of the population employed in those sectors considered to be public service industries (e.g. Health and social care, public administration and defence and education) it is not enough (Australia 25%, UK 30% (190;264)) to explain the national disparity in reporting of work-related psychological problems. This would therefore suggest the higher proportion of work-related mental ill-health diagnoses reported may be due to THOR-GPs' training in occupational medicine; these GPs are likely to recognise a work-related cause, possibly not considered by other 'untrained GPs', particularly with conditions such as psychological diagnoses that are often multifactorial in causation and influenced by personal factors as well as those attributed to work. In addition, Australian GPs may not report work-related mental ill-health as frequently as the UK based physicians, as the Australian workers compensation system concentrates primarily on physical problems. GPs know that claims for work-related psychological problems are not often accepted, again because of the multifactorial nature of the condition and the resulting difficulty in proving a relationship with work (265)

7.2.2.2 Calculation of incidence rates

As illustrated in Chapter Four, the calculation of incidence rates required the incidence cases to be divided by an appropriate denominator; for THOR-GP this was defined as the employed population of the patients registered with participating GPs' practices. Collecting the patient postcode information from participating GPs was not a simple process. It has been recognised by other researchers that this (patient based) information is not easily accessible, due to financial and ethical constraints (174;175). As discussed previously, these time constraints meant it was necessary to devise an interim method of calculating incidence rates for work-related ill-health using THOR-GP data. This interim method was used in two of the peer-reviewed publications (137;138) in this thesis (Section 5.2 and Chapter Six). As discussed in section 7.1.1, incidence rates calculated using this interim method may be over-estimated (by 32%). This over-estimation may have arisen for a number of reasons which resulted from the adjustment factors used in the calculation. These included differences in THOR-GPs' behaviour and the practices within which they work (compared with other GPs), the estimate of the number of GB GPs used to extrapolate the numerator, and the interpretation of what constitutes full and part-time practice. As described in Chapter Four, the THOR-GPs' practices are in general much larger (in terms of the number of registered patients) than the national average. Evidence (266) has suggested that there is an inverse relationship between practice size and consultation rate, therefore despite adjustment for part-time practice (i.e. number of clinical general practice sessions), GPs participating in this study might have a lower consultation rate enabling these GPs to spend more time with each patient seen in practice. Harber *et al* found that time was as important as inadequate knowledge in the recognition of occupational diseases (92). In addition, GPs with a specialist interest in occupational medicine may consult longer in order to make a thorough assessment of a patients' occupational history. By analogy, a study by Whitehouse (267) found that GPs with a specialist interest in mental health had longer mean consultations, and because of this were able to identify more psychological problems in their patients. The adjustment for part-time practice is another possible source of error. In the LFS denominator method, full-time practice was taken as 10 sessions per week (i.e. AM and PM session for five days a week). The numerator reported by THOR-GPs working (overall) 70% of full-time practice was adjusted up to calculate the number of cases if they were practising 10 sessions each week. This may have led to an over-adjustment as opinions on what constituted 'full-time' in general practice varied. A general practice workload survey carried out in 2006/2007 suggested that full-time practitioners were GPs who worked eight or more sessions per week (268). The British Medical Association (BMA) state on their website that full-time is considered to be nine sessions a week (269). There could also be errors in the multiplication by the number of full-time equivalent (FTE) GPs in GB. In England and Wales, these figures are calculated each year (171;172); however in Scotland the only available figure was estimated from a survey of GP in 2009 (170), therefore this may be less reliable.

This over-estimation is less likely to be an issue in the sickness absence peer-reviewed publication (Chapter Six) as GP generated rates are shown relative to each other, and the underestimate in the rates of incidence are fairly consistent across industrial sectors. It is possible however, that the use of this interim denominator method may have influenced the results shown in Section 5.2, which compared THOR-GP rates with those calculated from other schemes; in particular, in comparison with the SWI. The incidence rate for musculoskeletal disorders based on GP reports was shown to be higher than the rate based on results from the SWI. Rates from GPs were expected to be lower than those based on studies where a medical consultation is not required for the case to be included in the dataset. As an example, a study of CTS in general practice (outlined in the introductory chapter) found rates 10 times lower in GP based studies than in population based studies (72). When rates were recalculated using the THOR-GP population denominator, GP rates for musculoskeletal disorders are lower than those based on self-reports, and therefore more in-line with the higher rates expected from the (more inclusive) SWI. However, rates for work-related skin disease from THOR-GP reports are higher than those based on self-reports irrespective of which method of incidence rate calculation used. This finding is consistent with a study by Hilt *et al*, which showed that skin conditions were amongst those least likely to be considered work-related by patients (85) and are therefore not reported as such in an SWI interview.

With the benefit of hindsight, it may have been preferable to use the THOR-GP population denominator method to calculate incidence rates whilst the detailed patient postcode information was being collected. As in the LFS denominator method, the THOR-GP denominator method would have presumed that the population in THOR-GP was nationally representative, however the size of the population could have been calculated from publicly available information on practice list size (180-182).

As discussed in Chapter 4, the patient postcode information was collected between 2007 and 2009, the data received from ONS and GROS was classified by industry using SIC 2003 (now replaced by SIC 2007) and the THOR-GP population was classified (and subsequently weighted to industrial distribution of the LFS of 2006 to 2008) using the latest available Census information (2001). As a result, the population denominator information in THOR-GP collected as part of this thesis can only be reliably used within a certain time period. There was a small but persistent change in the THOR-GP membership, with participants leaving due to a change in practice (e.g. to full-time occupational medical practice), retirement or reasons (that were likely to be related to reporting fatigue) such as ‘lack of time’, and annual drives to recruit new GPs to participate in the scheme.

There are limited appropriate data sources with which to compare incidence rates of work-related ill-health calculated from THOR-GP. As in THOR-GP, annual incidence rates calculated as part of the SWI (31) are high in the construction industry (rates in agriculture are not shown in the SWI due to small sample numbers). However, the highest SWI rates were in sectors shown in THOR-GP to have increased rates of mental ill-health diagnoses, such public administration & defence, health & social care and education (Chapter Six). This reflected differences in reporting from GPs and the self-reports of the SWI; the latter (unlike GP rates) showed higher rates for mental ill-health diagnoses than for musculoskeletal disorders. Only one paper has been identified where an incidence rate for a specifically work-related condition was calculated using GP diagnosed data. This study (discussed in the introduction) by Keegal *et al* (71) showed occupational dermatitis rates reported by GPs (that were subsequently confirmed by patch test) to be six per 100,000 persons employed per annum. However, the rate of GPs' reports not confirmed by patch test was 40 per 100,000 persons employed per annum (THOR-GP cases are also unconfirmed by patch testing). The THOR-GP rate of skin disease (calculated using the LFS denominator method) reported in Section 5.2 was 152 per 100,000 persons employed per annum. As contact dermatitis makes up 82% of skin disease reported to THOR-GP, this would result in a contact dermatitis rate of 125 per 100,000 persons employed per annum. As discussed previously, this (LFS denominator) method may overestimate (by 32%) incidence rates calculated from THOR-GP, therefore dividing this rate by 1.32 gives the rate based on the THOR-GP population denominator method (95 per 100,000 persons employed per annum). Both methods of THOR-GP incidence rate calculation give a rate higher than in the Keegal study. In this Australian based study, the incidence rates were calculated by dividing the incident cases by the employed population of the study area. These rates, particularly those based on GPs reports, are likely to be highly underestimated as only 63/700 of the eligible GPs took part; therefore the majority of the population would be seen by GPs not participating in the study. THOR-GP rates are adjusted for response rate and divided by the population registered with the participating GPs and therefore likely to be more accurate.

7.2.2.3 Comparisons

Data reported to THOR-GP was compared to information from other UK data sources and their strength and weaknesses discussed. Many of the differences in the reported case mix result from the type of cases presented to clinicians and are subject to biases such as severity, referral patterns, and in the case of occupational physicians, the coverage of occupational health services. As described in Section 5.2, the majority of cases will only have been seen (and subsequently reported) by dermatologists, respiratory physicians, rheumatologists and psychiatrists as a result of a GP's decisions to refer a patient for treatment (of likely more severe conditions) or diagnostic uncertainty or (in the case of contact dermatitis or asthma) identification of allergens (270). In addition to GPs' referral decisions, cases seen by clinical specialists are also influenced by referral systems such as triage and pain clinics for musculoskeletal problems (231). GP referral rates differ for many reasons such as diagnosis and patient and GP characteristics (226;271;272). Unsurprisingly, publications reporting referral rates for all cause diagnoses show highest rates for neoplasms (271;273). This is reflected in the results shown in Table 5.2.4; here, neoplasms constitute just 1% of skin cases reported by GPs but 26% of cases reported by dermatologists. For the four major diagnostic categories reported to THOR-GP, referral rates differed greatly. There was less variation in studies of all cause data, however publications have shown referral rates for musculoskeletal disorders to be highest (7.8% and 3.2%) and respiratory disease to be lowest (3.1% and 1.0%) (271;273). Comparisons are difficult between all cause and work-related conditions. The case mix will differ with a high proportion of the all cause respiratory disease being made up of common upper respiratory tract infections (which are unlikely to be referred), compared to work-related conditions that may require referral to specialist clinics where links to potential allergens can be investigated. Research has also shown how GP characteristics influence referrals (271;272). Studies have suggested that GP referral rates decrease with increased years of experience. Conversely, it has been shown that GPs with a interest in a particular area of medicine refer more frequently within that specialty, possibly because they are more aware of the benefits of specialist referral (271;272). Results in Section 5.2 suggested that THOR-GPs may refer skin cases at a higher rate than other GPs possibly due to greater awareness of the benefits of patch testing.

Cases reported by OPs are subject to different referral biases than those introduced by GP referrals. With each case, occupational physicians reporting to OPRA are asked to specify (from eight options) the reason for the consultation.

According to these data, consultations are most frequently for employer referral (44%), sickness absence (28%), self-referral (16%) and health surveillance (7%) (274). An employer or manager within a company may refer an employee to an OP for a number of reasons. Situations that require medical advice include fitness for work (and return to work) assessment, ill-health retirement, about an illness that is attributed to work or if work performance is being affected by a patient's ill-health (275). As discussed in Section 5.1, OPs report higher proportions of mental ill-health cases than GPs, even after adjusting for industrial bias. This might be explained by the fact that OPs are actively referred patients on sick leave and work-related mental ill-health cases are often issued with sickness certification compared to other diagnoses (135;138).

Biases in the coverage of occupational health services in the UK have been shown (in Section 5.1) to influence the type of work-related ill-health reported to OPRA. The distribution of occupational health services across UK industries also causes problems when calculating incidence rates from OP reported cases, as LFS data cannot justifiably be used as the population denominator. The survey conducted by McDonald published in 2002, aimed to estimate the proportion of the UK workforce covered by the OPs reporting to OPRA (estimated at 12%) (9). This study found that 43% of the population covered by OPRA reporters was employed within health & social care compared to just 11% of the UK population (according to LFS data) (9). These OPRA population estimates were used to calculate incidence rates for data reported by OPs from 1996 to 2001 (13). A similar 'denominator study' has since been carried out amongst OPRA participants from 2005 to 2010, in which OPs were asked to estimate the working population covered by their services, however results have been difficult to interpret. Increasingly, OPs work for independent occupational health clinics that are contracted to supply occupational health services to a number of clients, rather than working for one particular employer such as a hospital or manufacturer. Therefore it is very difficult for OPs to estimate the population covered by their services and enable the calculation of incidence rates. It would have been preferable to express the results in Section 5.1 as rates in order to make comparisons more meaningful. For example, the comparison of age and gender illustrated in Figure 5.1.1 was unable to take into account a possible healthy worker effect; there was a fall in the proportion of cases reported within older workers but this is likely to be as a result in the reduced number of people in older age groups at work (276).

Although THOR-GP may not be subject to biases related to referral, it may still be affected by severity and by other biases involved around a patient's decision to consult the GP, such as gender. In a literature review 'Why do people consult the doctor?' Campbell and Roland examine the published evidence on the factors that influence GP consultation rates (277). As illustrated in Chapter Three and Section 5.1 the majority of cases are reported in males, however it is well documented that women consult more than men, although this will be inflated by family planning and childbirth issues (278). A patient's attendance at a GP surgery will also result from the perceived severity of the condition. In theory, the SWI would capture all cases of work-related ill-health as it is not subject to these biases that affect consultation behaviour, however, like THOR-GP it may still be subject to bias related to problem recognition or what an individual is willing to discuss with a GP or a SWI interviewer, particularly in the case of psychological ill-health. Results in this thesis show that reports in males predominate in every diagnostic category apart from mental ill-health. This is perhaps unsurprising as most epidemiological studies of psychological ill-health find higher prevalence rates among females; moreover, ill-health reporting by GPs is also going to be influenced by gender differences in help seeking behaviour (279). A large study into gender differences in depression across six European countries found that 59% of females and 48% of males who manifested some level of depressive symptoms sought help from their GP or family doctor (279). In addition, a study examining sex differences in psychiatric help-seeking from four large scale surveys, found that 10% to 28% of excess female psychiatric morbidity could be due to problem recognition resulting in an increase in GP consultation rates (280).

Of the schemes compared, the SWI is closest to the base of the work-related health surveillance pyramid, and as such should capture more cases as individuals do not have to be seen by a GP or any other type of physician to be included in the data. However (as suggested above), not only is the data collected based on an individual's decision to discuss the ill-health episode with the interviewer but also the interviewee's assessment of whether the case is work-related or not. An individual may not have considered an episode of ill-health experienced as being work-related until specifically asked "*Within the last 12 months have you suffered from any illness, disability or other physical or mental problem that was caused or made worse by your job or by work you have done in the past?"* (211). The attribution of an illness to work may be influenced by a number of factors including beliefs about disease aetiology or the need for an external explanation for symptoms (281-283). In 2012, the HSE commissioned a review of the validity of self-report to assess work-related diseases (283). The review examined the evidence on the validity of workers' self-reported illness and the validity of workers' self-assessed work-relatedness of an illness. The authors highlighted the importance (although the terms are often used interchangeably) of realising the difference between illness and disease. Physicians diagnose and treat disease whereas patients suffer illness. People's opinions about work-related illness can be of interest in itself, however self-reported ill-health represents the individuals' perception of the presence of an illness and the effect that work may have had as opposed to a medical diagnosis and a formal assessment of the work-relatedness of the condition (283). Therefore people with similar symptoms, illness or injury may have differing perceptions of their condition (284).

The review identified 32 studies where workers' self-reports of illness (not specifically work-related) were compared with a 'reference standard'. These 'reference standards' were defined as a diagnosis based on clinicians examination and/or results from functional tests. Results found that agreement was most frequently low to moderate. Evidence on the validity of self-assessed work-relatedness was concluded to be scarce. Only four studies examined this issue; agreement with expert opinion was also found to be low to moderate. These studies examined the agreement between self-reports and a 'reference standard' in neck, shoulder and arm pain (281), asthma exacerbation (285), sensory loss due to hand-arm vibration (286) and poisoning from pesticide exposure (287). Results suggest that there is a wide diagnostic variation in the correlation between self-reported ill-health and expert opinion. In a study by Mehlum *et al*, a large proportion of neck, shoulder and arm pain was assessed as work-related by both workers self-reports and by the opinion of OPs, however workers considered their musculoskeletal pain to be work-related more frequently, particularly in the case of neck/shoulder pain (self-reports 80%, OP assessment 65%); proportions were more similar for arm pain (self-reports 78%, OP assessment 72%). Overall, opinions may not appear to differ greatly, however on an individual basis, there was considerable disagreement as to which cases were work-related (281). Similarly, patients' self-report of work-related exacerbation of respiratory symptoms in individuals already diagnosed with asthma was found to be poor; just one third of symptoms self-reported by patients could be corroborated by serial peak flow findings (285). Agreement was also found to be low in a study to test whether self-reported symptoms were useful as an indicator of poisoning (correlated with results of blood tests) in farmers exposed to pesticides (287). Other diagnoses may show higher levels of agreement between self-report and expert opinion. A study by Lundstrom *et al* found that approximately 60% of study participants were graded equally when using a self-reporting questionnaire compared with clinical vibrotactile perception measurements (286).

Despite this (limited) evidence, it is difficult to draw conclusions on the validity of the self-reported data used in the SWI, as these studies asked more specific questions targeted to a particular diagnosis. For example, the Lundstom *et al* study asked participants to give gradings on symptoms such as nocturnal numbness, whether they dropped things easily and whether they had difficulty buttoning clothing (286). The musculoskeletal pain study by Mehlum *et al* asked questions about the temporal relationship of pain with exposure and occupational risk factors (281). The review commissioned by the HSE concluded that the best method of finding cases within a population at risk would be to use a sensitive symptom questionnaire with a follow-up by a medical practitioner in conjunction with other data collection methods such as an active workers' health surveillance program (283).

As discussed previously, the SWI has the potential to capture more cases. It would therefore be expected that incidence rates based on self-reports would be higher than those based on GPs reports, however rates of work-related skin disease are highest when based on THOR-GP data than rates calculated from self-reported SWI data. It is interesting to note the results of a project (not included in the review by Lenderink *et al*) which aimed to estimate the prevalence of occupational dermatitis in the printing industry (288). In this study approximately 2600 members of the Graphical, Paper and Media Union in Nottingham were issued a self-completion questionnaire. In addition, a sample of respondents who self-reported skin problems and a sample of those who did not were invited to attend a short dermatological examination. The self-reported prevalence was high (estimated at 40%) and this was confirmed by clinical examination. Moreover, the dermatological examination also identified a substantial proportion of mild cases which were not reported by the individuals. This suggests that data based on workers self-reports may underestimate work-related skin conditions, however as these cases were mild they may also not have been picked up by GP data as the patient may have not considered the symptoms severe enough to warrant a visit to their GP.

7.2.2.4 Sickness absence

The fact that THOR-GPs have received occupational medicine training may, in particular, have had an effect on the sickness absence certification issued by participants. Tellnes found that doctors practising part-time as industrial officers (as do the majority (73%) of THOR-GPs (215)) issued shorter periods of certified sickness absence (19). Research has shown that THOR-GPs are similar to other GPs (102;103) in their awareness of the problems associated with their role as gatekeeper to the benefits system balanced with their advocacy function and maintaining the doctor-patient relationship, although they also perceive that their training in occupational medicine may alter their outlook in relation to the interaction between work and health. A qualitative study was conducted questioning 31 THOR-GP participants about how they felt about issuing sickness absence certification (in general, and for a specific case), their training, and resistance to patients' demands for a certificate (18). This study found that, because of their training, THOR-GPs felt better equipped to consider patients' fitness for work and issued fewer sickness absence certificates as a result. Nationwide surveys have shown that the majority of GPs stated that they had not received any training in sickness certification (124;133). Although this training is not the same as occupational health training, it would increase a GPs knowledge and awareness of some issues surrounding work and health, including the benefits of keeping a patient in work where possible. In one survey, of GPs who had received sickness absence training, three-quarters of responders said that the training had improved their knowledge and confidence, and that it had helped them to issue more appropriate certificates (124). In addition to the effect training may have on how a GP issues sickness certification, the gender mix in THOR-GP may also have an influence on the sickness absence reported. Sheils *et al* (110) showed that the gender interaction between GPs and patients influenced the length of absence for intermediate sickness certificate outcomes; this was significantly longer in male patient and male GP consultations, compared to when female patients were certified by female GPs. Three-quarters of the THOR-GP participants are male, therefore sickness absence episodes reported in males may be longer than if similar data were reported by non-THOR-GPs with a (nationally) more equal gender mix. More of the THOR-GP cases in men are likely to be reported by male GPs.

Sickness absence information reported to THOR-GP was collected by participating GPs completing a number of fields on an on-line web form. For each reported case, a GP states whether a sickness certificate was issued to the patient, and if so, for how many days. There is also the opportunity for the GP to state if there had been any sickness absence days (and how many) self-certified prior to the GP consultation. Should the patient return at the end of the initial sickness certification period requiring further certification, GPs could access a different web form and report this information. The two papers in this thesis providing information on sickness absence data (Chapters 3 and 6) show that approximately half the cases of work-related ill-health reported were issued with sickness absence certification. Results from the first paper show that 50% of cases in 2006 and 2007 were issued with sickness certification, whereas in the second paper (based on data from 2006 to 2009) the proportion is slightly higher (56%). This was because there was a slight difference in the data being analysed. Unlike the first paper, the latter included any case where the patient had self-certified prior to consultation but who was not necessary certified sick by the GP. It was considered that this inclusion of all sickness absence gave a more accurate picture of the burden of work-related sickness absence as the patients could have been away from work for up to seven calendar days before seeing the GP (110).

The sickness absence information reported to THOR-GP is routinely audited. A year retrospectively, a random selection of reporters who submitted cases with associated sickness absence were asked how long the patient had been away from work in total. This data showed that although there is the facility for GPs to report periods of absence should the patient consult requiring further time away from work, they do not do this routinely; therefore the periods of absence are under-estimated. Work on this retrospective sickness absence data collection (based on a total 664 cases) has shown the length of time to be underestimated by approximately 60%. The prospectively collected data does not therefore give a complete longitudinal picture of the length of absence; however it is of value when comparing the frequency of episodes of absence and lengths of absence between industrial sectors. It has been suggested that the lower rates of sickness absence in the public sector may be due to underreporting of absence in the private sector (239), however THOR-GP data is based on GP reports which should theoretically not be biased by industrial sector.

Other published studies give a valuable insight into how sickness absence rates vary by a number of factors (such as demography and diagnosis) based on certification rates, rather than the length of absence. In the study by Wynne-Jones *et al* (23) rates of certification were calculated, standardised for age and gender, however it was not possible to capture the duration of the certification due to limitations in the information included in the sickness certificate record. ONS data, based on information collected as part of the LFS, is often cited and compares rates of absence (all cause) by a number of factors including age, gender, occupation and industry (14;120). Here, individuals are asked about any absence from work in a specified reference week; therefore the length of absence recorded can never be more then seven days. In one ONS publication Barham *et al* (14) stated information collected by the Chartered Institute of Personnel and Development (289). This survey of HR and ‘management specialists’ found that the majority of absence was due to short-term sickness; two-thirds of absence episodes were of five days or less. However, this is unlikely to be the case for work-related ill-health which will not include short-term illness such as upper respiratory tract and gastrointestinal infections. Figure 6.1 shows that over 80% of episodes of sickness absence reported to THOR-GP are longer than seven days.

It is clear that patients with work-related conditions are issued with sickness absence more frequently than conditions not attributed to work. Results from Chapter Three show that 42% of musculoskeletal conditions and 79% of mental ill-health cases are issued with sickness certification in THOR-GP. According to work by Wynne-Jones *et al* (290;291) sickness absence certification was issued to 30% of musculoskeletal conditions and 36% of mental ill-health diagnoses. It is perhaps unsurprising that work-related ill-health is certified more frequently than all ill-health as GPs may feel it necessary to keep patients away from the exposure (substance or mental or physical stressor) that is attributed to the problem. A qualitative study by Fylan *et al* (292) found that GPs were less likely to recommend a return to work if they felt that the patient's job contributed to the ill-health.

Results in Chapter Six stated that work-related ill-health reported in males had associated sickness absence significantly less (54% of cases) than female cases (59% of cases). In the discussion of this Chapter, it was acknowledged that differences in sickness absence between genders may be partly explained by diagnoses as more of the reports of mental ill-health (frequently issued with sickness certification) are reported in females, unlike all other diagnostic categories which have more cases reported in males. This study of work-related sickness absence may have benefited from further stratification by sex as the gender mix of the workforce (and reported cases (as shown in Section 5.1)) are likely to vary by industry. Sectors with the highest rates of absence, such as health & social care and education had more cases reported in females (136). However, despite this, public administration & defence had the highest incidence rates of mental ill-health (and associated high sickness absence rates) and this sector had more cases reported in males (60% of cases (Section 5.1) (136)).

Results shown here have illustrated that these (mostly public sector) industries have the highest rates of sickness absence in workforces that are most likely to have access to occupational health services. Studies (293;294) have shown how sickness absence rates have been reduced as a result of occupational health interventions. A study by de Boer *et al* (293) identified 116 workers older than 50 years who were at risk of taking early retirement. They were randomly assigned into an intervention (lasting six months) and a control group. The intervention involved an assessment by an OP who explored the reasons why the employee felt they were unable to work to retirement age. The factors explored included health, work-related and psychosocial factors. As a result of this assessment, the OP consulted with the employees' supervisor, HR department and GP to discuss how best to deal with the issues raised. Two further consultations with the OP took place within the six month study period. Fewer employees (11%) in the intervention group took early retirement than in the control group (28%). In another study, Taimela *et al* (294) used a randomised control trial to show the effects of similar interventions on a group of employees with high risk of sickness absence. At one year follow up, the mean sickness absence was 11 days in the intervention group but 30 days in the control group. These results would suggest that accessibility to occupational health services should reduce the levels of sickness absence in a workforce; therefore rates in these industries may be even higher without this access. ONS figures for all cause sickness absence also show higher rates in the public compared to the private sector (295). A number of reasons are suggested for this in the 'Sickness absence in the Labour Market report' published in 2012. As discussed here and in Chapter Six, there may be a difference in the type of jobs (and therefore exposures) experienced between the two sectors, women have higher sickness absence rates than men and the public sector employs more female workers, and employees within the public sector are more likely to be paid for a period of sickness than those working within the private sector.

7.3 Recommendations for further work

7.3.1 Denominator

THOR-GP's population denominator can only strictly be applied to contemporary numerator data, therefore with on-going data collection; the denominator information will need to be updated. It is probably not necessary to ask the GPs to send in the patient postcode information again (so as not to over-burden them) as it has been shown that the population based on practice postcode is not dissimilar to that based on patient postcode. However, it would be beneficial to send an updated list of participating practice postcodes to ONS and GROS (for populations to be broken down by industry and occupation) when the Census 2011 data are released (estimated at the end of 2012/2013). This would result in information on the denominator population not only being updated in line with THOR-GPs participant list, but also to Census 2011 population data, and with the industry information broken down using the updated SIC 2007 classification rather than SIC 2003.

7.3.2 THOR-GP participation

Most of the questions regarding generalisability of THOR-GP data relate to the ‘trained’ nature (in terms of occupational medicine) of the participating GPs. It is not yet known how GPs without this vocational training in occupational medicine would behave if asked to report similar data. Asking ‘untrained’ GPs to report may be problematic as they would likely be less motivated to report due to the lack of interest in work-related issues. However, this would be particularly of interest in order to assess how ‘untrained’ GPs recognise work-related ill-health, and in particular, (as has been suggested in other studies) if they issue more and less appropriate sickness certificates (18;124).

7.3.3 Sickness absence

GP data collection has continued beyond the scope of this thesis, and the sickness absence information that is collected changed in-line with the introduction of the ‘fit note’ in April 2010 (22). Instead of signing a patient as unfit for work altogether, the ‘fit note’ aims to improve communication with the employer, and allow GPs to recommend tasks that the patient is capable of performing in the workplace. It is hoped that this will help to keep employees in the workplace, which evidence has shown is beneficial for health and well-being (16). THOR-GP’s web form was adapted so that GPs could report whether a patient was fit for work, unfit for work (with sickness certification issued), or fit for work with workplace adjustments recommended. Once sufficient ‘fit note’ data have been collected this will enable comparisons with the sickness absence data collected prior to the change in procedure and assess whether it has facilitated a reduction in sickness absence rates.

The audit of sickness absence data has shown the level of underreporting as approximately 60%. This data collected one year retrospectively, has consistently shown the same level of underreporting year on year. As such, HSE have published (in 2011 and 2012) the THOR-GP sickness absence data adjusted by the level of underestimation to give an estimate of the days lost if GPs reported the total length of absence. This data collection is set to continue with further analysis to assess whether the level of underreporting differs by diagnosis. In addition, these audits will continue with the collection of information about ‘adjustment’ cases. As described above, with the introduction of the 'fit note' cases can be reported as fit for work with a workplace adjustment recommended. However it is unknown (with the prospectively collected data) whether the patient was able to remain in the workplace through the employer acting on the GPs recommendations, or whether the ill-health episode ultimately resulted in a period of sickness absence. This information can be sought one year retrospectively.

7.3.4 Incidence rate calculation

There are a number of possible sources of error within THOR-GP, as in other surveillance schemes. In calculating incidence rates a number of adjustments need to be made, such as for reporter response rates, estimating incident cases based on sample reporting and estimating the size of the population covered by participating GPs. An accurate method for calculating confidence intervals that takes all these possible sources of error into account is yet to be determined. One of the main sources of error may lie in the possibility that prevalent cases are being reported as incident. Further research is required to understand this, including measures such as questioning GPs about consultations related to particular reported episodes of work-related ill-health, and asking them whether they, or any other GP in their practice, had seen the patient before.

Since 2010, the proportion of THOR-GPs participating as sample reporters has increased. Questioning the GPs about previous consultations will also help give a greater understanding about the reporting of 'harvested' cases from months prior to GPs allocated reporting period. Once collected, this data plus other analysis of reporting patterns will give a greater understanding of the differences in core and sample reporters' behaviour and how this affects incidence rate calculations.

7.4 Overall conclusions

This thesis has shown how the systematic collection of work-related ill-health data from GPs adds to the knowledge base about conditions affecting the health (and subsequent sickness absence) of the employed population of the UK/GB. Incidence and sickness absence rates calculated from THOR-GP data (such as those illustrated in Table 6.2) have been used to contribute to evidence (Appendices 23 and 24) (22;296;297) aimed to help identify working populations most at risk of becoming ill through their occupation and the work-related factors that influence absence from work. HSE have also used other information from THOR-GP to show the precipitating stressors (e.g. lack of managerial support and interpersonal relationships) that contribute to psychological ill-health in the workplace (298). Information such as this can be used to inform prevention policy to improve the working environment and help reduce work-related sickness absence. This work has also illustrated how this surveillance scheme compares to work-related ill-health information from other data sources. Data collection from GPs has the advantage of not only being more inclusive and less prone to biases than schemes that collect data from clinical specialists and occupational physicians, but GPs are also able to provide additional information on case management through sickness absence and onward referral data. Referral data may also be of use in providing information for health care providers about the burden of work-related ill-health across primary and secondary care (in conjunction with data from other schemes) in the allocation of resources. The SWI is ‘nearer the base of the surveillance pyramid’ and therefore includes cases without the need for medical consultation, however the cases reported to THOR-GP are not only based on medical opinion, but originate from physicians trained in the issues surrounding work and health. GPs are also able to provide information about what has caused or aggravated a condition, be it a chemical substance or work task/event. This information has not previously been collected, particularly in the UK/GB; other studies have often been based on patients’ (84;85) or GPs’ (91;92;103;133) opinions, elicited through questionnaire rather than from a prospective collection of GPs’ actual case reports. Although knowledge can be gained from studies in other countries, application of such information can be difficult when there are different socio-economic structures and sickness absence policies in place.

Beyond establishing estimates of incidence rates of work-related ill-health, this work contributes to knowledge relating to the ‘primary care denominator problem’ (205). Chapter Four describes how a practice population (and therefore the study population) can be characterised in the absence of ‘gold standard’ patient based information by using practice list size and practice postcode data. It is hoped that once published these methods will be useful to researchers calculating incidence or prevalence rates for other GP based healthcare studies.

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Appendices

Appendix One: Excerpt from THOR-GP proposal (2004) showing the power calculation carried out by Dr Roseanne McNamee to estimate the number of GPs required to detect a 10-15% change in incident cases over two years

Sample size and power calculation:

We have estimated the expected number of cases based on results from the Labour Force Survey (Jones et al., 2003) and information from the ONS on General Practitioners (http://www.statistics.gov.uk/STATBASE/Expodata/Spreadsheets/D7785.xls, accessed 29 April 2004). The average number of patients by GP varies from 1,392 in Wales to 1,838 in England (Table 4), of which 61.7% are of working age (http://www.statistics.gov.uk/downloads/theme_population/PT115.pdf, accessed 29 April 2004). The results of the Labour Force Survey suggests that in 2001/2 approximately 5% of the working population in the UK suffered from a work-related or work-aggravated ill-health with 2.2% of people of working-age reporting a new case of work-related ill-health during the previous 12 months (Jones et al., 2003). As 50% of these cases resulted in sickness absence of less than 3 days, we have assumed that 1.1% would consult their GP.

Based on these assumptions, the expected annual number of new cases of work-related ill-health reported to THOR-GP is 965 (Table 4). During the first year we will monitor the rate of reporting and adapt the sampling strategy if necessary.

Table 4. Estimated annual number of new cases of work-related ill-health in GP-THOR

	Number of GPs	Patients per GP	Number of patients per GP (16-65)	Incidence cases per GP per year	Target number of GPs	Annual number of cases*
England	28,031	1.838	1,134	12.5	240	798
Scotland	1,793	1,704	1,051	11.6	15	46
Wales	3,769	1,392	859	9.4	30	76
Northern Ireland	1,076	1,651	1,019	11.2	15	45
Total					300	965

* Assuming an annual incidence of 1.1%.

We have carried out power calculation for the GP-Thor scheme to detect a 10% and a 15% change in incident case of work-related ill-health over 2 years using a 2-sided test, based on a Normal approximation to the Poisson distribution with continuity correction. Table 5 provides estimates of the required sample sizes for the various power levels.

Table 5. Estimates of required sample sizes to detect a 10% and 20% change in incident cases of work-related ill-health.

Power	Number Incident Cases per year	
	10% change	*15% change*
70%	1,020	300
80%	1,300	485
90%	1,735	825

Appendix Two: An example of a THOR-GP recruitment letter sent to COEH diplomates

THOR-GP

«Title» «Initials» «Surname» «Centre_Number»
«Address1»
«Address2»
«Address3»
«Town»
«County» «Postcode»

18th November 2011

Dear «Title» «Surname»

The Health & Occupation Reporting network in General Practice (THOR-GP)

I hope you enjoyed our Occupational Medicine course, and are still interested in this important area of medicine.

I am writing to ask if you would be interested in further involvement with the Centre for Occupational and Environmental Health by participating in a National Research Project, THOR-GP.

- THOR-GP is funded by the Health and Safety Executive to collect work-related ill-health and sickness absence data from General Practice.
- Approved by the North West Multi-Centre Research Ethics Committee (ref: MREC 02/8/72).
- The data is extremely valuable in estimating incidence of occupational ill health in the UK.

If you agree to join the scheme you will be asked to report information on **new cases of occupational ill-health from General Practice**. Information is collected by use of a **web form**, which takes no more than ***thirty seconds*** to complete for each case.

Your support would be invaluable.

If you would be willing to take part in the scheme, you would receive:

- Free access to EELAB (Experiential Electronic Learning, Audit & Benchmarking) our on-line learning facility
- Regular reports
- Free advice and support
- Other opportunities for participation in our research
- Free continuing medical education in Occupational Medicine

Please complete the enclosed reply form and return it in the stamped addressed envelope.

Please find also enclosed, an example quarterly report, 'THOR-GP-a reporters' view' and a paper published in the British Journal of General Practice. Further information can also be found at http://www.medicine.manchester.ac.uk/oeh/research/thorgp and you can contact the THOR team on 0161 275 8492 or by email, louise.hussey@manchester.ac.uk.

I hope that you can continue to be associated with us through our research, and would like to thank you in advance for your time.

Yours sincerely

Raymond Agius

Raymond Agius, Professor of Occupational & Environmental Medicine.

Appendix Three: THOR-GP recruitment reply slip sent out with recruitment letter GP participants

THOR-GP

The Health & Occupation Reporting network in General Practice

Please tick the appropriate box and return this form to the Centre for Occupational & Environmental Health in the stamped addressed envelope provided or return by fax (0161 275 5506)

☐ I would be willing to participate in THOR-GP

If you have gained a formal qualification in Occupational Medicine, we would be grateful if you could confirm which qualification you have:

☐ D Occ Med ☐ AFOM ☐ MFOM

☐ I would not be willing to participate in THOR-GP

☐ I am not eligible to participate in THOR-GP, as I am no longer working in general practice

If you no longer work in General Practice, do you work in full time Occupational Health?

☐ Yes ☐ No

Please amend the details below if incorrect or incomplete. Thank you.

«Title» «Initials» «Surname» «Centre_Number»
«Address1»
«Address2»
«Address3»
«Town»
«County»
«Postcode»

Email Address……………………………………………………………………………

Telephone Number………………………………………………………………………

Fax Number………………………………………………………………………………

P.T.O. →

Also, is order for us to complete our records, please could you confirm/add your General Practice address details below. Thank you.

«Title» «Initials» «Surname»   «Centre_Number»

Address 1 ………………………………………………………………….

Address 2 ………………………………………………………………….

Address 3 ………………………………………………………………….

Town ……………………………………………………………………….

County ……………………………………………………………………..

Postcode ……………………………………….

Email Address………………………………………………………………………

Telephone Number……………………………………………………………….

Fax Number………………………………………………………………………….

Please do not hesitate to contact Louise Hussey, the THOR-GP Project Manager, on 0161 275 8492 or email, louise.hussey@manchester.ac.uk

Appendix Four: Article published in the weekly GP magazine, Pulse (19th January 2006) to publicise THOR-GP and encourage GPs to participate

Could you help us find solutions to problem of work-related ill-health?

19 Jan 2006

From Dr Kevan Thorley, Senior clinical research fellow, Manchester

THOR-GP is a project funded by the Health and Safety Executive for the collection of work-related ill-health data from general practice. It aims to provide new solutions to the difficulties in obtaining valid and reliable data on occupational ill-health from medical practitioners.

Based at the Centre for Occupational and Environmental Health at the University of Manchester, the principal investigators include Professor Raymond Agius, Dr Kevan Thorley, Dr Susan Turner and Dr Roseanne McNamee.

The project needs interested and motivated GPs, with training in occupational medicine to diploma level or higher, to contribute to this important research. GPs are asked to return specific information on new cases of occupational ill-health seen in their clinical practice via a web form which takes no more than 30 seconds to complete.

In return for participation, contributors receive:

- Free continuing medical education in occupational medicine
- Regular reports
- Free advice and support
- Other opportunities to participate in research
- An honorarium of £200 per annum

Further information may be found at www.coeh.man.ac.uk/thor/thorgp and the THOR GP team may be contacted on 0161 275 8492 or by e-mail, louise.hussey@manchester.ac.uk

Appendix Five: A list of oral and poster conference presentations incorporating THOR-GP data including three examples of posters

Oral Presentations

- Hussey *et al*. Using multiple data sources to triangulate work-related ill-health incidence estimates. EPICOH, 2011

- Hussey *et al.* The Health & Occupation Research network – an overview. Society of Occupational Medicine Yorkshire Group educational meeting, 2010

- Hussey *et al*. Work-related ill-health and sickness absence. Calculating rates of incidence from general practice. Society of Occupational Medicine Annual Scientific Meeting, 2010

- Hussey *et al*. The determinants of work-related sickness absence as reported by general practitioners. UK & Ireland Occupational & Environmental Epidemiology Meeting, 2010

- Hussey *et al*. Work-related ill-health reporting by occupational physicians and general practitioners The fit note - Managing the return to work' Conference, Royal free hospital, 2010

- Hussey *et al*. Sickness absence associated with work-related ill-health as reporting by general practitioners. Lane Research Day, The University of Manchester, 2010

- Hussey *et al.* Work-related ill-health incidence and the pyramid of health surveillance. Association of Local Authority Medical Advisors (ALAMA) Spring Conference, 2009

- Hussey *et al*. Identifying novel causes – increasing the signal. MODERNET, Paris 2009

- Hussey *et al*. The sickness absence associated with the work-related ill-health reported by general practitioners. Association of Local Authority Medical Advisors (ALAMA) Spring Conference, 2008

- Hussey *et al*. General Practitioners' referral patterns for cases of work-related ill-health. Society of Occupational Medicine Annual Scientific Meeting, 2008
- Hussey *et al*. Work-related ill-health and sickness absence reported by general practitioners. MODERNET, Amsterdam 2008

- Hussey *et al*. The sickness absence associated with the work-related ill-health reported by general practitioners. Society of Occupational Medicine Annual Scientific Meeting, 2007

- Hussey *et al.* Sickness Absence Associated with Work-Related Musculoskeletal Disorders and Mental Ill-Health Reported by General

Practitioners. Royal College of General Practitioners, Annual Joint Research Conference. 2007

- Hussey *et al.* A comparison of occupational ill health as reported by occupational physicians and general practitioners. Society of Occupational Medicine Annual Scientific Meeting, 2006

- Hussey *et al*. Occupational ill health and sickness absence reported to the health and occupation network in general practice (THOR-GP). Royal College of General Practitioners, Annual Joint Research Conference, 2006.

- Hussey *et al*. The value of the health and occupation reporting network (THOR) in providing information on work-related ill-health. Society of Occupational Medicine Annual Scientific Meeting, 2005

- Hussey *et al*. The Health and Occupational Reporting Network in General Practice (THOR-GP). Lane lecture, the University of Manchester, 2005.

Poster presentations

- Hussey *et al.* The Health & Occupational Reporting network in General Practice (THOR-GP). Lane Research Day, University of Manchester, 2006.

- Hussey *et al.* Occupational ill-health reporting in general practice – meeting the needs for more representative work-related surveillance in the UK. NICE conference, 2006.

- Hussey *et al.* A comparison of occupational ill-health as reported by occupational physicians and general practitioners. International Commission on Occupational Health (ICOH) Congress, Milan 2006.

- Hussey *et al.* The importance of work-related ill-health reporting by general practitioners and occupational physicians in identifying populations and employment sectors at risk in the UK. Society of Social Medicine (SSM) Annual Scientific Meeting, 2006.

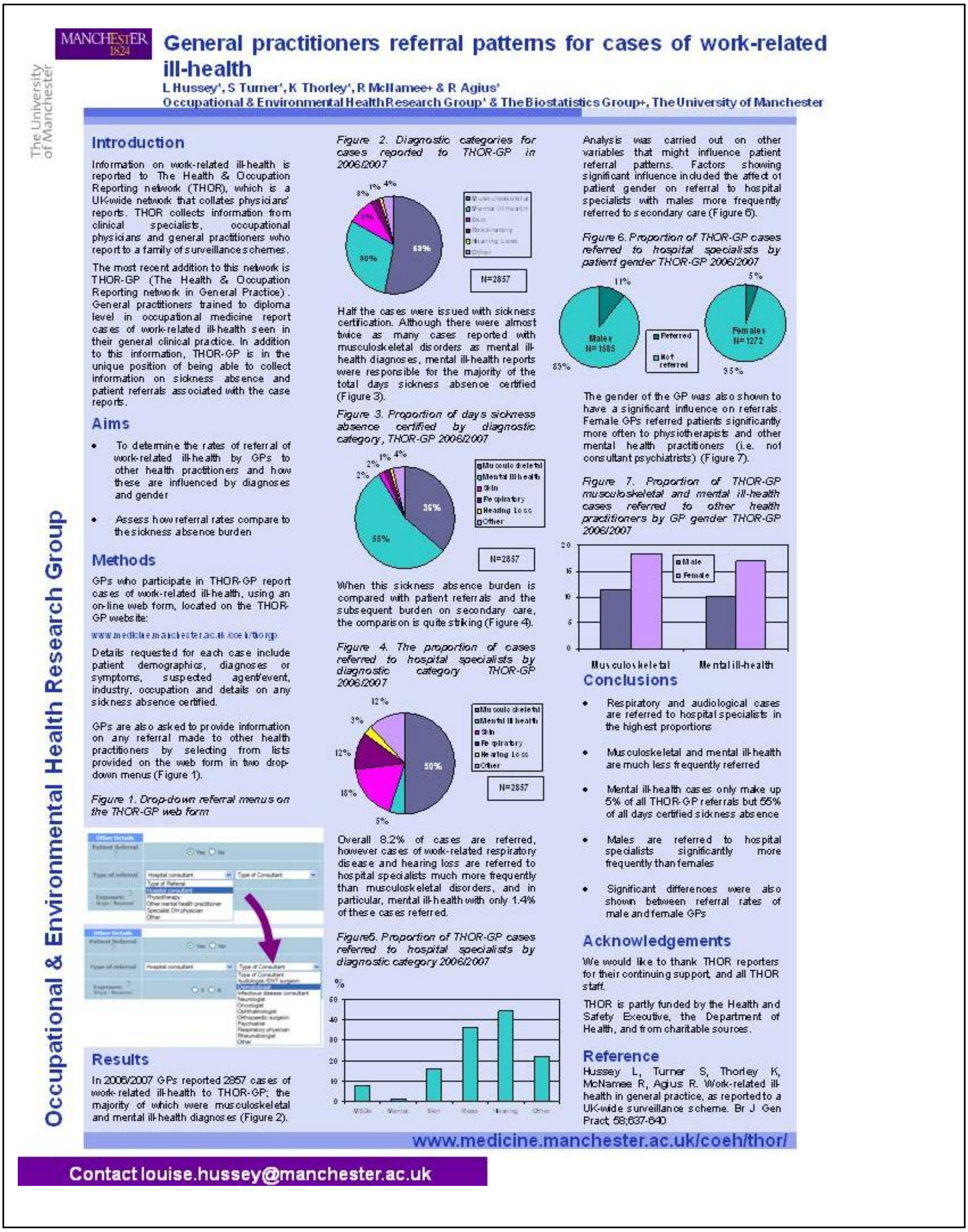
- Hussey *et al.* Work-related musculoskeletal disorders seen in general practice. British Society for Rheumatology (BSR) Conference, 2007.

- Hussey *et al.* The Health & Occupational Reporting network in General Practice (THOR-GP) – Surveillance of work-related ill-health and sickness absence. Primary Care Research Network (PCRN) Conference, 2007.

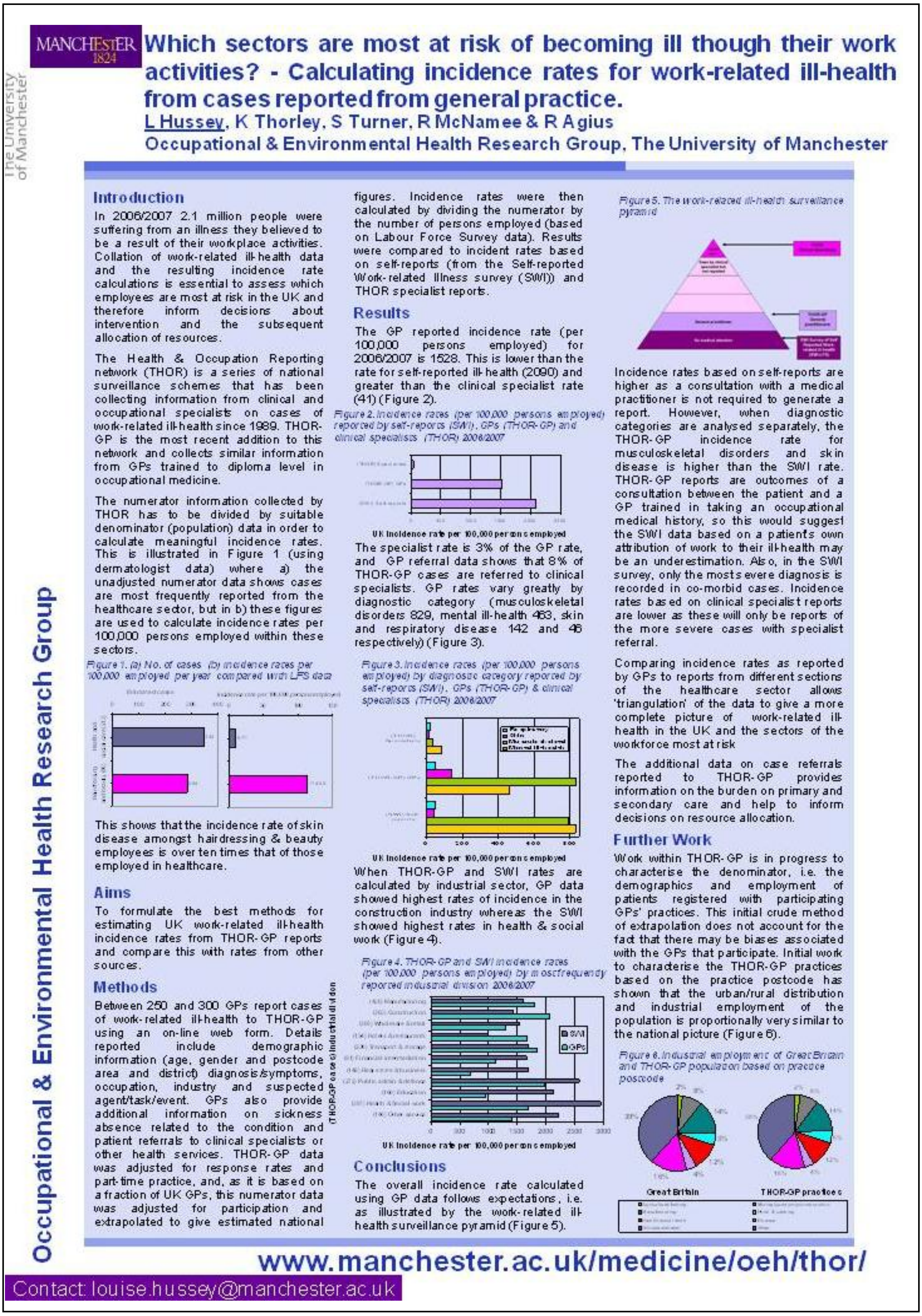
- Hussey *et al.* Work-related mental ill-health in the UK: cases reported to The Health & Occupational Reporting network in General Practice (THOR-GP) by psychiatrists, general practitioners and occupational physicians. Royal College of Psychiatrists Conference, 2007.

- Hussey *et al.* Risk factors and sickness absence associated with work-related musculoskeletal disorders and mental ill-health reported by general practitioners. British Occupational Hygiene Society Conference, 2007.
- Hussey *et al.* The sickness absence associated with the work-related ill-health reported by general practitioners. Society of Occupational Medicine Annual Scientific Meeting, 2007.
- Hussey *et al.* General practitioners referral patterns for cases of work-related ill-health. Royal College of General Practitioners Annual Scientific Meeting, 2008 (Example 1)
- Hussey *et al.* Proportionate distribution and incidence estimates of work-related ill-health presenting in general practice in the UK. UK & Ireland Occupational & Environmental Epidemiology Meeting 2008.
- Hussey *et al.* Which sectors are most as risk of becoming ill through their work activities? – Calculating incidence rates for work-related ill-health from cases reported from general practice. Royal College of General Practitioners Annual Scientific Meeting, 2009. (Example 2)
- Hussey *et al.* Can GPs predict duration of work-related sickness absence? Royal College of General Practitioners Annual Scientific Meeting, 2010
- Hussey *et al.* Calculating incidence rates of work-related ill-health from general practice – establishing the denominator. EPICOH, 2011(Example 3)

Poster example 1- Hussey *et al.* General practitioners referral patterns for cases of work-related ill-health. Royal College of General Practitioners Annual Scientific Meeting, 2008



Poster example 2- Hussey *et al.* Which sectors are most as risk of becoming ill through their work activities? – Calculating incidence rates for work-related ill-health from cases reported from general practice. Royal College of General Practitioners Annual Scientific Meeting, 2009.



MANCHESTER 1824

The University of Manchester

Which sectors are most at risk of becoming ill though their work activities? - Calculating incidence rates for work-related ill-health from cases reported from general practice.

L Hussey, K Thorley, S Turner, R McNamee & R Agius

Occupational & Environmental Health Research Group, The University of Manchester

Occupational & Environmental Health Research Group

Introduction

In 2006/2007 2.1 million people were suffering from an illness they believed to be a result of their workplace activities. Collation of work-related ill-health data and the resulting incidence rate calculations is essential to assess which employees are most at risk in the UK and therefore inform decisions about intervention and the subsequent allocation of resources.

The Health & Occupation Reporting network (THOR) is a series of national surveillance schemes that has been collecting information from clinical and occupational specialists on cases of work-related ill-health since 1989. THOR-GP is the most recent addition to this network and collects similar information from GPs trained to diploma level in occupational medicine.

The numerator information collected by THOR has to be divided by suitable denominator (population) data in order to calculate meaningful incidence rates. This is illustrated in Figure 1 (using dermatologist data) where a) the unadjusted numerator data shows cases are most frequently reported from the healthcare sector, but in b) these figures are used to calculate incidence rates per 100,000 persons employed within these sectors.

Figure 1. (a) No. of cases (b) incidence rates per 100,000 employed per year compared with LFS data

This shows that the incidence rate of skin disease amongst hairdressing & beauty employees is over ten times that of those employed in healthcare.

Aims

To formulate the best methods for estimating UK work-related ill-health incidence rates from THOR-GP reports and compare this with rates from other sources.

Methods

Between 250 and 300 GPs report cases of work-related ill-health to THOR-GP using an on-line web form. Details reported include demographic information (age, gender and postcode area and district) diagnosis/symptoms, occupation, industry and suspected agent/task/event. GPs also provide additional information on sickness absence related to the condition and patient referrals to clinical specialists or other health services. THOR-GP data was adjusted for response rates and part-time practice, and, as it is based on a fraction of UK GPs, this numerator data was adjusted for participation and extrapolated to give estimated national figures. Incidence rates were then calculated by dividing the numerator by the number of persons employed (based on Labour Force Survey data). Results were compared to incident rates based on self-reports (from the Self-reported Work-related Illness survey (SWI)) and THOR specialist reports.

Results

The GP reported incidence rate (per 100,000 persons employed) for 2006/2007 is 1528. This is lower than the rate for self-reported ill-health (2090) and greater than the clinical specialist rate (41) (Figure 2).

Figure 2. Incidence rates (per 100,000 persons employed) reported by self-reports (SWI), GPs (THOR-GP) and clinical specialists (THOR) 2006/2007

UK Incidence rate per 100,000 persons employed

The specialist rate is 3% of the GP rate, and GP referral data shows that 8% of THOR-GP cases are referred to clinical specialists. GP rates vary greatly by diagnostic category (musculoskeletal disorders 829, mental ill-health 463, skin and respiratory disease 142 and 46 respectively) (Figure 3).

Figure 3. Incidence rates (per 100,000 persons employed) by diagnostic category reported by self-reports (SWI), GPs (THOR-GP) & clinical specialists (THOR) 2006/2007

UK Incidence rate per 100,000 persons employed

When THOR-GP and SWI rates are calculated by industrial sector, GP data showed highest rates of incidence in the construction industry whereas the SWI showed highest rates in health & social work (Figure 4).

Figure 4. THOR-GP and SWI incidence rates (per 100,000 persons employed) by most frequently reported industrial division 2006/2007

SWI
GPs
THOR-GP cases (industrial division)
UK Incidence rate per 100,000 persons employed

Conclusions

The overall incidence rate calculated using GP data follows expectations, i.e. as illustrated by the work-related ill-health surveillance pyramid (Figure 5).

Figure 5. The work-related ill-health surveillance pyramid

Incidence rates based on self-reports are higher as a consultation with a medical practitioner is not required to generate a report. However, when diagnostic categories are analysed separately, the THOR-GP incidence rate for musculoskeletal disorders and skin disease is higher than the SWI rate. THOR-GP reports are outcomes of a consultation between the patient and a GP trained in taking an occupational medical history, so this would suggest the SWI data based on a patient's own attribution of work to their ill-health may be an underestimation. Also, in the SWI survey, only the most severe diagnosis is recorded in co-morbid cases. Incidence rates based on clinical specialist reports are lower as these will only be reports of the more severe cases with specialist referral.

Comparing incidence rates as reported by GPs to reports from different sections of the healthcare sector allows 'triangulation' of the data to give a more complete picture of work-related ill-health in the UK and the sectors of the workforce most at risk.

The additional data on case referrals reported to THOR-GP provides information on the burden on primary and secondary care and help to inform decisions on resource allocation.

Further Work

Work within THOR-GP is in progress to characterise the denominator, i.e. the demographics and employment of patients registered with participating GPs' practices. This initial crude method of extrapolation does not account for the fact that there may be biases associated with the GPs that participate. Initial work to characterise the THOR-GP practices based on the practice postcode has shown that the urban/rural distribution and industrial employment of the population is proportionally very similar to the national picture (Figure 6).

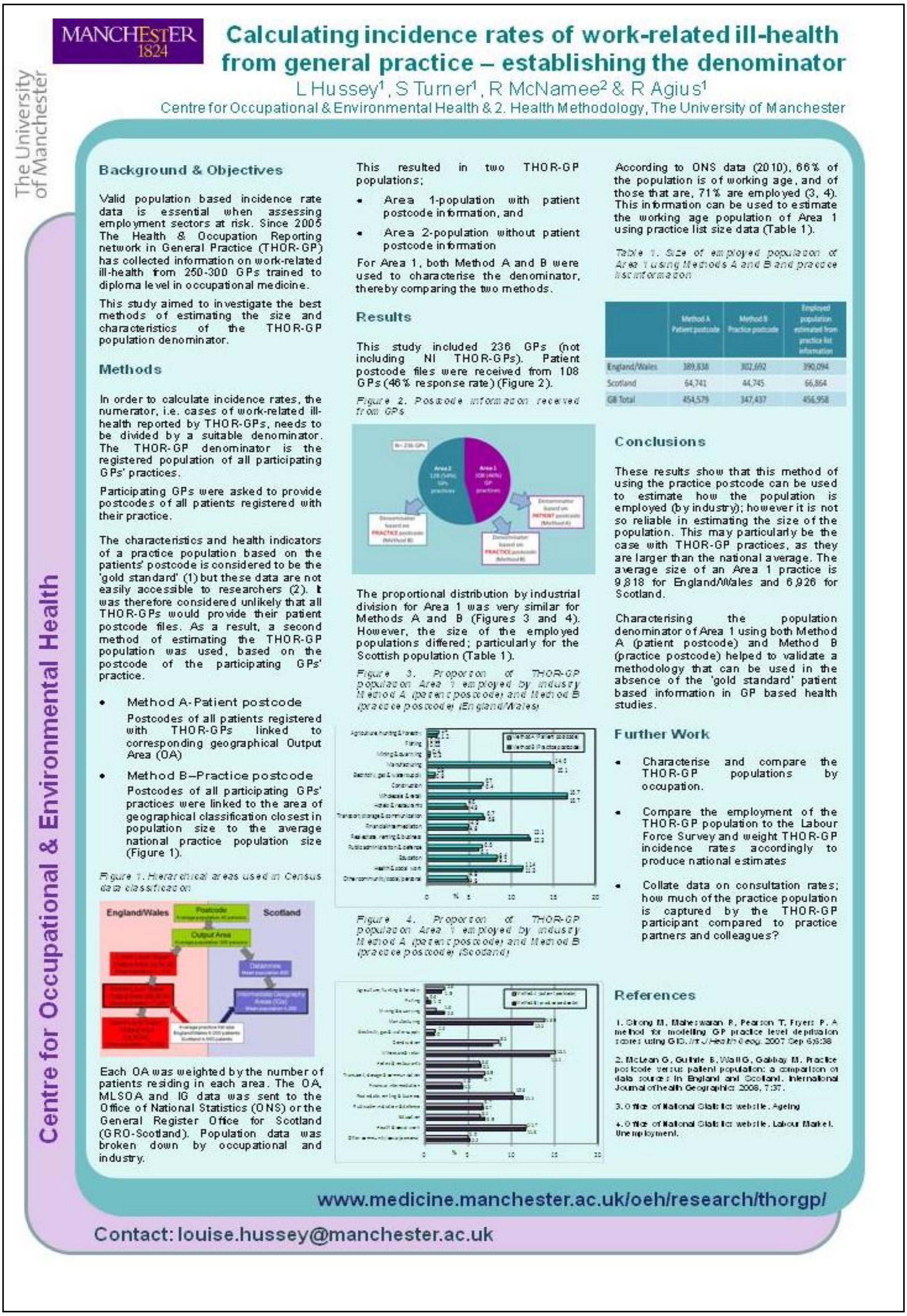
Figure 6. Industrial employment of Great Britain and THOR-GP population based on practice postcode

Great Britain
THOR-GP practices

www.manchester.ac.uk/medicine/oeh/thor/

Contact: louise.hussey@manchester.ac.uk

Poster example 3- Hussey *et al.* Calculating incidence rates of work-related ill-health from general practice – establishing the denominator. EPICOH, 2011



Appendix Six: the primary THOR-GP reporting principles as sent out in recruitment packs to GPs

THOR-GP Reporting Principles

THOR-GP principles & data quality

Thank you for agreeing to participate in THOR-GP. The details below summarise the principles of reporting to THOR-GP, including, the aims of the data collection and criteria for eligibility of case reports.

THOR-GP's aim is to collect cases of

Work-related ill-health seen in **General Practice**

These data will be used to calculate the **incidence** of occupational disease in the UK, and to examine **trends** in work-related ill-health.

Criteria for inclusion of cases into THOR-GP:

- **Cases** should be **only** those seen by **you**, the reporter, **personally**. (If you send us cases seen by your partners as well, it will distort our incidence calculations)
- **Cases** should be **only** those seen in **general practice** (We do **not** want those you might see in your Occupational Health work as we have no means of calculating a denominator for these and therefore we cannot calculate incidence)
- **Cases** should be **only** those presenting to you **for the first time**. (Please do not "harvest" cases that you think should have been included as this also distorts incidence calculations)

As participating reporters in THOR-GP, your contribution is vital to this important research. This data is of great importance and is used to calculate national rates of incidence and sickness absence; therefore it is essential that the data you provide us with are of the highest quality. This information will make an important contribution to building a picture of the interaction between work and health and the identification of workplace hazards and populations at risk, and therefore in planning health interventions to reduce risk to employees and absence from work.

If you have any queries about case eligibility or any other aspect of reporting to THOR-GP please do not hesitate to contact Louise Hussey on 0161 275 8492 or email louise.hussey@manchester.ac.uk.

Appendix Seven: THOR-GP clinical reporting guidelines as sent out to THOR-GP participants

THOR-GP clinical guidelines

Clinical Guidelines for THOR-GP reporting

New cases, diagnosed by **you** in your **general practice** clinic during your specified reporting month as being caused or aggravated by **work** exposure or working environment should be recorded. Cases diagnosed by you outside your specified month should not be reported as this would lead to an overestimate of cases.

Please note that you do not need to have made a "specific" diagnosis in order to report a case. We rely on the physician's clinical judgement for many case reports.

Amongst the groups of doctors that we have studied, for most, the decision on whether a disease is work-related depends on **the clinician's judgement on the balance of probabilities** (whether it is more likely than not).

In reaching this judgement many doctors consider

- Whether the disease would have occurred in the **absence of work exposure**
- **Or** whether **work exposure** was a **major factor** in causation
- **Pre-existing illness** in which work conditions made a **substantial difference to severity** may also be included in the consideration

Frequently reported conditions

Examples of conditions frequently reported in other THOR schemes are:

Date patient seen	Diagnosis/ Symptoms	Job	Industry	Task/ suspected agent
June 2006	Contact Dermatitis-Allergic	Hairdresser	Beauty	Hair dyes
March 2007	Depression/ Anxiety	Secondary school teacher	Education	Workload and bullied by colleagues
August 2008	Hand arm vibration syndrome	Grinder	Steel	Vibrating Tools
January 2009	Asthma	Paint Sprayer	Manufacturing of motor vehicles	Isocyanates

Occupational disease or injury

Major groups of occupational disease or injury are outlined below:

Musculoskeletal

Including disorders affecting:

- **Back or neck**
- **Upper limbs** (including shoulders, elbows, wrists and hands)
- **Lower limbs** (including hips, knees, ankles and feet)

The following should be included: carpal tunnel syndrome/tendonitis/writer's cramp/vibration white finger/hand arm vibration syndrome/occupational injuries e.g. lacerations, fractures, muscle strains, etc.

Stress/mental illness

- **Anxiety/Depression**: Include cases with symptoms of either disease (please specify if possible, or say "mixed")
- **Post-traumatic stress disorder**: Include cases where the event or causal circumstances occurred at work
- **Other work related stress**: associated with work: include distress and disorders relating to adjustments or change in work-related circumstances
- **Alcohol or drug abuse**: cases where the illness is either the result of working conditions or where access to substances at work have helped precipitate or sustain the illness
- **Psychotic episode**: where cases caused or precipitated by work (including toxic exposure)
- **Other problems**: agoraphobia, obsessive/compulsive disorder etc. (if caused or aggravated by work)

Skin

- **Contact dermatitis**: allergic, irritant, mixed or unknown
- **Contact urticaria**: denoted by immediate hypersensitivity
- **Inflammatory**: for example folliculitis
- **Infective**: for example, tinea, warts, scabies
- **Traumatic**: dermatitis and callosities caused by mechanical trauma
- **Neoplasms**: skin neoplasia (keratosis, BCC, SCC, melanoma) caused by radiation, occupational sun exposure or chemicals
- **Nail problems**: chronic paronychia and dystrophies caused by physical or chemical occupational contact
- **Other dermatoses**: include low humidity dermatitis, scleroderma-like disorders and ulceration

Respiratory

- **Asthma**: cases where the agent acted either as a sensitiser or an irritant (please specify which if known)
- **Inhalation accidents**: denoted by acute respiratory systems due to inhalation of toxic gas or fumes
- **Bronchitis/emphysema**: includes cases in which occupational exposure is believed to be an important factor
- **Infectious disease**: for example TB acquired through work
- **Non-malignant asbestosis related pleural disease**: includes plaques, diffuse thickening, effusions
- **Mesothelioma**: report all cases with or without evidence of occupational exposure
- **Lung cancer**: includes cases in which occupational exposure is considered an important contributing factor, regardless of smoking habit
- **Pneumoconiosis**: includes pulmonary fibrosis due to coal, asbestos, silica, talc, etc
- **Other respiratory illness**: for example, building-related illness, byssinosis

Hearing loss and other ENT conditions

- **Occupational deafness** (defined as "sensorineural hearing loss due to occupational noise amounting to at least 50dB, being the average of hearing loss at 1,2 and 3 kHz frequencies")
- **Rhinitis** due to occupational exposure: agricultural workers, florists, etc
- **Dysphonia / speech disorders** relating to work: teachers, professional singers, etc
- **Any other ear / nose / throat disorders** relating to work

Miscellaneous (this includes infection not elsewhere mentioned)

You are encouraged to report other serious diseases which, in your clinical judgement, were caused by work. These might include:

- Lacerations and other injuries
- Cancers (e.g. bladder cancer associated with work exposure)
- Blood dyscrasias
- Nephritis
- Hepatitis (e.g. health care workers)
- Leptospirosis (e.g. agricultural workers)

We also are interested in receiving information on other or suspected new diseases caused by work, for example those relating to "new" industries or exposures.

Additional (non-clinical) information

Please input the following details for each case onto the web form:

Diagnosis (see above) - please provide as much detail as possible, however in reality this may not be very specific (e.g. elbow pain relating to packing boxes in an office worker).

The reference number YOU assign to the case - this is to help **you** to identify the case.

Age - age when diagnosed.

Postcode - please give the first half of the postcode if possible (e.g. M13), or postal town if not.

Job - type of work (e.g. florist or welder). Be as specific as possible (machinist, assembler, process worker can be difficult to code without more detail).

Industry - the industrial group of the patient's employer. Be as specific as possible (e.g. for engineering we need to know the product manufactured and for cleaning we need the site of work, such as hospital).

Activity/Event/Agent/Exposure - please be as specific as possible, e.g.

- 'Chicken de-boning' rather than 'repetitive work'
- 'Interpersonal difficulties with line manager' rather than 'work stress'
- If giving proprietary names, please try give the active agent if known

Sickness Absence and Fit note information

Please specify the patient's fitness for work, by selecting one of the three following options

- Yes
- No, sickness absence certified
- Yes, but adjustment recommended

If sickness absence has been certified, provide any available information on the certification (issue and duration) and days absent (e.g. self certification) prior to consultation with you. Please could you also indicate whether, when issuing certification, you would expect the condition to be resolved at the end of the duration of the certificate (e.g. if issuing a note for 2 weeks, whether you expect the patient to be able to return to work at that time, or whether you have issued a 2 week certificate as you wish to review the individual in 2 weeks time).

If Fit note advice has been given, select as many of the options (see below) in the Fit note section as required

- A phased return to work
- Amended duties

- Altered hours
- Workplace adaptations

Any information on other adjustments recommended, or other comments can be given in the 'Other adjustments/conditions or comments'.

Specialist referral - please indicate if you have referred the patient to a specialist. However, please report the case even if you think that it might also be reported by a specialist (for example a dermatologist might report the same case if you referred a patient with work-related contact dermatitis).

Pattern of exposure - is the problem related to a single event or to repeated exposure?

Nothing to report

If you have no relevant cases to report in your reporting month, it is important to let us know this information by entering the relevant month and year and returning a form indicating "no cases to report". This should be done at the end of the month.

If you have any queries about any of the above guidelines please do not hesitate to contact the THOR-gP team for further information. We welcome any queries or suggestions about these guidelines, as we constantly seek to improve them.

Appendix Eight: Reporting sickness absence guidelines as sent out to GPs when they join the scheme

Recording Sickness Absence Information Guidelines

There are 3 different situations where we would be grateful for you to provide us with sickness certification information:

1. A patient is issued with a sick note when reported to THOR-GP as a **new case** of occupational ill health.

2. A patient that you have **previously reported** to THOR-GP is issued with a further sick note

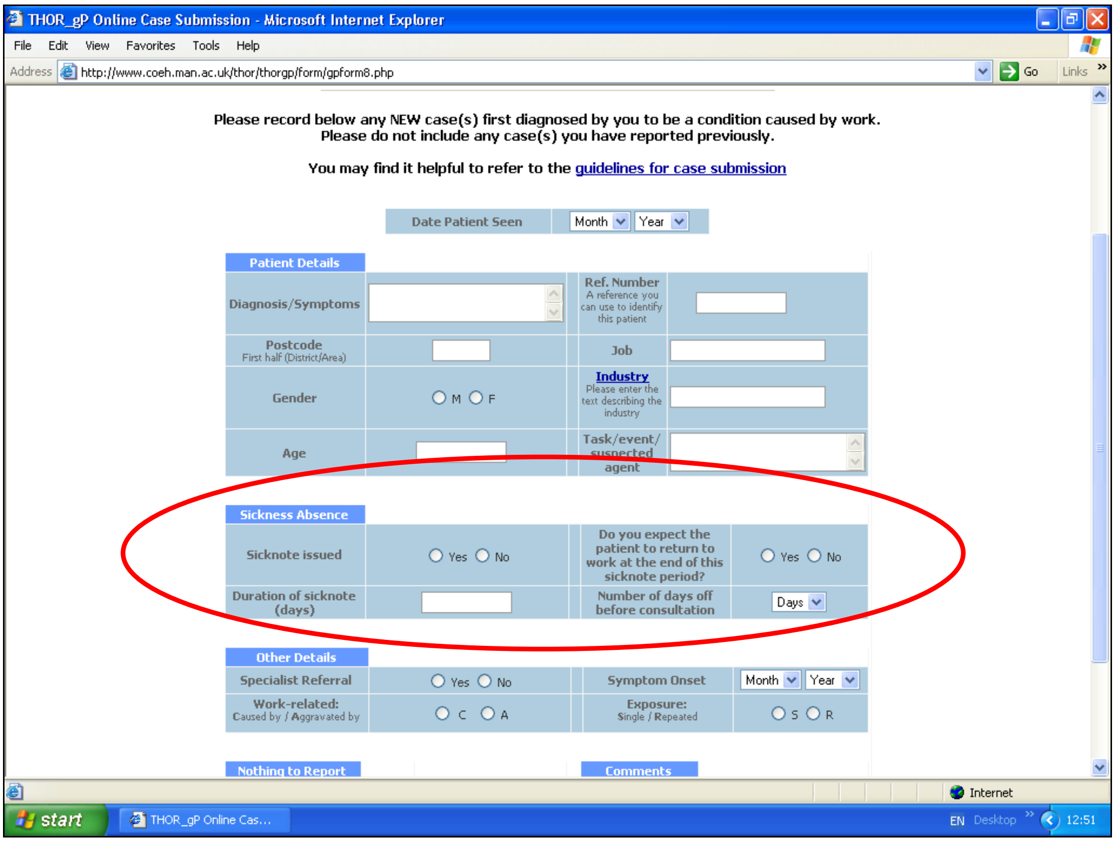
3. A patient that you have already seen in clinic with their occupational ill health problem is issued with a further sick note, but you have **not previously reported** them to THOR-GP as you first saw them previous to your participation in THOR-GP.

Situation 1

A **new case** of occupational ill health issued with sickness certification.

This is recorded using the same new ‘Case Report’ web form, using the same method as before, shown in Figure 1.

Figure 1. New case report web form



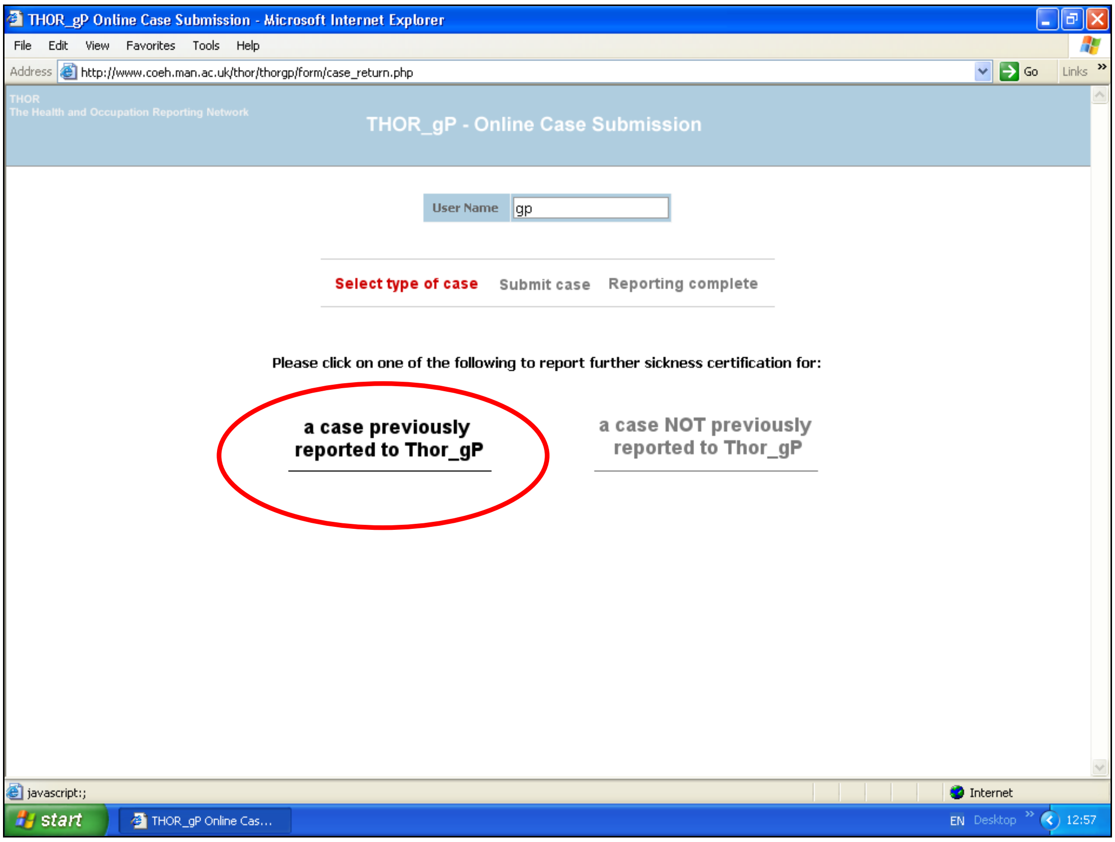
Situation 2

A patient that you have **previously reported** to THOR-GP is issued with a further sick note.

i. Click on the **'Sickness Absence'** button on the THOR-GP homepage

ii. Once you have entered your username and password you will enter a page where it will ask you to select from 2 options. Click on **'A case previously reported to THOR-GP'.** See Figure 2

Figure 2. Select type of case



iii. This will take you to a form that will ask you to select the case ID of a case you have previously reported. This can be done by clicking on the **'View Cases'** button and then entering the case ID number shown into the form.

Figure 3. Form to report sickness absence of previously reported cases
Click on 'View Cases'

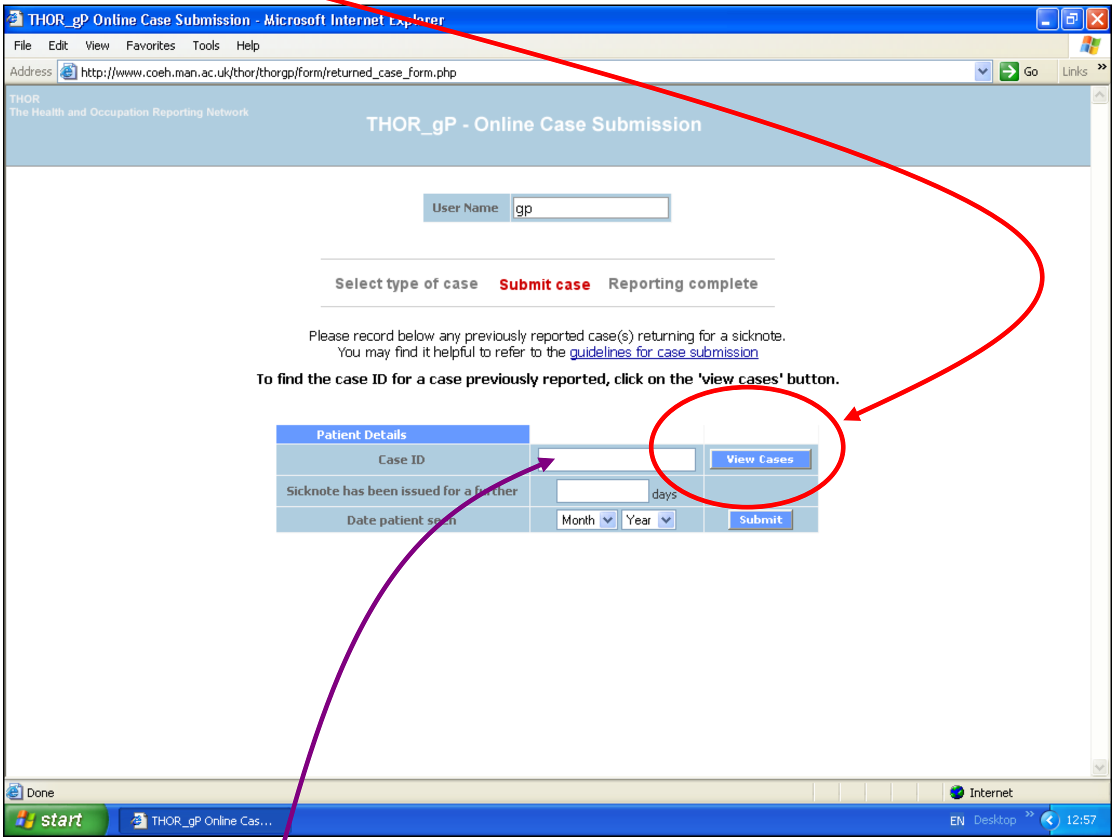
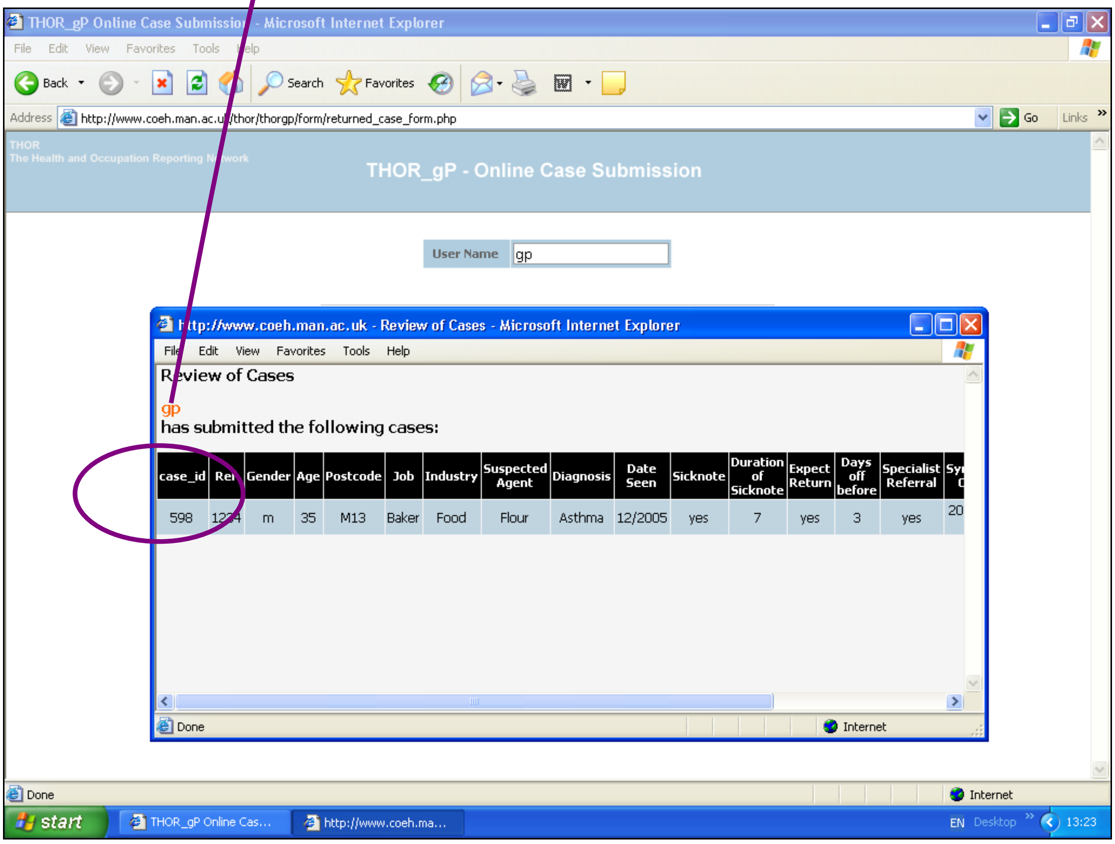


Figure 4. Enter the Case ID shown when your view your previously reported cases into the form



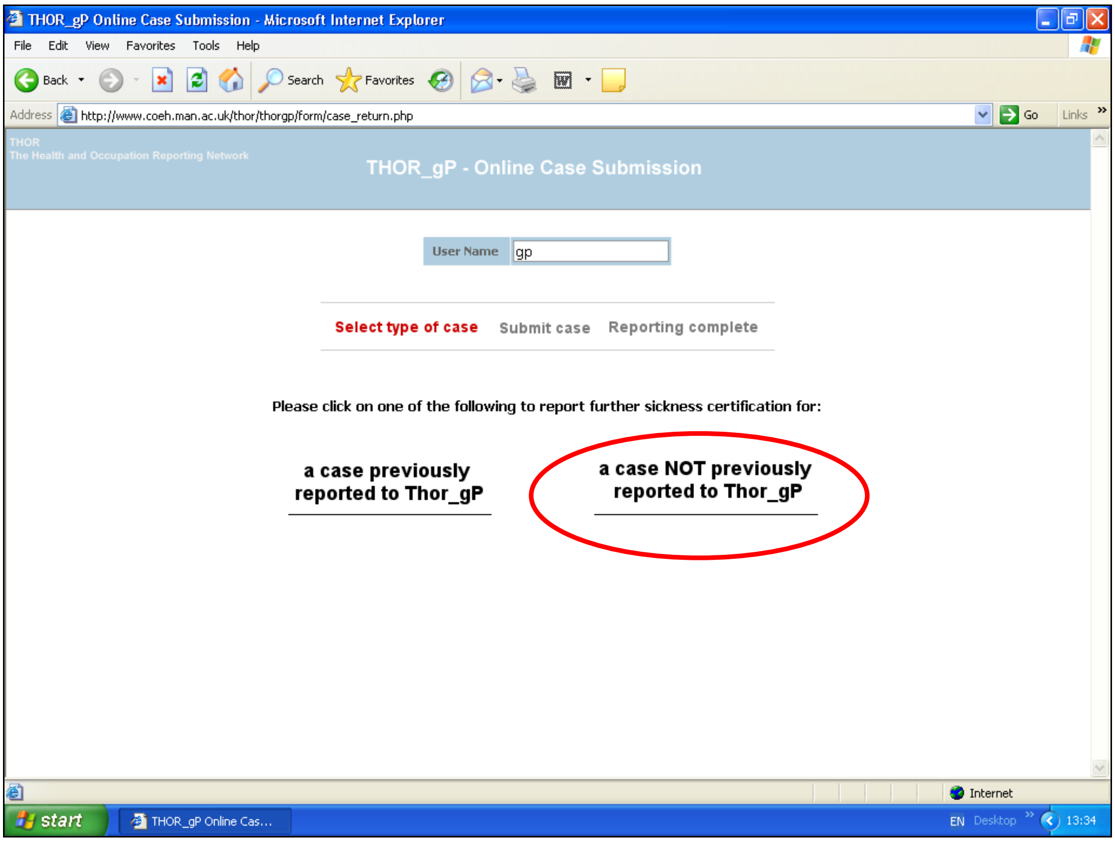
iv. Enter the length of time for the further sickness certification, the month and year of this return visit and then click ‘submit’.

Situation 3

A patient that you have already seen in clinic with their occupational ill health problem is issued with a further sick note, but you have **not previously reported** them to THOR-GP as you first saw them previous to your participation in THOR-GP.

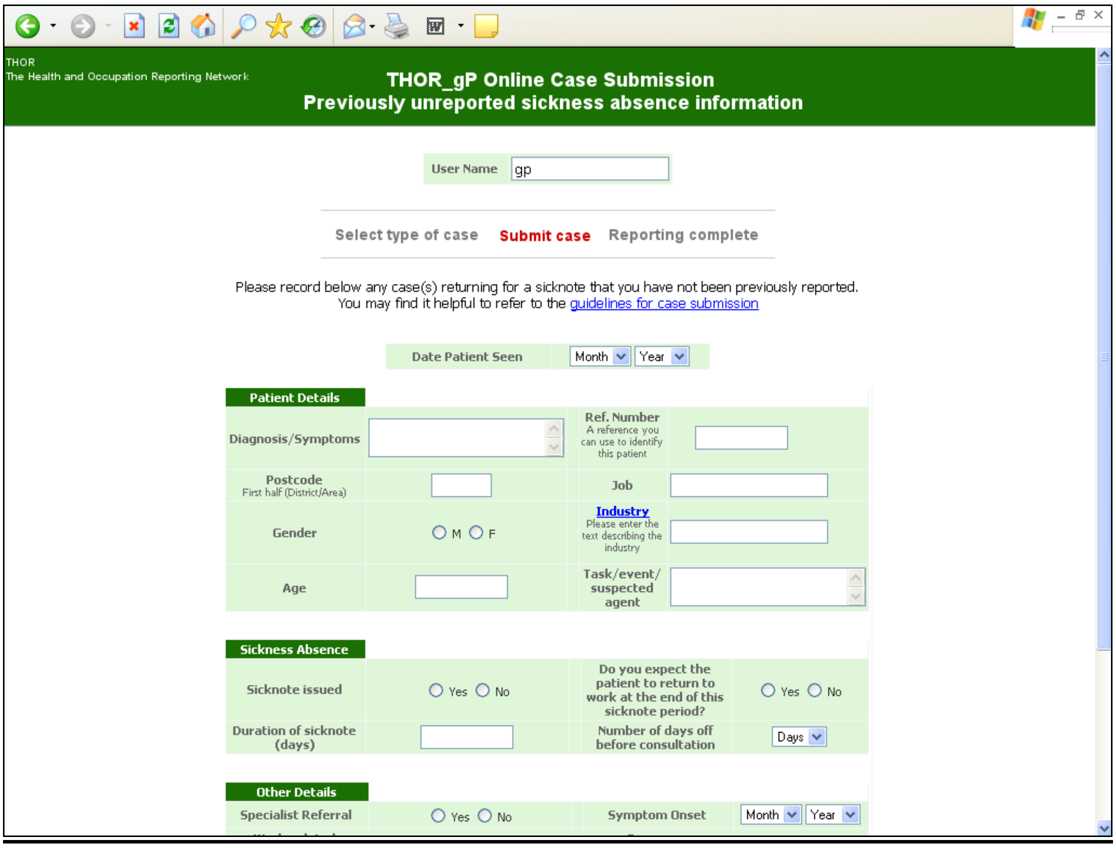
Once you have entered your username and password you will enter a page where it will ask you to select from 2 options. Click on **‘A case NOT previously reported to THOR-GP’.** See Figure 5

Figure 5. Select type of case



This will then take you to a form (Figure 6) similar to the new case report web form as it requires similar information. Although it is the sickness certification information that is being recorded it is still necessary to know the type of disease, occupation etc. that is associated with the sickness absence.

Figure 6. Web form for reporting sickness certification issued for a case not previously reported to THOR-GP



Appendix Nine: Automatic reminder email – sent out to GPs as a second chase-up email in the middle of the month following their reporting month

Dear THOR-GP reporter,

Thank you for your participation in the THOR-GP scheme.

You report to the scheme for just **one** randomly allocated month each year. For **2012** you were allocated **FEBRUARY** as your reporting month.

We have not yet received a return from you for February.

Please note, cases reported to THOR-GP **must be from your General Practice clinic** and not from any of your Occupational Health work.

To make it easier for you to tell us of your reporting status for February we have provided 3 links below that will generate an automatic email. Please click on one of the options.

OPTION 1: 'I HAVE SEEN NO NEW WORK-RELATED CASES IN FEBRUARY'

Click here mailto:susan.taylor@manchester.ac.uk?subject=THOR-GP%20Reporting%20&body=Option%201.%20I%20have%20no%20cases%20to%20report%20for%20February

OPTION 2: 'I HAVE FEBRUARY CASES TO REPORT AND WILL SEND THEM TO YOU SHORTLY'

Click here mailto:susan.taylor@manchester.ac.uk?subject=THOR-GP%20Reporting%20&body=Option%202.%20I%20will%20report%20my%20cases%20for%20February%20shortly

OPTION 3: 'I HAVE NO CASES TO REPORT BECAUSE I HAVE NOT BEEN PRACTICING IN FEBRUARY AND SAW NO PATIENTS (WORK RELATED OR OTHERWISE)'

Click here mailto:susan.taylor@manchester.ac.uk?subject=THOR-GP%20Reporting%20&body=Option%203.%20I%20saw%20no%20patients%20in%20February

I look forward to receiving your submissions for February.

Best wishes,

Susan

Appendix 10: List of frequently used ICD10 codes used to classify the diagnoses/symptoms reported by GPs

Musculoskeletal

M76.6	**Achilles Tendonitis / Bursitis**
M75.0	**Adhesive Capsulitis (frozen shoulder)**
T14.1	Animal Bite, site u/s (on back, S21.2)
M13.9	Arthritis / Arthropathy, unspecified
M54.9	**Back Pain/Dorsalgia/Back condition**
M70.5	Beat Knee
S90.3	Bruised Foot (contusion, foot, u/s)
S80.0	Bruised Knee S20.2 Bruised Ribs
M77.5	Bursitis, Calcaneal (Heel)
M70.2	Bursitis, Olecranon (elbow)
M75.5	Bursitis, Shoulder ; M70.5 Bursitis, Knee u/s
M70.4	Bursitis, Prepatellar; M70.6 Trochanteric (hip) bursitis
M75.0	**Capsulitis - Shoulder**
G56.0	**Carpal Tunnel Syndrome**
M54.1	Cervical Nerve Root Irritation (radiculopathy)
M54.2	**Cervicalgia/Neck Pain u/s**
D48.0	Chondro - elbow (neoplasm u/s)
M22.4	Chondromalacia patella
M53.3	Coccydynia / Coccygodynia
S52.5	Colles' Fracture (arm/wrist, lower radius)
T79.6	Compartment Syndrome
M79.9	Complex Regional Pain (soft tissue disorder u/s)
T04.3	Crush Injuries, Multiple, Legs u/s
S97.8	**Crushed Foot/Ankle u/s**
S67.8	Crushed Hand/Wrist u/s S77.1 Crushed Thigh
M65.4	**De Quervain Tenosynovitis (wrist tendonitis)**
M47.9	Degenerative lumbar spine disease u/s
M23.3	Degenerate Meniscus
M67.9	Disorder of synovium/tendon u/s (not tendinitis)
M25.4	Effusion of Joint
M77.1	**Epicondylitis u/s (site 2)**
	Fractures:
S82.8	**Ankle u/s ; S92.3 Metatarsal (foot)**
T10	**Arm u/s ; S42.3 Humerous u/s**
S62.6	**Finger u/s ; S22.3 Rib ;** S02.2 Nose
S62.8	**Wrist/Hand u/s ;** Elbow S52.0 ; T12 Leg
S62.0	**Scaphoid/Navicular (Hand, 4)**
S22.0	Thoracic Vertebra ; T08 Spine u/s
S82.0	Patella (knee cap) ; S52.5 Radius u/s
S32.8	Pelvis u/s ; S32.2 Coccyx ; S02.9 Skull
M75.0	**Frozen Shoulder / Periarthritis**
M10.9	Gout
T75.2	**HAVS/VWF (effects of vibration)**
R51	**Headache**
M76.3	Iliotibial Band Syndrome (Runner's Knee)
M75.4	**Impingement Syndrome (shoulder)**
S83.5	Injury, Anterior Cruciate Ligament (knee)
S39.9	Injury: Abdominal (u/s)
S86.0	Injury: Achilles Tendon
S49.9	Injury: Acromioclavicular (u/s)
S39.9	**Injury: Back (lower/us)**
M51.9	Intervertebral Disc Disorder u/s (slipped disc)
S61.0	**Laceration (cut/bite), Finger u/s**
S01.9	Laceration (cut), Head u/s
M77.1	**Lateral Epicondylitis/Tennis Elbow**
M54.5	**Low Back Pain/Strain/Mechanical Back Pain**
M54.5	**Lumbago (back pain) u/s**
M54.4	**Lumbago (back pain) with Sciatica**
M20.0	Mallet Finger
M77.0	**Medial Epicondylitis/Golfers Elbow**
M77.4	Metatarsalgia
M62.9	Muscle Disorder u/s
M62.6	Muscle Strain & Overuse
M99.9	Musculoskeletal u/s (Biomechanical lesion u/s)
M70.9	Numbness (limb) due to immobility
M18.9	Osteoarthritis: carpometacarpal, first (u/s)
M17.9	**Osteoarthritis: Knee (Gonarthrosis u/s)**
M47.9	Osteoarthritis: Spine u/s (Spondylosis u/s)
M19.9	Osteoarthritis: unspecified
M86.9	Osteomyelitis: u/s (Bone infection u/s)
	Pain in :
M62.9	Buttock: (disorder of muscle u/s)
R07.3	Chest Wall ; R51 Face u/s ; R07.3 Ribs
M25.5	**Joint (inc shoulder,wrist,elbow,ankle)**
M79.6	**Limb (inc. fingers, hand, foot)**
M54.6	Thoracic Spine ; R10.2 Perineal/Pelvic
M54.2	Neck with referral into hands
M72.2	Plantar Fasciitis
M51.2	**Prolapsed (Lumbar) Intervertebral Disc**
M75.1	**Rotator Cuff Syndrome / Tendonitis (shoulder)**
M46.1	Sacroiliitis
M54.3	**Sciatica (site 8)**
T79.6	Shin Splints
M75.8	Shoulder Lesion (other)
M75.9	Shoulder Lesion u/s
M47.9	**Spondylosis: Spine Osteoarthritis u/s**
M47.8	Spondylosis: Cervical
S43.7	**Sprain/strain of Shoulder u/s**
S93.4	**Sprain/strain: Ankle**
S13.4	Sprain/Strain: Cervical Spine
S73.1	Sprain/Strain: Hip
S83.5	Sprain/strain: knee ant/post cruc. Ligament
S83.6	Sprain/strain: knee, other/us parts inc patellar ligmt
S33.5	**Sprain/Strain: Low back (lumber spine)**
S13.6	Sprain/Strain: Neck joints/ligaments u/s
S43.4	**Sprain/strain: shoulder joint (rotator cuff)**
S23.3	Sprain/Strain: Upper back, Thoracic Spine
S23.5	Sprain/Strain: Upper back, Thorax (u/s)
S63.5	**Sprain/Strain: Wrist**
S76.2	Strain, Groin
S46.8	Strain/injury: Trapezius (shoulder/upper arm level)
S86.1	Strain: Calf (injury post. Musc. lower leg)

S29.9	Injury: Chest u/s
S69.9	**Injury: Hand / Wrist u/s**
S09.9	**Injury: Head u/s**
S89.9	**Injury: Knee (lower leg u/s)**
T13.9	**Injury: Leg u/s**
S19.9	Injury: Neck u/s
S39.9	Injury: Pelvis (u/s)
S46.0	**Injury: Rotator Cuff Tendon (shoulder)**
S69.9	Injury: Scaphoid (wrist) u/s
S49.9	**Injury: Shoulder u/s**
T11.5	Injury: Tendon/Muscle, Arm (u/s)
T14.9	Injury: unspecified
T11.9	**Injury: Upper limb eg arm u/s**
M75.1	**Supraspinatus tendonitis (torn/ruptured tendon)**
S56.0	Tear/injury: flexor policis (thumb musc/tendon)
S83.2	Tear/injury: Meniscus (knee, bucket handle tear)
M77.9	**Tendinitis (tendon inflammation) u/s**
M65.9	Tenosynovitis (tendon sheath inflamm.) /Synovitis u/s
M65.8	Tenosynovitis, extensor/flexor (Other Tenosynovitis)
M65.8	**Tenosynovitis, wrist etc (Other Tenosynovitis)**
M65.3	Trigger Finger (nodular tendinous disease)
G56.2	Ulnar Nerve Entrapment/Neuralgia/Lesion
S13.4	Whiplash injury
S61.9	Wound, open (wrist/hand u/s)
M70.9	Writer's Cramp
M70.9	**WRULD/RSI/Overuse syndrome**

Stress/Mental Illness (5)

F43.2	**Adjustment Reaction / Disorder**
F32.2	Agitated Depression (severe episode)
F10.1	**Alcohol Abuse**
R41.3	Amnesia u/s
F41.2	**Anxiety & Depression (mixed)**
F41.1	Anxiety State / Disorder
F41.9	**Anxiety: acute / chronic, u/s**
F91.9	Behaviour Issues / Conduct disorder
F31.9	Bipolar Disorder
Z73.0	Burnout / Vital exhaustion
F48.0	Chronic Fatigue Syndrome
F32.9	**Depression (inc. reactive)**
F34.1	Dysthymia (a chronic depression)
R53	Fatigue / Lethargy / Tiredness
F43.2	Grief Reaction
G47.2	Insomnia - Shifts (sleep-wake disorder)
F51.0	Insomnia (mental, dominant symptom)
K58.9	Irritable Bowel Syndrome (IBS) u/s
R45.4	Irritability & Anger
Z56.6	Mental Health Disorder, unspecified
F39	Mood Disorder/Disturbance, u/s
F51.5	Nightmares / Dream Anxiety Disorder
F42.0	Obsessional Thoughts
F42.9	Obsessive Compulsive Disorder
F41.0	**Panic Disorder / Attacks**
F60.9	Personality Disorder u/s
F40.9	Phobic Anxiety Disorder / State
F43.1	**Post Traumatic Stress Disorder**
G93.3	Post Viral Fatigue Syndrome
F23.9	Psychotic Episode (reactive)
F20.9	Schizophrenia, u/s
Z56.6	**Stress / Strain**
F19.1	**Substance (Drug) Abuse, u/s**
Z91.5	Suicide Risk/Attempt
R45.2	Unhappiness/Worries

Respiratory (1)

R06.8	Abnormality in Breathing (DIB) u/s or other
J06.9	Acute URTI u/s (upper resp tract infection)
J45.0	Allergic Asthma
J30.4	Allergic Rhinitis (u/s)
J61	Asbestosis
J45.9	**Asthma, u/s (inc. Irritant asthma)**
J68.0	**Bronchitis, Chemical (acute)**
J42	Bronchitis, Chronic (u/s)
R07.1	Chest pain on breathing (painful respiration)
R07.4	Chest pain u/s
J60	Coalworker's Lung / Pneumoconiosis
J44.9	COPD u/s
R05	Cough
R49.0	**Dysphonia (hoarse voice)**
R06.0	Dyspnoea
J67.9	Grainhandler's Fever
J68.0	Hypersensitivity pneumonitis (chemical)
J68.9	**Inhalation accident / Respiratory irritation**
J04.0	Laryngitis (acute u/s) / laryngeal irritation
J37.0	Laryngitis (chronic u/s)
C34.9	Lung Cancer (malignant neoplasm of lung u/s)
C45.1	Mesothelioma of peritoneum (malignant neoplasm)
C45.0	Mesothelioma of pleura (malignant neoplasm)
C45.0	Mesothelioma, unspecified (malignant neoplasm)
T56.8	Metal Fume Fever (Toxic effect of metals, other)
R07.3	Other chest pain (anterior chest wall pain u/s)
R07.0	Pain in throat
J31.2	Pharyngitis (chronic sore throat) u/s
J92.0	**Pleural Plaques (with asbestos)**
J60	PMF (Progressive Massive Fibrosis)
J68.3	RADS (Reactive Airways Dysfunction Syndrome)
T78.4	**Respiratory Allergy u/s**
J98.9	Respiratory Disorder u/s
J31.0	**Rhinitis (chronic)**
J30.0	**Rhinitis - vasomotor (irritant)**
J31.0	Sick Building Syndrome
J62.8	Silicosis (Pneumoconiosis due to silica dust)
J32.9	Sinusitis (chronic) u/s
R06.7	Sneezing
J62.2	Throat irritation

A16.9	Tuberculosis (TB), Pulmonary / Respiratory / u/s
J38.1	Vocal Chord / Larynx Polyps
J38.2	Vocal Chord Nodules
R49.8	Voice Fatigue (change in voice n.o.s.)
R06.2	Wheezing

Hearing Loss (4)

T70.0	Barotrauma, otitic
H93.9	Disorder of Ear u/s
T70.0	Effects of change of Ambient Pressure
H83.3	**NIHL (Noise Induced Hearing Loss)**
H93.2	Temporary Auditory Threshold Shift
H93.1	Tinnitus
S09.2	Traumatic TM perforation (ear drum)

Other (6)

B16.9	**Acute Hepatitis B (viral) n/s**
B17.1	**Acute Hepatitis C**
B24	AIDS / AIDS related complex (ARC) n/s
I20.9	Angina n/s
B34.9	**Blood Borne Virus u/s**
H26.1	Cataract (traumatic)
G40.2	Complex Partial Seizures
H10.9	**Conjunctivitis (Red Eye)**
Z20.2	Contact with/exposure to STD
Z20.5	**Contact with/exposure to Viral Hepatitis**
T26.9	Corrosion, Eye (chemical burn)
T70.3	**Decompression Sickness**
I80.2	Deep Vein Thrombosis
A09	Diarrhoea/Gastroenteritis (infectious) u/s
T75.4	Electrocution / Electric Shock
G40.5	Epilepsy
Z57.5	Exposure to toxic agents
R50.9	Fever u/s
T35.4	Frostbite (upper limb) u/s
R19.8	**Gastrointestinal (u/s)**
T67.0	Heatstroke
K43.9	Hernia (Incisional) Ventral u/s
K46.9	**Hernia (u/s)**
K42.9	**Hernia (Umbilical)**
K40.9	**Hernia(s) (Inguinal)**
K46.0	**Hernia (strangulated), no gangrene**
B24	HIV Disease u/s
I10	**Hypertension**
G47.0	**Insomnia (not Mental Health)**
T56.0	Lead Poisoning
B54	**Malaria u/s**
G43.9	Migraine u/s
R25.2	Muscle Cramp u/s
T81.2	**Needlestick / Sharps Injury**
J45.1	Nervous asthma
F45.3	Nervous dyspepsia
A08.1	**Norwalk Virus (intestinal infection)**
R04.0	Nose Bleed

Skin (2)

L70.9	Acne u/s
L23.9	**Allergic Contact Dermatitis, u/s**
T22.0	Burn, forearm, u/s degree
T30.0	Burn, u/s region, u/s degree
T30.4	Chrome Ulcer of skin, elsewhere (corrosion u/s)
T20.4	Chrome Ulcer: Nasal (corrosion, head/neck, u/s degree)
L25.9	**Contact Dermatitis / Eczema, unspecified**
L84	Corn/Callus
L30.9	**Eczema, other, u/s**
T78.4	**Hypersensitivity (allergic reaction u/s)**
L60.0	Ingrowing Nail
L24.9	**Irritant Contact Dermatitis / Eczema u/s**
L23.9	**Latex Allergy (allergic contact dermatitis)**
L60.3	Nail Deformity / Dystrophy
H60.9	Otitis Externa u/s
H60.5	Otitis Externa Acute
H60.8	Otitis Externa Chronic
L40.9	Psoriasis u/s
L98.0	Pyogenic granuloma
R21	**Rash (u/s)**
L59.0	Reddened Skin, due to heat
L98.9	**Skin Disorder u/s**
R21	Skin eruption (u/s)
L27.8	Steroid withdrawal rash (dermatitis from substance taken internally)
L55.9	**Sunburn**
B37.9	Thrush
B35.4	Tinea Corporis (Ringworm, body)
B35.3	Tinea Pedis (Athlete's Foot)
L50.9	**Urticaria, (Hives) unspecified**
L50.6	**Urticaria, Contact / Type I Sensitivity**
T79.3	Wound Infection, post-traumatic

E66.0	Obesity, due to excess calories
E66.9	Obesity, simple, n/s
G20	Parkinson's Disease
K27.9	Peptic Ulcer
S09.2	Perforated Tympanic Membrane (ear drum)
I64	Stroke
T67.0	Sunstroke
G44.2	Tension Headache
T88.1	Vaccine Rash
I86.1	Varicocele (varicose veins, scrotum)
I83.9	Varicose Veins u/s
A08.4	Viral Gastroenteritis (intestinal infection) u/s
B34.9	Viral Infection u/s (site u/s)
A08.1	Winter Vomiting Virus

Appendix 11: Geographical region coding system used to classify the postcode district information provided with each case

REGIONS

01 Tyne and Wear

21 Tyne and Wear

02 Rest of Northern Region

22 Northumbria
23 Cumbria
23 Durham
25 Cleveland

03 South Yorkshire

26 South Yorkshire

04 West Yorkshire

27 West Yorkshire

05 Rest of Yorkshire and Humberside

28 North Yorkshire
28 Humberside

06 East Midlands

30 Derbyshire
31 Leicestershire
32 Northamptonshire
33 Lincolnshire
34 Nottinghamshire

07 East Anglia

35 Cambridgeshire
36 Norfolk
37 Suffolk

08 Inner London

38 Inner London

09 Outer London

39 Other London

10 Rest of South East

40 Hertfordshire
41 Buckinghamshire
42 Berkshire
43 Surrey
44 Kent
45 Essex
46 Oxfordshire
47 Hampshire
48 West Sussex
49 East Sussex
50 Bedfordshire

11 South West

51 Gloucestershire
52 Wiltshire
53 Dorset
54 Somerset
55 Devon
56 Cornwall
57 Avon

12 West Midlands Metropolitan County

58 West Midlands Metropolitan County

13 Rest of West Midlands

59 Shropshire
60 Staffordshire
61 Warwickshire
62 Hereford & Worcester

14 Greater Manchester

63 Greater Manchester

15 Merseyside

64 Merseyside

16 Rest of North West

65 Cheshire
66 Lancashire

17 Wales

67 Clywd

68 Gwynedd
69 Powys
70 Dyfed
71 Gwent
72 Glamorgan – West
73 Glamorgan – Mid
74 Glamorgan - South

18 Central Clydeside

18 Strathclyde regions

19 Rest of Scotland

75 Highland
76 Grampian
77 Tayside
78 Central
79 Fife
80 Lothian
81 Strathclyde
82 Borders
83 Dumfries & Galloway

20 Northern Ireland

84 Northern Ireland

Appendix 12: Skin substance coding system used to code the chemicals and other substances attributed to reported work-related skin diagnoses reported by GPs

Code	Substance
009.9	Nil
045	Bottle coating
046	Res akinol
047	Wlactone
048	Standard series
049	Photo series
050	Paints
051	Dyes and pigments
052	Inks
053	Photographic chemicals
054	Paper/cardboard
055	Glues and adhesives (unspecified)
056	Unspecified textile & finisher, collar stiffener
057	Unspecified polishes
058	Shoe set
059	Leg series
060	Explosives
065	Paint remover/stripper
066	Bleach
067	Cleaning materials
068	Soaps & detergents
068.1	Defoaming agents
068.2	Degreasing agents/defatting
068.3	Shampoo
069	Sterilising & disinfecting agents
070	Cosmetics
071	Hairdressing
071.1	Perms
071.2	Dyes and pigments
071.3	GMTG/acid perm
071.4	ATG/thioglycolate
071.5	Ammonium persulphate
072	Perfumes/fragrances
073	Barrier creams
075	Refrigerant
076	Foods, additives & flavourings
077	Preservatives
080	Fertiliser
085	Cement, plaster & masonry
087	Rubber chemicals & materials & MBT & PTBP
087.1	Thiuram mercapto
090	Smoke
091	Matches/phosphorous sesquessulphide
092	Fire retardants

Code	Substance
098	Unspecified irritants
140	Water/wet work/washing/washing up
140.1	Dirty water
144	Friction/mechanic/dirt/grit/trauma
150	Low temperatures, cold work
150.1	Low humidity/dry air
151	High temperatures/hot work
151.1	High humidity/steam
151.2	Burns
160	Non-ionising radiation-ultra violet
161	Radiation-ionising
164	Visual display unit
169	Irritations-insect bites (NOC), zoonoses (NOC), infestations & infections.
172	Protective clothing & ppe (technical advice)
178	Work involving exposure to dust or fumes
191	Work involving stress, mental health occupational psychology (&stress)
201	Ethyl alcohol (ethanol)
202	Methyl alcohol (methanol)=meths
203	Isopropyl alcohol
204	Amyl alcohol
205	Butyl alcohol
206	Propyl alcohol
207	Allyl alcohol
208	Thios/mercaptans
209	Other alcohols (+lanolin)
211	Ethylene glycol
219	Other glycols
221	Acetaldehyde
222	Formaldehyde (+formalin)
223	Glutaraldehyde
229	Other aldehydes
231	Phthalate esters
239	Other esters
241	Acetonitrile
242	Acrylonitrile
249	Other nitriles
251	Acetamide
252	Di methyl formamide
259	Othe amides
261	Ethylene diamine
262	Hexamethylene diamine
265	Other aliphatic polyamines
266	Methylamine
269	Other aliphatic amines
270	THIOUREAS
280	Nitrosamines
301	Crude petroleum
302	Light petroleum

Code	Substance
302.1	Gasolene
302.2	Kerosen/parrafin oil
302.3	White spirit
302.4	Carba chemicals
302.5	Naphthol
302.6	Benzol
310	PETROLEUM OILS (unspecified oils)
311	Fuel oil/diesel fuel
312	Lubricating oils
313	Greases
314	Oil additives
315	Cutting oils/soluble oils
316	Synthetic coolants
317	Asphalt
321	Petroleum jelly
322	Paraffin wax
331	Naphthalene
332	Biphenyl
333	Benzine
334	Benzpyrenes
335	Anthracene
336	Benzanthracenes
338	Ill-defined aromatic and PAH mixtures Parabens
338.1	Soot
338.2	Tar
338.3	Pitch
338.4	Bitumen
338.5	Creosote
339	Other polycyclic hydrocarbons and PAH'S not specified
341	Aniline
342	Methylene dianiline
343	P-Phenylene diamine (PPD) IPPD rubber antiozonant
344	Pyridene
350	Chloroanilines
351	MbOCA
359	Other chloroalilines
361	Trinitrotoluene
362	Nitrobenzenes
363	Chloronitro benzenes
364	Toluidines
365	Naphthylamines
369	Other and unspecified aromatic amines and nitro compounds (+dichlorobezene)
371	Chlorinated naphthalene
372	Chlorinated paraffins
373	Polychlorinated biphenyls (PCB)
374	Pentachlorophenol
379	Other chlorinated petroleum distillates
391	Nitroglycerine

Code	Substance
392	Nitroglycols
392.1	Ethylene glycol dinitrate
392.2	Other nitroglycols
411	Benzene
412	Toluene
413	Xylenes
414	Mesitylene
419	Other homologues of benzene
421	Chloroform
422	Methylene chloride/dichloromethane
423	Methyl chloride
431	Trichloroethane
432	Ethyl chloride
433	Tetrachloroethane
434	Trichlorofluoroethane
441	Ethylene dichloride
442	Trichloroethylene
443	Perchloroethylene/tetrachloroethylene
444	Ethylene dibromide
449	Other and unspecified halogenated hydrocarbon solvents
461	Corbon tetrachloride
463	Vinyl chloride
464	Vinylidene chloride
472	Bis chloromethylether
473	Glycol ethers
474	Dioxane
475	Tetrahydrofuran
479	Other ethers
481	Acetone
482	Butanone
483	MEK/methyl ethyl ketone thiokols (sealant)
484	MBK/methyl butyl ketones
489	Other ketone solvents
491	Carbon disulphide
492	N-hexane
493	Butadiene
494	Styrene
499	Other solvents
501	Carbolic acids/phenol, Paratertiary butyl catechol
502	Cresols
509	Other corrosive aromatics
511	Hydrochloric acid
512	Nitric acid
513	Sulphuric acid
514	Chromic acid
515	Hydroflouric acid
516	Formic acid
517	Oxalic acid

Code	Substance
518	Acetic acid
519	Other and unspecified acids
521	Ammonium hydroxide
522	Patassium hydroxide (caustic potash)
523	Sodium hydroxide/caustic soda
524	Clay
525	Chalk
529	Other caustic alkalis
530	SILICA AND NATURAL SILICATES
531	Silica (crystalline-including quartz, cristobalite etc)
532	Kieselguhr (amorphous silica-diatomite)
534	Talc
535	Asbestos
539	Other silicates including sand
540	MAN-MADE FIBRES
541	Mineral wools
541.1	Rock wool
541.2	Slag wool
541.3	Glass wool
542	Continuous filament glass fibre, fibre glass
543	Ceramic fibres
545	Other and unspecified MMF
546	Carbon fibres
549	Other and unspecified non mineral fibres
551	Silicon compounds nec
551.1	Silicone compounds
551.2	Other
552	Boron and compounds
553	Sulphur and compounds
554	Phosphorous and compounds
555	Elemental carbon
556	Nitrogen compounds (other than oxides)
556.1	Azo and Diazo compounds
556.2	Azides
556.3	Hydrazines
560	Lead
561	Inorganic lead
562	Organic lead
571	Mercury and its compounds
571.1	Inorganic mercury
571.2	Organic mercury
573	Arsenic and its compounds
573.1	Arsine
573.2	Inorganic arsenic
573.3	Organic arsenic
575	Manganese and its compounds
576	Zinc and its compounds
577	Beryllium and its compounds

Code	Substance
578	Cadmium and its compounds
579	Nickel and its compounds
581	Chromium and its compounds
581.1	Chromates-Dichromate
581.2	Chrome, other chromium
583	Colbolt and its compounds
584	Molydbenum and its compounds
585	Tungsten and its compounds
586	Antimony and its compounds
587	Platinum and its compounds
588	Selenium and its compounds
589	Tellurium and its compounds
591	Thallium and its compounds
592	Uranium and its compounds
593	Vanadium and its compounds
594	Aluminium and its compounds
595	Gallium, germanium and their compounds
596	Tin and its compounds
596.1	Inorganic tin
596.2	Organic tin
597	Lithium and its compounds
598	Silver and its compounds
599	Other and unspecified metals
600	GASES, FUMES AND VAPOURS
610	Carbon monoxide
611	Blast furnace gas
612	Coke oven gas
613	Motor exhaust
619	Other carbon monoxide sources
621	Butane
622	Propane
625	Other LPG
628	Natural gas
629	Other hydrocarbon gases
631	Ammonia
632	Sulphur dioxide
634	Hydrogen sulphide/silphuretted hydrogen
635	Hydrogen chloride gas
640	Oxides of hydrogen
641	Ethylene oxide
642	Other oxides of nitrogen
662	lachrymogenic gases and vapours
664	Freons
665	Anaesthethic gases
665.1	Halothane
671	Chlorine
672	Bromine
673	Fluorine

Code	Substance
674	Iodine
681	Radon
682	Other rare gases
683	Carbon dioxide
684	Ozone
685	Nitrogen
689	Other gases
690	Ill defined fumes and gases
691	Welding fumes
692	Rubber fume
700	PESTICIDES, HERBICIDES AND BIOCIDES
710	Organchlorine pesticides
711	Aldrin
712	Chlordane
713	Dieldrin
714	Benzene hexachloride/lindane
715	Unspecified pesticides
719	Othe organochloride perticides
720	Organophosphate and carbamates
721	Carbaryl
723	Demeton
724	Dichlovos
725	Malathion
726	Parathion
729	Paraquat/bipyridyls
730	Herbicides
731	Other organophosphate and carbamate pesticides
732	2, 4-D
733	2,4,5-T
739	Other herbicides nec
790	Other biocides
791	Methyl bromide
792	TBTO (tributyl tin oxide)
800	DRUGS AND MEDICAMENTS
811	Antibiotics
812	Local anaesthetics
813	Anti fungals
814	Anti histamines
815	Steroids
820	Hormones (including synthetics)
821	Oestrogens
830	ENZYMES
840	TEXTILE FIBRES/DUSTS
841	Cotton
842	Wool
850	WOOD AND WOOD DUST
851	Coal
861	Grain

Code	Substance
862	Flour
863	Food-vegatables/fruit
864	Bracken
865	Plants
866	Fungal-skin infections including dermatophytosis
868	Colophony & flux
870	Aflatoxins and other mycotoxins
890	OTHER BIOLOGICAL SUBSTANCES
891	Leather, skin and furs
892	Laboratory animals and sewerage
893	Viral-skin infections-warts/orf
894	Food-animal eg meat/fish
901	Hydrogen cyanide/hydrocyanic acid
902	Sodium cyanide
903	Potassium cyanides
905	Other cyanides
906	Strychnine and salts
911	Maleicanhydride
912	Phthalic anhydrides
913	Trimellitic anhydrides
919	Other anhydrides
921	Toluene di-isocyanate
922	Methyl isocyanate
929	Other isocyanates
931	Epoxy resins, Epoxy resin hardeners
939	Other resins, Resin hardeners unspecified
941	Polytetrafluoroethylene
942	Polyethylene
943	Polypropylene
944	Polyurethane
945	Polyvinylchloride PVC
949	Other polymers, plastics unspecified
951	Methacrylate esters
951.1	Methyl methacrylate
951.9	Other methacrylate esters
959	Other acrylics and acrylates, Acrylic hardeners
983	Chlorhydrin other than epichlorhydrin
984	Epichlorhydrin
985	Dioxins
989	Hypochlorites
991	Peroxides
991.1	Inorganic peroxides
991.2	Organic peroxides
999	Other specified substances & unspecified

Appendix 13: Respiratory substance coding system used to code the chemicals and other substances attributed to reported work-related respiratory diagnoses reported by GPs

CODES	SUBSTANCE
009.9	Unknown
010	All dusts
011	Hairdressing products
050	Paints
051	Dyes and pigments
051.1	Reactive dye
052	Inks
053	Photographic chemicals
054	Paper/cardboard
055	Glues and adhesives
065	Paint remover/stripper
066	Bleach
067	Cleaning materials
068	Soaps and detergents
069	Sterilising agents and disinfectants
070	Cosmetics
075	Refrigerant
076	Food colourings/flavourings/addictives
076	Food colourings/flavourings/addictives
080	Fertiliser
085	Cement, plaster and masonry; stone dust, quarry dust
090	Smoke
099	Other substances
105	Sensitsers
106	Toxic substances
110	Carcinogenic agents
111	Mutagenic agents
112	Teratogenic agents
113	Reproductive toxicity
120	Genetic manipulation
140	Water/wet work
146	Smoking, active/passive
147	Hard metal's disease
148	Sick building syndrome
149	Ventilation
150	Low temperatures, cold work
151	High temperatures, hot work
152	Lighting and colour
153	Noise
154	Vibration
155	Electricity
156	Ionising radiation
158	Non-ionising radiation
159	Non-ionising radiation

CODES	SUBSTANCE
160	Non-ionising radiation
161	Non-ionising radiation
162	Radio frequencies
163	High intensity magnetic fields
164	Visual display units
165	Offshore health, rig medics
166	Diving, work in compressed air
167	Accidents - protected against
168	Dangerous occurrences
169	Irritations
170	Immunisation
171	First aid (techinical advice)
171.1	Procedures
171.2	Equipment
172	Protecive clothing and ppe
173	Medical examination, medical supervision
174	Biological monitoring
175	Disposal of clinical waste
176	Heavy manual work/lifting
177	Work involving repetitive strain
178	Work involving exposure to dust or fumes
179	Work involving exposure to weather (continual)
180	Work at heights or near vehicles/machinery
181	Work requiring fine/accurate vision
182	Work requiring normal colour vision
183	Work with high dermatitis risk
184	Work requiring normal hearing
185	Work requiring handling of food/involving risk from processing food
186	Employment during pregnancy
187	Abuse of alcohol and other substances
188	Hours of work/shift work
189	Ecology, bionomics, environmental pollution
190	Ergonomics
191	Work involving stress, mental health occupational psychology
192	Rehabilitation: medical examination for course of rehabilitation involving hazards
193	Sickness absence, causes and effects (NOT staff sickness returns)
194	Safety committees and safety reps
196	Training for skill: medical examination for course of training for skill involving hazards
199	Cause not known
200	Alcohols
201	Ethyl alcohol
202	Methyl alcohol
203	Isopropyl alcohol
204	Amyl alcohol
205	Butyl alcohol
206	Propyl alcohol
207	Allyl alcohol
208	Thios mercaptans

CODES	SUBSTANCE
209	Other alcohols
210	Glycols
211	Ethylene glycol
219	Other glycols
220	Aldehydes
221	Acetaldehyde
222	Formaldehyde
223	Gluteraldehyde
229	Other aldehydes
230	Esters
231	Phthalate esters
239	Other esters
240	Nitriles
241	Acentonitrile
242	Acrylonitrile
249	Other nitriles
250	Amides
251	Acetamide
252	Dimethyl formamide
259	Other amides
261	Ethylene diamine
262	Hexamethylene diamine
265	Other aliphatic polyamines
266	Methylamine
267	Ethanolamine
269	Other aliphatic amines
270	Thioureas
280	Nitrosamines
300	Petroleum distillates and related materials
301	Crude petroleum
302	Light petroleum nos
302.1	Gasoline
302.2	Kerosine/paraffin oil
302.3	White spirit
302.4	Naptha
302.5	Napthol
302.6	Benzol
310	Petroleum oils
311	Fuel oil/disease fuel
312	Lubricating oils
313	Greases
314	Oil additives
315	Cutting oils/soluble oils
316	Synthetic coolants
319	Oils nos
321	Petroleum jelly
322	Paraffin wax
330	Aromatic petroleum distillates

CODES	SUBSTANCE
331	Napthalene
332	Biphenyl
333	Benzine
334	Benzpyrenes
335	Anthracenes
336	Benzanthracenes
338	Ill defines aromatic and PAH compounds
339	Other polycyclic aromatic hydrocarbons
340	Aromatic amines and nitrocompounds
341	Aniline
342	Methylene dianline
343	p-Phenylene diamine (PPD)
344	Pyridine
350	Chloroanilines
351	MbOCA
359	Other chloroanilines
361	Trinitrotoluene
362	Nitrobenzenes
364	Toluidines
365	Napthylamines
369	Other aromatic amines and nitro compounds
370	Chlorinated petroleum distillates
371	Cholorinated napthalenes
372	Chlorinated paraffins
373	Polychlorinated biphenyls (PCB)
374	Pentachlorophenol
379	Other chlorinated petrol distillates
390	Other petroleum distillates and related materials
391	Nitroglycerine
392.1	Ethyleneglycol dinitrate
392.2	Other nitroglycols
400	Solvents nec
410	Benzene and homologues
411	Benzene
412	Toluene
413	Xylenes
414	Mesitylene
419	Other benzene homologues
420	Halogenated hydrocarbon solvents
421	Chloroform
422	Methylene chloride/dichloromethane
423	Methyl chloride
431	Trichloroeane
432	Ethyl chloride
433	Tetrachloroethane
434	Trichlorofluoroethane
441	Ethylene dichloride
442	Trichloroethylene

CODES	SUBSTANCE
443	Perchloroethylene
444	Ethylene dibromide
459	Other halogenated hydrocarbon solvents
460	Other halogenated solvents
461	Carbon tetrachloride
463	Vinyl chloride
464	Vinylidene chloride
470	Ether
471	Ethyl ether
472	Bis chloromethylether
473	Glycol ethers
474	Dioxane
475	Tetrahydrofuran
479	Other ethers
481	Acetone
482	Butanone
483	MEK/Methyl ethyl ketone
484	MBK/Methyl butyl ketone
489	Other ketone solvents
490	Other solvents
491	Carbon disulphide
492	n-hexane
493	Butadiene
494	Styrene
499	Other solvents
501	Carbolic acids/phenol
502	Cresols
509	Other corrosive aromatics
511	Hydrochloric acid
512	Nitric acid
513	Sulphuric acid
514	Chromic acid
515	Hydrofluoric acid
516	Formic acid
517	Oxalic acid
518	Acetic acid
519	Sulphuric acid-descaler
519	Other acids
521	Ammonium hydroxide
522	Potassium hydoroxide
523	Sodium hydroxide
529	Other caustic alkalis
530	Silica and natural silicates
531	Silica (crystalline)
531.1	Silicotuberculosis
532	Kieselguhr (amorphous silica0)
534	Talc
535	Asbestos

CODES	SUBSTANCE
535.1	Domestic asbestos exposure
535.2	No known asbestos exposure
539	Other silicates
540	Man made fibres
541.1	Rock wool
541.2	Slag wool
541.3	Glass wool
542	Continuous filament glass fibre
543	Ceramic fibres
545	Other man made fibre
546	Carbon fibre
549	Other non mineral fibres
550	Other non metals
551.1	Silicone compounds
551.2	Silicon compounds n.s
552	Boron and compounds
553	Sulphur and compounds
554	Phosphorus and compounds
555	Elemental carbon
555.1	Carbon black
556	Nitrogen compounds (not oxides)
556.1	Azo and Diazo compounds
556.2	Azides
556.3	Hydrazines
560	Lead
561	Inorganic lead
562	Organic lead
571	Mercury
571.1	Inorganic mercury
571.2	Organic mercury
573	Arsenic
573.1	Inorganic arsenic
573.2	Organic arsenic
573.3	Arsine
575	Manganese
575.1	Manganese compounds
576	Zinc
576.1	Zinc compounds
577	Beryllium
577.1	Beryllium compounds
578	Cadmium
578.1	Cadmium compounds
579	Nickel
579.1	Nickel compounds
581	Chromium
581.1	Chromates
581.2	Other chromium
583	Cobalt

CODES	SUBSTANCE
583.1	Cobalt compounds
584	Molybdenum
584.1	Molybdenum compounds
585	Tungsten
585.1	Stungsten compounds
586	Antimony
586.1	Antimony compounds
587	Platinum
587.1	Platinum compounds
588	Selenium
588.1	Selenium compounds
589	Tellurium
589.1	Tellurium compounds
591	Thallium
591.1	Thallium compounds
592	Uranium
592.1	Uranium compounds
593	Vanadium
593.1	Vanadium compounds
594	Aluminium
594.1	Aluminium compounds
595	Gallium/germanium
595.1	Gallium/germanium compounds
596	Tin
596.1	Inorganic tin
596.2	Organic tin
597	Lithium
597.1	Lithium compounds
598	Silver
598.1	Silver compounds
599	Other metals
599.1	Other metallic element compounds
610	Carbon monoxide
611	Blast furnace gas
612	Coke oven gas
613	Motor exhaust
619	Other carbon monoxide sources
620	Liquid petroleum gas and other hydrocarbon gases
621	Butane gas
622	Propane gas
625	Other liquid petroleum gases
628	Natural gas
629	Other hydrocarbon gases
631	Ammonia
632	Sulphur dioxide
633	Sulphur trioxide
634	Hydrogen sulphide
635	Hydrogen chloride gas

CODES	SUBSTANCE
636	Hydrogen fluoride
640	Oxides of nitrogen
641	Nitrous oxide
642	Other oxides of nitrogen
651	Phosgene
661	Ethylene oxide
662	Lachrymogenic gases or vapours
664	Freons
665	Anaesthetic gases
665.1	Halothane
671	Chlorine
672	Bromine
673	Fluorine
674	Iodine
681	Radon
682	Other rare gases
683	Carbon dioxide
684	Ozone
685	Nitrogen
689	Other gases
690	Ill defined fumes/gases
691	Welding fumes
691.1	Stainless steel welding fumes
692	Rubber fumes
700	Pesticides nos
710	Organochloride pesticides
711	Aldrin
712	Chlordane
713	Dieldrin
714	Benzene hexachloride/lindane
719	Other organochloride pesticides
720	Organophosophate and carbamates
721	Carbaryl
723	Demeton
724	Dichlorvos
725	Malathion
726	Parathion
729	Other organophosph/carbamate pesticides
730	Herbicides
731	Paraquat
732	2, 4-D
733	2, 4, 5-T
739	Other herbicides
791	Methyl bromide
792	Tributyl tin oxide (TBTO)
799	Other biocides
800	Pathogens and micro-organisms
810	Drugs and medicaments

CODES	SUBSTANCE
811	Antibiotics
820	Hormones
821	Oestrogens
830	Enzymes
840	Other textile fibre/dust
841	Cotton
842	Wool
850	Wood and wood dust
851	Coal
860	Other veg and fungal agents
861	Grain
861.1	Hay/straw
862	Flour
863	Food (other)
864	Bracken
866	Fungi/moulds/yeast
868	Colophony and flux
890	Other biological substances
891	Leather, skin, furs and feathers
892	Laboratory animals
892	Laboratory animals and insects
893	Other creatures/animals (not lab)
893	Other creatures
893.1	Crustaceans and fish
901	Hydrogen cyanide/hydrcyanic acid
902	Sodium cyanide
903	Potassium cyanide
905	Other cyanides
906	Strychnine and salts
911	Maleic anhydride
912	Phthalic anhydride
913	Trimellitic anhydride
919	Other anhydrides
920	Isocyanates nos (HDI)
921	Toluene di-idocyanate (TDI)
922	Methyl isocyanate
924	MDI/Di-phenyl methane di isocyanate
929	Other isocyanates
931	Epoxy resins (TGIC)
939	Other resins
941	Poly tetra fluoroethylene
942	Polyethylene
943	Polyproplene
944	Polyurethane
945	Polyvinylchloride
949	Other polymers
949.1	Latex
951.1	Methyl methacrylate

CODES	SUBSTANCE
951.9	Methacrylate esters
959	Other acrylics and acrylates
970	Aflatoxins and other mycotoxins
983	Chlorhydrin
984	Epichlorhydrin
985	Dioxins
989	Hypochlorites
991	Peroxides nos
991.1	Inorganic peroxides
991.2	Organic peroxide
999	Other specified chemicals

Appendix 14: Musculoskeletal coding system used to classify the task and the movement attributed to work-related musculoskeletal disorders reported by GPs

Table 1. List of task codes, description and examples

Task coding		
Code	**Description**	**Examples**
1	Keyboard work	Typing, VDU or computer, checkout, piano
2	Driving screw, cutting	Use of scissors
3	Hammering, chopping, sawing	Carpentry
4	Guiding or holding tool	Painting, boring, drilling, ironing
5	Meat boning or filleting	
6	Packing or sorting	Meat packing, assembly line sorting
7	Assembly (small or delicate parts)	
8	Assembly (large or heavy parts)	Vehicle assembly or repair
9	Materials manipulation	Potter, carpet layer, masseur, gardening
10	Machine operation (heavy or forceful)	Jackhammer, farming equipment
11	Machine operation (light or technical/scientific)	Sewing machine operation
12	Heavy lifting /carrying /pushing /pulling	Digging, loading bins, patient lifting
13	Light lifting /carrying /pushing /pulling	Filing and office work, domestic cleaning
14	Coordinated whole body movement	Climbing, sports, athletics, performing arts
15	Driving: Heavy plant, forklift	
16	Driving: Automobiles	
0	Other	
99	Uncodeable	
88	Only stated accidents	
77	No task recorded, blank, NK	

Table 2. List of Movement codes, description and examples

Movement coding		
Code	**Description**	**Examples**
1	Fine hand	Keyboard, sewing
2	Forceful upper limb /Grip	Bricklaying, hammering, beating, painting, meat boning
3	Torque upper limb	Driving screw
4	Lifting	
5	Carrying	
6	Pushing	
7	Pulling	
8	Forceful leg movement	Machine treadle or foot switch
9	Overhead work	
10	Materials handling n.e.s.	
11	Bending	Digging (with lifting as well
12	Sitting	If relevant (eg: not with keyboard use)
13	Standing /walking	
14	Kneeling	Carpet laying
15	Twisting (postural)	
16	Postural n.e.s.	(Postures not covered under 11-15)
0	Other	Vibration stated, highly repetitive movement stated, heavy manual
99	Uncodeable	
88	Only stated accidents	
77	No task recorded, blank, NA	

Appendix 15: Coding system used to classify precipitating events attributed to work-related mental ill-health diagnoses reported by GPs

Risk Factors of Work Related Mental Ill Health

1.0 Factors Intrinsic to the Job

- **1.1** Workload / over-demand / pressure of work
- **1.2** Work schedule / hours / shift work
- **1.3** Travel / working away from home
- **1.4** Isolation
- **1.5** Organisational factors
  Role poor defined, low job control and perceived lack of support
  Poor management
- **1.6** Under-load / boredom / monotony
- **1.7** Responsibilities

2.0 Changes at Work

- **2.1** Change of management / organisational change / company takeover
- **2.2** Changes in ways of work - e.g. technology
- **2.3** Change of work content (new job, added responsibilities, capability problems - real or perceived)
- **2.4** Reduction in resources available, including staff
- **2.5** Relocation

3.0 Interpersonal Relationships

- **3.1** Interpersonal difficulties with manager / foreman
- **3.2** Interpersonal difficulties with other workers
- **3.3** Interpersonal difficulties with patients / clients / relatives / pupils
- **3.4** Bullying / sexual harassment
- **3.5** Practical joking
- **3.6** Whistle blowing

4.0 Inequality

- **4.1** Racism
- **4.2** Sexism

5.0 Personal Development

- **5.1** Job not secure
- **5.2** Redundancy / unemployment / threat of redundancy / sacked
- **5.3** Business failure, bankruptcy, work related financial problems
- **5.4** Lack of opportunities / demotion
- **5.6** Exams / training pressures / courses / OFSTED / appraisal
- **5.7** Lack of training

6.0 Physical Working Environment

- **6.1** Physical working conditions (temperature, lighting, smell or noise)
- **6.2** Risks to self from environmental factors (chemicals, infection, radiation, etc)
- **6.3** Musculoskeletal risk factors

7.0 Traumatic Events

- **7.1** Violence at work / verbal abuse / sexual assault
- **7.2** Accidents and physical injury

7.3 Traumatic experience of other people, injury or fatality at work
7.4 Disciplinary action / accusation / legal proceedings etc

8.0 Home - Work Interface

8.1 One or more physical illness
8.2 Previous psychiatric illness / Family history of psychiatric illness
8.3 Family responsibilities / home-work interface
Pregnancy / childbirth / children
Severe health problem in close relative
8.4 Severe event
Death in family or close friend
Separation, marital break up or marital problem
8.5 Personal financial problem (excluding business bankruptcy or business failure)

9.0 Others

9.1 War / strife / combat related
9.2 Personal characteristics, e.g. loss of confidence, felt not good enough for the job or over expectation for the job
9.3 Unspecified work stress
9.4 Alcohol & drug abuse
9.9 No reason given

Guidance Notes:

1. If e.g. depression is given as cause and it is unclear whether this is diagnosis/cause/effect, then code it as “9.9 No reason given”.
2. If cannot allocate cause in sub-code, then major code can be used, i.e. 1.0 is an appropriate code.

Appendix 16: Questionnaire sent to participating GPs to establish what proportion of the GPs' registered practice population could be captured by the reporting GP

«Title» «Initials» «Surname» «Centre_Number»
«Address1»
«Address2»
«Address3»
«Town»
«County»
«Postcode»

9th February 2011

Dear «Title» «Surname»

In order to estimate how much of the THOR-GP population (patients registered with all participating practices) is covered by GPs reporting to the scheme, we need to know how many of your practice sessions are covered by you.

We would be grateful if you could answer the following 3 questions. We understand that it may be difficult to give a totally accurate answer (e.g. with locums etc) but if we have some idea of how the practice workload is divided it would be extremely helpful in estimating THOR-GP coverage of the population.

1. How many GPs work in your practice?

2. How many general practice sessions do you do a week?

Please answer 1 to 10

(1 session = 1 morning or 1 afternoon, therefore 10 sessions a week in total would be considered a standard week)

3. How many sessions (including yours) a week does your practice run in total? (Please see example below)

Example: In a practice of 4 GPs

Dr A does 10 sessions

Dr B does 4 sessions

Dr C does 8 sessions

Dr D does 9 sessions

Therefore the total number of sessions is 31

To illustrate how we would use the information you give us, suppose you were **Dr A** in this example, we would then deduce **that you are responsible for 10/31 = 32%** of all sessions

Many thanks for your help with this and your continued support for THOR-GP

Yours sincerely

Dr Kevan Thorley
Senior Clinical Research Fellow
MD MB BChir MRCGP DRCOG Dip Occ Med

Appendix 17: Data (patient postcode, age and gender) extraction guidelines for EMIS IT systems

How to Extract Denominator Information from EMIS for use by THOR-GP

To enable incidence rates of work-related ill health in the UK to be calculated, the THOR-GP denominator (patients registered with all THOR-GP practices) needs to be characterised. Therefore information is needed on the age, gender and postcode of all patients registered with your practice. To insure there is no risk of patients being identified the postcode data is separated from the age and gender before it is sent to the THOR-GP staff. Instructions on how to extract using the EMIS system are as follows:

EMIS will not search for Postcode using the normal search function, but we have found a method of extracting postcode and the other demographic data we need. The principle is to find an existing search, add in postcode, age and sex and then delete all the other data. The procedure may seem a little complex, but if the instructions below are followed, it should be straightforward!

1. From the EMIS "front Screen" select ST "searches and statistics"
2. Select B, A, A, [RETURN], Y
3. Give the search a title "Postcode"
4. Save in Regular Search file (suggested)
5. Run Search
6. Go to search Results - Select "Regular Search", Select search name ("Postcode")
7. Select F "Report Names and Addresses Plus Aspects of Patient Record"
8. Select any search currently stored - *(literally pick any search, preferably a simple one - you will throw away the data we don't want and add in postcode, age and sex - don't worry, the original search is still saved)*
9. Select A "Add Aspect"
10. Select A "Registration Details", Select Sex and Postcode by using the space bar to mark them.
11. [f8] to file
12. Select A "Add Aspect"
13. Select J "Age"
14. Select Y "Age in Years"
15. [f8] to file
16. Select D "Delete Aspects unwanted"
17. Arrow down to delete data not required, leaving "age in years", "sex-current", "postcode"

18. [P] export to excel file

19. When asked to indicate Delimiter Character enter[Return]

20. File as an excel file

21. Save as “postcode” in “my documents”

22. Open the file

23. Highlight the ‘postcode’ column *(by clicking on the field heading ‘postcode’)*, and click ‘Edit’ and then ‘Cut’.

24. Click on ‘sheet 2’ at the bottom of the page, and then click ‘Edit’ and ‘Paste’.

25. Highlight the ‘postcode’ column again, and click ‘data’ and then ‘sort ascending’

26. Click ‘OK’ *(this will alphabetise the list of postcodes)*

27. Save the file again

28. It is now ready to email to THOR-GP at louise.hussey@manchester.ac.uk

Appendix 18: Peer-reviewed published paper from Chapter 3

Hussey L, Turner S, Thorley K, McNamee R, Agius R. **Work-related ill-health and sickness absence in general practice, as reported to a UK-wide surveillance scheme.** Br J Gen Prac, 2008:58, 637-640.

Appendix 19: Peer-reviewed published paper from Chapter 5.1

Hussey L, Turner S, Thorley K, McNamee R, Agius R. **Comparison of work-related ill health reporting by occupational physicians and general practitioners.** Occup Med, 2010: 60, 284-300.

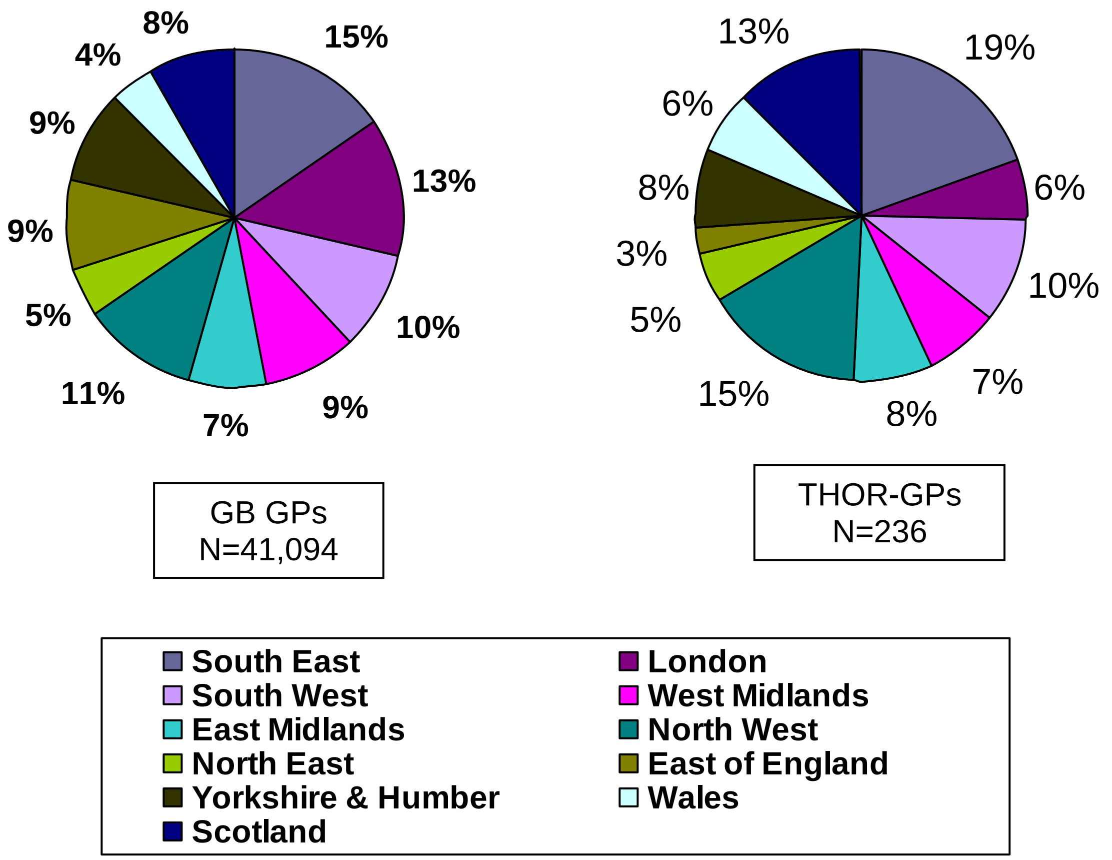
Appendix 20: Peer reviewed published paper from Chapter 5.2

Hussey L, Carder M, Money A, Turner S, Agius R. **Comparison of work-related ill-health data from different GB sources** Occup Med, 2013: 63 (1), 30-37 (Appendix 19)

Appendix 21: Peer reviewed published paper from Chapter 6

Hussey L, Turner S, Thorley K, McNamee R, Agius R. **Work-related sickness absence as reported by UK general practitioners.** *Occupational Medicine* **2012;62:105-111.**

Appendix 22: Distribution of GPs in Great Britain and THOR-GP practice postcodes by government region



Appendix 23: Excerpt from the Health and Safety Executive Annual Statistical report 2010/2011 illustrating the use of THOR-GP data (296)

The Health and Safety Executive Statistics 2010/11 www.hse.gov.uk

KEY FACTS | WORK-RELATED ILL HEALTH | WORKPLACE INJURY | ENFORCEMENT | OTHER TOPICS | SOURCES AND DEFINITIONS

Reports of ill health by doctors and specialist physicians

Since 2005, a surveillance scheme has collected reports of new cases of work-related ill health from a sample of around 300 general practitioners (GPs). In 2010:

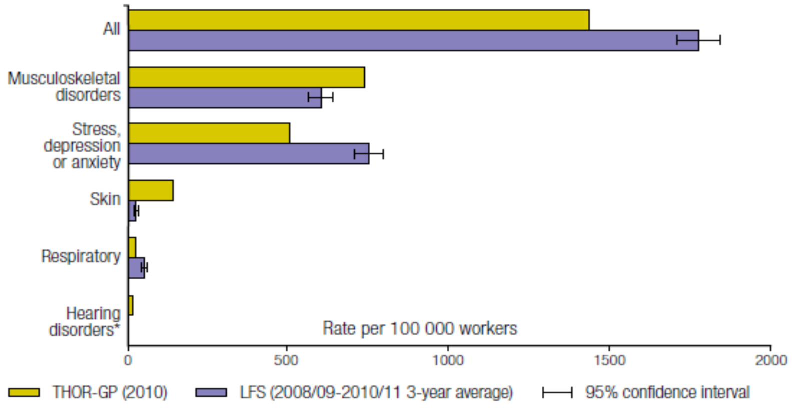
- Musculoskeletal disorders were the most common type of work-related illness.
- Stress, depression or anxiety gives rise to most working days lost.
- The overall rate of new cases of work related ill health is roughly. 1500 cases per 100 000 workers (similar to the rate from the LFS).

Other surveillance schemes collect reports from specialist physicians on specific types of work-related ill health. For example, in 2010 the scheme involving hospital dermatologists recorded over 1100 confirmed cases of work-related dermatitis.

Ill health assessed for industrial injuries disablement benefit (IIDB) in 2010

- There were about 34 000 new IIDB cases, an increase from an annual figure of around 7000.
- This increase was solely due to osteoarthritis of the knee in miners which was added to the prescribed diseases list in July 2009 (28 000 cases in 2010).
- The next largest categories were vibration white finger, carpal tunnel syndrome and respiratory diseases associated with past exposures to substances such as asbestos and coal dust.
- Apart from asbestos related disease and osteoarthritis of the knee, the trend in numbers is generally downwards.

Comparison between THOR-GP and LFS rates for new cases of ill health



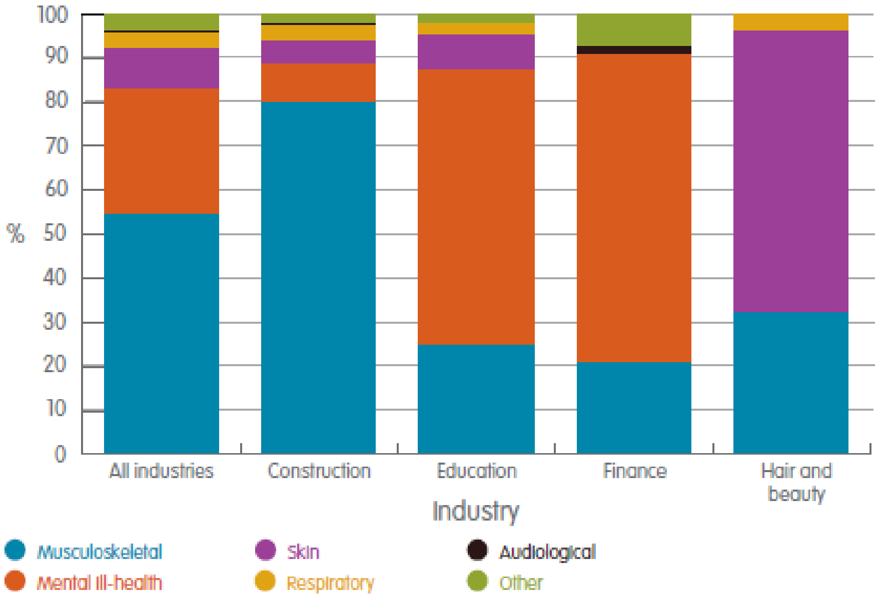
**Labour Force Survey sample numbers are too small to provide reliable rate*

Appendix 24: Excerpt showing THOR-GP data used in 'Working for a healthier tomorrow', Dame Carol Black's review of the health of Britain's working age population (22)

What keeps people out of work?

There is an obvious link between an individual's health status and ability to work. However, this relationship is not always straightforward and is influenced by a number of factors. First, work itself can be a cause of illness. Health and Safety Executive (HSE) figures suggest that around a quarter of days lost through absence may be due to work-related ill-health.[19] Figure 2.12 shows how different industries are likely to be associated with different patterns of work-related ill-health. Therefore, preventative measures need to be tailored to the industry sector, rather than adopting a 'one size fits all' approach. Second, timely diagnosis and intervention that could keep people in or help them to return to work is often unavailable, resulting in high numbers of people absent with relatively mild conditions and at risk of falling out of work. This can be illustrated by the examples of common mental health conditions and MSDs[20].

Figure 2.12 Work-related illness by industry



Note: Based on number of cases. Does not cover Scotland and Wales.

Source: Health and Occupation Reporting Network (THOR), a research programme of the Occupational and Environmental Health Research Group of the University of Manchester