The London School of Economics and Political Science

Understanding the Economics of Workplace Interventions for Common Mental Disorders

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A Thesis Submitted to the Department of Social Policy of the London School of Economics and Political Science for the Degree of MPhil in Social Policy

London, Nov. 2017

Declaration

I certify that the thesis I have presented for examination for the MPhil degree of the London School of Economics and Political Science is solely my own work other than where I have clearly indicated that it is the work of others.

I warrant that this authorisation does not, to the best of my belief, infringe the rights of any third party.

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Abstract

Anxiety and depressive disorders are the most common form of occupational health problems and are major causes of sickness absence, lost productivity and staff turnover, resulting in substantial costs to UK employers and the economy more generally. Economic hardship may increase the number of anxiety and depression cases in the workplace, and people with such problems may be vulnerable to losing their employment or performing in a below-average way. However, the association between anxiety and depressive disorders and employment across different macroeconomic situations in the UK has not been widely studied. Similarly, the economic case for workplace interventions to prevent lost productivity associated with such disorders has also not been well established in the UK. My thesis focuses on the links between common mental disorders and employment. A systematic review was performed to explore what economic evidence exists on workplace interventions that aim to prevent common mental disorders. The review shows that there is some evidence to support the economic case for workplace-initiated interventions of this kind. Another component of my thesis used data from three national cross-sectional surveys (from the Health Survey for England) to examine the links between common mental disorders and employment and the effects of macroeconomic recession. The study findings showed that the likelihood of both unemployment and anxiety or depression were higher during the recession period, while women were more affected by such problems during this period. During a recession, people who were in employment were more likely to work as an employee than be self-employed. Men with some anxiety or depression problems were less likely than women to be employees, whereas men with major problems were more likely to work as employees than women. Another part of this study evaluated the cost-effectiveness of a workplace intervention to prevent sickness absence for people with common mental disorders. Analyses were conducted from both societal and employer perspectives. These cost-effectiveness results came from a transferability study and indicated that the workplace intervention can be cost-effective in preventing the incidence of and time-to recurrent sickness absence. A third empirical component looked at a training programme for managers in a large UK company which aimed to help them recognise and respond appropriately to mental health problems in the people they supervise. A survey was conducted of managers who participated in the training. A cost-effectiveness analysis was designed for the training programme and approved by the company, but the data were not provided to me to allow this part of my study to be completed. Findings from this overall study have implications for policy discussion, for employers and for future research.

Acknowledgements

I would wholeheartedly like to thank my supervisor, Prof Martin Knapp, for his kindness, moral and technical support and guidance from inception to completion of my study. I would also like to thank Associate Professorial Research Fellow David McDaid, my co-supervisor, for his advice, support and constructive feedback on my thesis work.

I am grateful to my co-worker Dr Francesco D'Amico, Ms Catherine Henderson and Dr Bo Hu for their guidance on statistical methods. My special thanks go to Dr Iris Arends and Ute Bultmann from University of Groningen, the Netherlands to provide me intervention data for my transferability study. I am also indebted to Mr Kevin Dool from a multinational company to provide me platform for managing mental health study. I am also thankful to the UK Data Service to allow me access to Health Survey for England data sets for my study.

I am also thankful to the European Commission who provided me Marie Curie Scholarship under MARATONE grant for my study.

I am unreservedly grateful to my family and friends for their encouragement, unconditional love and moral support during my study.

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Chapter 1

1. Introduction

1.1 Common Mental Disorders (CMDs) and the Workplaces

Mental health and wellbeing are fundamental aspects of human survival. The World Health Organization (WHO) defines mental health as "a state of well-being in which every individual realises his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community" (World Health Organization, 2014a). Mental health is about how we feel, think and behave, and imbalances in these factors may result in mental health problems (Dunn, 2016).

The mental health or mental disorders of an individual are shaped by social, economic and/or environmental factors (World Health Organization, 2014b). For instance, poor socioeconomic conditions lead to increased risk of mental disorders and lower wellbeing (Hosman, Jané-Llopis, & Saxena, 2004). Individual and family-related determinants of mental health and disorders may include biological, cognitive, behavioural, emotional, interpersonal and family-related context (Hosman et al., 2004). For example, abuse in childhood may influence anxiety and depressive disorders later in life, whereas secure attachment and family support may reduce those risks (Hosman et al., 2004). Organizational factors can influence mental health and disorders among working populations besides individual, socioeconomic and environmental factors.

Employees' mental health and disorders can be shaped by organizational and other factors in the workplace. These factors may include moral support, organizational culture, leadership, career development, rewards and promotion, decision power, work pressure, engagement and involvement, work and family life balance, and job security (Canadian Centre for Occupational Health and Safety, 2012). For example, psychological help can be supportive for job attachment, commitment, performance and satisfaction, while the lack of it can lead to increased absenteeism, lost productivity, increased costs, burnout, increased accidents, conflict and employee turnover (Canadian Centre for Occupational Health and

Safety, 2012). It is, thus, necessary to create a good working environment to advance mental health and wellbeing among workers for better productivity at work (NICE, 2015).

Common mental disorders (CMDs) are prevalent among working age people (Nigatu et al., 2016). CMDs are generally defined to include depressive disorders and anxiety disorders, including generalised anxiety disorder, phobia, panic disorder and obsessive compulsive disorder (American Psychiatric Association, 2013; Stansfled et al., 2016). People may experience more than one poor mental health symptom and problem at a time (Andrews, 2012; Dunn, 2016).

Depression is characterised by the presence of sad, empty or ill-tempered mood coupled with somatic and cognitive changes that impact their normal function (American Psychiatric Association, 2013). Depression may impair judgemental ability and decision-making processes in affected employees (Harvard Medical School, 2010). Depression is probably the mental health problem that has most frequently been studied in relation to its impact on employment, and in relation to the business case for prevention or treatment. Anxiety disorders usually manifest with behavioural and somatic complaints. The most frequent symptoms of anxiety disorders are restlessness, fatigue, excess worrying and difficulty in concentration. The comorbid condition of anxiety with depressive disorders may present physical and behavioural symptoms (Harvard Medical School, 2010).

CMDs are the most frequently occurring health problems in the workplace. A comprehensive review of the prevalence and disability burden associated with mental disorders in European Union Member States in 2011 revealed that 19% of the disease prevalence from all causes was attributed to common mental disorders (Wittchen et al., 2011). The Office for National Statistics (ONS) for the UK reported that just over 32 million people are currently at work (Office for National Statistics, 2017a) and the Adult Psychiatric Morbidity Survey 2014 showed that 18-19% of working people were experiencing CMDs in any given year (Bridges, 2015). Based on this information, it can be estimated that about 6 million working people in the UK have been experiencing CMDs in any given year. Recent figures from the Health and Safety Executive showed that the prevalence and incidence of stress, anxiety and depression associated with work-related factors were 13.8 and 7.4 cases per 1,000 employees, respectively in Great Britain (HSE, 2015).

A recent survey by the Canada Life Group, an insurance company in the UK, predicted that about 57% of UK employees are experiencing mental health problems while in employment where stress and depression are the most common mental health problems. This study also pointed out that mental health and wellbeing can be negatively affected by a poor working environment. Fifty percent of employees perceive high work pressure and workloads to be a risk to their mental health, followed by 26% who were concerned with workplace bullying and unpleasant interactions with their managers and colleagues (HRD, 2016).

The macroeconomic situation of a country can have a major influence on employment. In the UK, the economic recession that started in the summer of 2008 affected all areas including employment (UK Commission for employment and skills, 2014). During a recession, individuals experiencing CMDs are particularly at risk of work loss and have lower chances of getting a new job (Evans-Lacko, Knapp, McCrone, Thornicroft, & Mojtabai, 2013). In Spain, the prevalence of mental disorders increased substantially during economic recession, with men particularly vulnerable to the impact of recession (Gili et al., 2016). The employment rate in UK fell to 70% in 2011 (during recession) from 73% record of early 2008 (before recession) and then gradually rose thereafter (Office for National Statistics, 2017a), and there was positive correlation between unemployment and mental health problems (Linn, Sandifer, & Stein, 1985). The impact of economic recession on suicide has been well studied in European countries including in the UK (McDaid, 2017), however, the effect of anxiety and depressive disorders on employment in the context of economic recession have not been well studied in England. It is noted that women are more vulnerable to common mental disorders (Stansfled et al., 2016), although, as noted, studies have found that men are more sensitive to economic recession (Gili et al., 2016).

In summary, it is evident that individual factors, socioeconomic conditions and the organisational environment are associated with mental disorders. It is also noted that anxiety disorder and depression are common health problems in workplaces, and have a negative influence on productivity. Hence, a better understanding of the consequences of CMDs in the workplace would help in the effective management of such problems among employees.

1.2 Does mental health matter: the business case?

Mental health problems in workplaces have several consequences for employees and employers. Some are now briefly described.

1.2.1 Disability and reduced quality of life (QoL)

According to the Equality Act 2010, disability can be understood as a substantial and long-term physical or mental impairment in a person that interferes with their normal day-to-day activities (HMG UK, 2010). CMDs were the major contributors to global burden of diseases of which anxiety and depressive disorders accounted for 9.18% years lived with disability (YLD) and 4.56% of disability-adjusted life year (DALY) in 2016 (Global Burden of Disease Collaborative Network, 2017). This study also confirmed that women were more affected by CMDs than their men counterparts.

The Institute for Fiscal Studies in the UK estimated that about £13.7 billion has been spent on disability living allowance, which accounted for 6.7% of total government (UK) expenditure on benefits and tax credits in 2013-14 (Hood & Oakley, 2014). Another study showed that mental disorders were associated with about half (47%) of the total disability benefit claims (Viola & Moncrieff, 2016). Therefore, effective interventions are needed to tackle problems associated with poor mental health in the working age population to reduce disability benefits claims in the UK.

Quality of life is a multidimensional concept of individual perception of well-being attached with socio-cultural systems (Carr, Higginson, & Robinson, 2003; Skinner et al.). A psychiatric survey conducted in the Finnish adult population found that anxiety and depressive disorders were major contributors to poor quality of life (Saarni et al., 2007).

1.2.2 Lost productivity

Sickness absence (absenteeism) and reduced productivity while at work (presenteeism) are common consequences associated with mental disorders (Loisel & Anema, 2013). A recent study from the Canada Life Insurance Group found that just over a half (51%) of employees who were experiencing mental health issues had taken days off work, out of

which 14% took longer than a month of sick leave, including 5% who took more than six months. This study also showed that 60% of employees perceived mental disorders as a barrier to work performance (HRD, 2016). The Office for National Statistics (ONS) reported that stress, anxiety and depressive disorders contributed to a substantial number of workdays lost (15.2 million workdays) in 2013 (ONS, 2014). Research showed that presenteeism was associated with a higher number of total workdays lost compared to absenteeism because in absenteeism employees have taken time off; however, in presenteeism employees present in their job but perform below an average (Hemp, 2004).

Another major consequence of poor mental health is staff turnover. The staff turnover rate is the number of employees who leave a job over a period of time divided by the total number of employees in the organisation. It covers all employees who leave either through retirement, resignation or any other redundancy (Basu, 2017; CIPD, 2015a). Employee turnover is expensive to the employer because of reduced productivity, higher workload for remaining staff, loss of specific skills and knowledge, and costs for hiring and training new staff (Locas, 2013). Employers have long understood that losing staff has negative economic consequences for their businesses, but only 15% of respondents in a resources and talent planning survey 2015 in the UK mentioned that their employers regularly calculate staff turnover costs (CIPD, 2015b).

A survey conducted by Oxford Economics in 2014 estimated that the economic impact of staff turnover costs UK business an average was £30,614 per employee: £25,181 in lost productivity (as it will take time to get optimal productivity from newly appointed staff) and £5,433 in logistics for the staff recruitment process (Oxford Economics, 2014). The resource and talent planning survey report 2015 revealed that the median employee turnover rate was 13.6% a year in the UK, most of which was voluntary (CIPD, 2015b). It can be estimated that UK industries have lost about £129 billion each year due to staff turnover. However, this estimate may not be applicable to all occupations. A research report by Sainsbury Centre for Mental Health (2007) projected that about 5% of staff turnover may be attributed to mental health problems, about £6.5 billion in financial terms in 2015 (staff turnover rate has not been adjusted for here).

Helping employees on sick leave to return to work is one of the most pressing problems for employers. Research findings suggest that the more days a person takes off work with

mental health issues; the less likely it is for them to return back to their job (Department for Work and Pensions, 2003). A well-managed early return to work intervention can be instrumental in reducing long-term absence from work and employee turnover, and improving employees' wellbeing (Fit for Work team, 2015; HSE, 2012).

Mental health problems also cause poor decision-making, an increase in error rates and accidents, and poor relationships at work such as poor relations with clients and colleagues which are common risk factors for conflicts and tensions (Mind & CIPD, 2011; World Health Organisation, 2000). These consequences of mental disorders have potentially substantial costs to employers and society at large.

1.2.3 Economic consequences to the UK employers

In addition to negative consequences for the lives of individual employees, work-related mental disorders have a significant economic impact on organisations/employers and wider societies. There is universal coverage for health services for all residents in the UK, financed mainly through general taxation. Most health services are free at the point of use and provided through the National Health Service (NHS) or in collaboration with private health service providers (Boyle, 2011). Therefore, employers are mostly distressed by the costs associated with sickness absence, lost productivity, staff turnover, and replacing, hiring and training new staff (Lelliott et al., 2008). Similarly, poor mental health can significantly reduce the income and employment rate of employees (Lu, Frank, Liu, & Shen, 2009).

Mental health problems have a significant cost to UK employers. A recent independent review by Deloitte suggests that mental health problem costs UK employers £33bn- £42bn per year, including £8bn sickness absence costs, £17bn- £26bn presenteeism costs and £8bn staff turnover costs (Deloitte MCS Limited, 2017).

1.3 Policy context

WHO has endorsed its Mental Health Action plan 2013-2020, which emphasises the crucial contribution to mental health for a healthy world. This action plan is built on a life-

course perspective, universal health coverage and highlights the significance of a preventive approach (Davies & Mehta, 2013; World Health Organization, 2013b).

In 2010, WHO developed a Healthy Workplace Framework with the intention to provide practical support to employers and workers in their work environment (Burton, 2010). The framework identified four roadmaps to influence a healthy work environment and one of the major components is the psychosocial work environment. This component identifies the predictors of psychosocial hazards and how to create a positive psychosocial work environment. In the same year, WHO developed a healthy workplace: a guide for employees, employers, practitioners and policy makers. This guiding document is based on a healthy workplace framework 2010 and aims to promote and improve mental health of employees (World Health Organization, 2010).

Some policy initiatives are in action in Europe to tackle mental health problems at work. An EU high-level consultation in Brussels in 2008 endorsed the European Pact for Mental Health and Wellbeing. The Pact listed five key sectors to implement strategies of mental health and wellbeing, including mental health in workplace settings (European Union, 2016; Leka et al., 2014; Samele, Frew, & Urquía, 2013). In 2004, European trade unions and associations related to enterprises signed the Framework Agreement on Work-Related Stress (European Union, 2004). This agreement offers a guiding framework to recognize and manage work-related stress problems for employees, employers and their representatives.

The European Network for Workplace Health Promotion (ENWHP) published a guideline in 2011 which emphasises mental health at work (Knifton et al., 2011). This document proposed hands-on guidance for managers and employers for the overall managerial support to employees who are at risk or experiencing mental disorders.

In the UK, if the mental health condition has a long-standing impact on everyday activities, it is considered a disability and a person having such a condition is covered by the Equality Act 2010 (HMG UK, 2010). In 2011, the UK government published a mental health strategy with a title “No health without mental health: a cross-government mental health outcomes strategy for people of all ages.” This document focuses on everyone’s

responsibility for mental health, including workplaces (Department of Health, 2011; Tholl & Associates, 2012).

The National Institute for Health and Care Excellence (NICE) endorsed health guidelines for employers in 2009 in the UK entitled, "promoting mental well-being through productive and healthy working conditions." This document emphasised a planned and harmonised method to improve workers' mental well-being, evaluating alternatives for mental wellbeing and handling workplace-related risks factors, providing a flexible working environment and the responsibility of managers, and assisting different sizes of business for both employees and employers (Bloomer, 2014; Hillage et al., 2014; Mental Health First Aid England, 2013; NICE, 2009).

1.4 Workplace-initiated interventions to tackle common mental disorders

Several strategies have been taken to address mental health problems in workplaces. Comprehensive interventions which cover psychosocial, medical and organisational management components are essential to effectively protect and encourage mental health and wellbeing, and treat mental disorders among employees (LaMontagne et al., 2014b; D. McDaid, Park, & Knapp, 2017). Such programmes should address work-related risk factors, create a positive work environment, as well as employees' strengths and capacities, and provide effective treatment services to employees experiencing mental disorders (LaMontagne et al., 2014b).

Workplace-initiated mental health interventions can be implemented at two levels: individual or group level, and organisational level. The most commonly used mental health interventions at individual or group level consist of psychotherapies, counselling, physical exercises, social skills training and pharmacological treatment. Changes in work practices, flexible work arrangements, training for occupational health providers, managers and supervisors for managing mental health, and training or support to employees to cope with stress and possible mental health issues are also some of the approaches that may be effective at the organisational level (Matrix insight, 2013).

Mental health management training to health providers and line managers can help to reduce days off work associated with CMDs. This thesis highlights training in mental

health for occupational physicians and managers to reduce sickness absence associated with CMDs.

1.4.1 Training for managers and supervisors on mental health management

Mental Health First Aid, England has developed a manual for managers to manage and support employees with poor mental health (Bloomer, 2014; Knifton et al., 2011). The contents of this resource material consist of help for the recruitment process for people with mental disorders, encourage psychological comfort, early recognition and prompt action, regular follow-up to employees who have taken days off work and help early return to work and offer suitable job options, and assist workers with mental disorders at work. This resource material is also a part of mental health training package for managers which aims to give hands-on knowledge and skills for managers to build a conducive work environment such as by initiating awareness-raising activities and assisting employees who feel mental health symptoms (Mental Health First Aid England, 2013).

Studies have shown that good supervision was associated with an increase in perceived work performance and staff retention, as well as job satisfaction and job commitment (Carpenter, Webb, Bostock, & Coomber, 2012). A workplace-based RCT looked at the effects of online mental health training to supervisors for the reduction of employees' distress levels in a sales and service company. This study measured work autonomy in item scores, which decreased compared to supervision provided by untrained supervisors and gives significant effect of the intervention ($p= 0.02$). But the study did not show noticeable reduction on the effects of job stress (Boyd, Hunt, & Ortiz, 2007; Takao, Tsutsumi, Nishiuchi, Mineyama, & Kawakami, 2006). Another study of the same intervention was carried out to evaluate the effectiveness of supervisor support on changes in psychological stress levels among workers. This study showed that the supervisor's support was considerably improved following training, but no significant changes were noticed in psychological stress levels in employees (Kawakami, Kobayashi, Takao, & Tsutsumi, 2005).

A non-experimental study conducted to assess the effects of mental health orientation for managers at an insurance company demonstrated a reduction in serum cortisol level and an

improved decision power in employees (Logan & Ganster, 2005; Skakon, Nielsen, Borg, & Guzman, 2010).

1.4.2 Training for occupational health workers on mental health management

Capacity-building of occupational health providers can have an important role in reducing sickness absence associated with common mental disorders. Proper psychological support together with treatment for employees with mental disorders by their occupational health workers may facilitate faster recovery from mental disorders, early return-to-work from sick leave and reduce recurrent sick leave. Very few economic evaluations of occupational health providers training as a means of workplace intervention to prevent common mental disorders in employees and lost productivity at work have been conducted so far. None of these studies are UK-based. In the following paragraphs, I briefly discuss two of these studies.

A Dutch study was carried out to examine the cost-effectiveness of the SHARP intervention to prevent recurrent sickness absence (RSA) within a randomised controlled trial (RCT) (Arends, Bulmann, van Rhenen, Groen, & van der Klink, 2013). The health providers in the SHARP group were provided with a two-day orientation on problem-solving skills to address days off work associated with CMDs among employees. Participants in the intervention group received treatment coupled with problem-solving intervention from trained occupational physicians. The intervention comprised five steps; to identify problems, discussions about possible solutions, jot down solutions and assess relevance, formulate a plan of action together with line managers, and evaluate progress. The control group received only traditional care from their physicians. After a 12-month follow-up, the study demonstrated that SHARP was cost-effective in preventing the incidence of RSA and delayed the time to RSA when compared to the control intervention. This study also indicated that the SHARP intervention was costly as compared to control and realised no financial benefit to the employers.

Another Dutch study was carried out to assess the economic evaluation of an intervention, based on specific guidelines, for employees experiencing mental disorders (Rebergen, Bruinvels, van Tulder, van der Beek, & van Mechelen, 2009). The health providers in the intervention group were provided with a three-day course on guideline-based care based on

the Netherlands Society of Occupational Medicine guideline for the management of employees with mental disorders by occupational physicians (OPs) (Daniëlle, 2016). The guideline focuses on OPs' role as a counsellor by the use of cognitive and behavioural components to encourage problem-focused management to help early return to work for workers who have taken days off work associated with mental disorders. The findings indicated that the intervention could be cost-effective as there were much lower costs in the intervention group but it was not superior in reducing sickness absence days as compared to control (lower cost and less effective).

1.5 Current challenges of mental health problems at work

It is evident that common mental disorders are major occupational health problems as these are frequent cause of sickness absence, lost productivity and staff turnover, costing billions of pounds to UK business every year. Employers are thus worried about increasing costs of workplace mental health problems (Goetzel, Ozminkowski, Sederer, & Mark, 2002). They are particularly interested in economic benefits of investment in mental health programmes. Effective workplace interventions can reduce costs associated with mental health problems. Several reviews demonstrate the economic case for workplace interventions to reduce common mental disorders and improve productivity (Hamberg-van Reenen, Proper, & van den Berg, 2012; McDaid, 2007; McDaid & Park, 2011).

There are several challenges of employees' poor mental health at the individual and employer or business levels. Stigma associated with mental health issues, lack of motivation to seek care, lack of belief in providers, lack of necessary skills of providers and health system shortcomings are some of the challenges at personal level. Uncertainty around the role of employers to address mental health problems, lack of evidence to support investment in employees' mental health, and information gaps among employers regarding the value of workplace intervention to generate beneficial effects among employees, their families and business itself are some of the examples of organisation-level challenges (Goetzel et al., 2002). Economic recession further complicates the association between CMDs and employment. The effect of those problems on employment may vary by gender.

1.6 Economic evaluation

Economic evaluation is the assessment of alternative courses of action in a systematic approach which is taken to identify, measure and appraise the efforts and results of such actions. The main driver of economic evaluation is to find the best alternatives from the available approaches (Drummond, Sculpher, Claxton, Stoddart, & Torrance, 2015; Silvia Evers, Salvador–Carulla, Halsteinli, & McDaid, 2007). The most commonly used economic evaluation methods in health care contexts are cost-effectiveness analysis (CEA), cost-utility analysis (CUA) and cost-benefit analysis (CBA) (Gray, Clarke, Wolstenholme, & Wordsworth, 2011). A brief description of each economic evaluation method is outlined below.

In CEA, the costs and effects of each option are individually identified, measured, valued and compared between two alternatives to produce an incremental cost-effectiveness ratio (ICER) by dividing the difference in costs between intervention and control groups by the difference in the outcomes of these alternatives (EUnetHTA, 2015; Gray et al., 2011). CUA is a variant of CEA method: it uses a generic measure of health outcomes considering both quality and quantity of life gain (as measured by quality-adjusted life years (QALYs)). In CBA, benefits of the interventions are valued in terms of monetary units, while in CEA those values are assessed in natural units (e.g., deaths avoided, life year saved) (Gray et al., 2011).

There are some issues related to the theoretical foundations of CEA and CBA approaches. CBA can be directly associated with welfare economics theory, where social welfare is the total sum of individual welfare or utility and resource allocation decision can be considered if these measures can result in net social welfare. Some economists have tried to link CEA directly to the welfare economics theory and others have proposed the extension of welfare theory called ‘extra-welfarism’, arguing that utility is not only related to social welfare function, but also with health utility function where sources of measurement and valuation of health outcomes may be different. From this perspective, cost-effectiveness analysis is theoretically and methodologically relevant in health care programmes. CBA addresses the broad questions of allocative efficiency in which input functions represent consumer preferences. On the other hand, CEA addresses the questions of production efficiency, where effective services are being delivered in the lowest possible costs (Gray et al., 2011; Petrou & Gray, 2011).

1.7 Rationale of the study

As I have argued, workplace interventions to prevent sickness absence, lost productivity while at work and staff turnover associated with mental health problems are of growing interest to employers to address the high costs to their businesses and the high wellbeing consequences for employees. Therefore, a well-developed workplace strategy should properly address common mental health problems in employees. It is also important to understand the association between common mental health problems and employment in different macroeconomic situations, in particular at a time of major economic recession. To identify factors which are associated with employment status can also help policy-makers to develop effective policy frameworks and programmes to address problems associated with those factors.

Robust information is lacking in the UK context to confirm whether there is an economic case for workplace-initiated interventions to reduce CMDs in employees and lost productivity at work. Policy-makers and employers still appear to be reluctant to invest in mental health services for employees, perhaps because of the limited and non-conclusive evidence regarding effectiveness and cost-effectiveness of interventions. So, further research on economic evaluations of workplace-initiated interventions could help to support investment in such interventions, and so help to prevent CMDs and reduce both low wellbeing and lost productivity.

Effective training for company occupational physicians and managers to help employees to address mental illnesses at work can be instrumental in reducing the severity of mental health problems, sickness absence and staff turnover. This suggests a need to properly train key staff in employment settings in the skills to support employees to identify problems related to mental health issues, how to help employees to find alternatives to address these problems, prepare plan of action for execution, implement plan of action for solutions and monitor progress and status of employees regarding their mental health. This could be beneficial to achieve organizational goal and improve productivity.

To fill some of these research gaps, my study has addressed the following research questions:

Research question 1: What is the effect of anxiety and depressive disorders on employment and how do gender differences and a country's macroeconomic situation impact on such associations?

Research question 2: What is the evidence on workplace-initiated interventions for the prevention of CMDs in employees? And are these interventions economically worth investing in?

Research question 3: What is the cost-effectiveness of the SHARP-at work (problem-solving) intervention to reduce sickness absence associated with CMDs in the English context?

Research question 4: What is the cost-effectiveness of managing mental health (MMH) interventions for the reduction in sickness absence associated with CMDs?

My study was carried out to examine the impact of anxiety and depressive disorders on employment, explore the economic case for workplace-initiated intervention to prevent CMDs and assess the cost-effectiveness of workplace-initiated interventions to prevent sickness absence associated with such problems.

A cross-sectional study addresses the first research question. This study considered the macroeconomic situation of a country and how the effects of anxiety and depressive disorders on employment status differ in the short-term and long-term following the economic recession in England that started in 2008. I used data from the Health Survey for England. The study also considered the effect of anxiety and depressive disorders on employment status by gender and the impact of employment status on anxiety and depression.

The systematic review answers the second research question. The review was conducted to explore the economic case for workplace-initiated interventions to prevent common mental disorders in employees.

Cost-effectiveness studies were conducted to evaluate the economic case of workplace interventions to prevent sick leave absence related to CMDs. The cost-effectiveness studies address the third and fourth research questions. These studies considered the English context and evaluate the economic case for mental health training to managers and occupational physicians to reduce days off work related to CMDs.

In this thesis, I assess the effect of CMDs on employment in England and explore the possible alternatives to prevent sickness absence associated with such problems in a cost-effective way. This study may therefore help employers and policy-makers decide whether to invest in workplace interventions to reduce CMDs in employees and lost productivity in the English context. It is evident from the literature described earlier that mental health problems are associated with absenteeism, lost productivity and staff turnover that cost billions of pounds to a country every year. Consequently, economic evaluation of workplace interventions to prevent such problems in a cost-efficient way should be highly recommended.

1.8 Ethical considerations

Data from the Health Survey for England (HSE) 2008, 2011 and 2014 were retrieved from the UK Data Service online repository (https://www.ukdataservice.ac.uk/). HSE data were used to assess the effects of anxiety and depressive disorders on employment in different macroeconomic situations in England. For my study related to transferability of economic evaluation results from the Netherlands to the English context, the proposal for my research work was approved and a written data-sharing agreement was set up with the data owner according to the data-sharing policy of their organization. In empirical studies, anonymous data were collected in a way that maintained confidentiality. For the study related to cost-effectiveness of the managing mental health (MMH) intervention, the company in which the study was conducted formally approved the research analysis plan. Written consent was taken from all participating managers through the company's human resources (HR) department. It was expected that secondary data for the MMH study would be collected from HR records held by the company. Unfortunately, I could not access economic and sickness absence data from the company to complete this evaluation despite a considerable amount of preparatory work and engagement with the company. This was due to the unexpected unavailability of the person from the company responsible for

'hosting' my study, and not because of any ethical issue. Data for all three studies were handled according to the Data Protection Act 1998. Furthermore, the London School of Economics and Political Science approved my study proposal.

1.9 Structure of the thesis

The main research question of this thesis is 'What is the impact of mental health conditions on employment across different microeconomic situations and whether workplace-initiated interventions are cost-effective to prevent sickness absence associated with such conditions? To address this overall research question, this thesis systematically reviews the evidence on economic evaluation of workplace-initiated interventions for employees with CMDs (Chapter 2) followed by three empirical chapters which address three specific research questions. Each thesis chapter comprises introduction, methods, results and discussion sections.

There was an increase in common mental health problems among employees following economic recession in 2008. Chapter 3 addresses the research question entitled "What is the effect of anxiety and depressive disorders on employment in short-term and long-term following economic recession in England?" This chapter explores the association of anxiety or depression with employment, and whether the association differs by gender and the macroeconomic situation of the country.

CMDs are one of the major occupational health problems that have negative consequences for productivity and staff retention at work. Employers are losing billions of pounds each year due to such problems, which also have direct economic impact at societal level. Several programmes have been implemented in workplaces to prevent or reduce CMDs. However, no updated comprehensive review of economic evaluations of such interventions has been recorded. To bridge this gap, Chapter 2 addresses the research question entitled 'what is the evidence on workplace-initiated interventions for the prevention of CMDs in employees? And are these interventions economically worth investment?' This chapter explores evidence on economic evaluations of workplace-initiated interventions for CMDs and suggests whether those interventions are economically worthwhile.

Transferability of economic data from one country to another to evaluate cost-effectiveness of an intervention can be one of the alternatives to save time and costs for making policy decisions about implementation of an intervention in a new geographical location. Economic evaluation research on workplace interventions for workers with CMDs in the UK is still very rare. In this scenario, transferability of economic evaluation results from other countries may provide a starting point to study the economics of occupational mental health interventions here. Transferability of multinational trial results in economic evaluation has been practiced across some countries, but disease patterns, medical practice patterns and costs for medical and other service use tend to vary between countries which may pose transferability issues. There are different approaches for transferability of economic evaluation results; in this study I use clinical and productivity results and health service use data from a study country (the Netherlands) and unit cost data from a decision country (the UK) to assess the cost-effectiveness of the workplace intervention. This study is reported in Chapter 4 of the thesis.

To train managers to be better at managing the mental health of employees can have positive results for employers if it reduces lost productivity and staff turnover, as well as health and quality of life benefits for employees. Employers are interested to look at the economic benefits of their investment in employees' mental health and wellbeing. Economic evaluation is one of the several tools to support investment decisions. However, economic evaluations of such interventions in workplace settings are lacking both in the UK and are also rare internationally. To partially fill this gap, Chapter 5 addresses the research question, 'What is the cost-effectiveness of managing mental health (MMH) training for managers to prevent sickness absence with CMDs?' To address this research question, this chapter would have used employee data from a large multinational company, including resource use and sickness absence data to assess cost-effectiveness of MMH intervention from an employer's perspective. My final chapter summarises my study and discusses the implications.

Chapter 2

2. Economic Evaluation of Workplace-initiated Interventions for Common Mental Disorders: A Systematic Review

2.1 Introduction

More than 450 million people around the globe experience mental health problems (World Health Organization, 2013a). One in every four people experience mental health problems, and many of these problems go undiagnosed and untreated (Bloom et al., 2011; Swann, 2011). Global Burden of Disease 2016 estimated that 8.78% of years lived with a disability (YLD) and 2.95% of Disability Adjusted Life Years (DALY) were associated with anxiety and depressive disorders worldwide, while it was 9.18% for YLD and 4.49% for DALY in UK (Global Burden of Disease Collaborative Network, 2017). The total costs of mental disorders (anxiety and mood disorders) in Europe were estimated at around $214 billion (€179.4 billion) in 2010: thirty-seven percent of this figure being treatment costs, twenty-three percent direct non-treatment costs, and forty percent were indirect costs due to productivity loss (Gustavsson et al., 2011). It was projected that the costs of output losses from mental illness would be $8.5 trillion in 2010 and $16.1 trillion in 2030 worldwide (Bloom et al., 2011).

Common mental disorders (CMDs), including anxiety and depressive disorders, are major causes of sick leave, poor levels of creativity and productivity, high levels of staff turnover and premature retirement (David McDaid & Park, 2014). There were 526,000 people who were experiencing stress, anxiety and depressive disorders related to work in Great Britain in 2016/17; which comprised 40% of all ill health at work and 49% of all working days lost (Health and Safety Executive, 2017). Obtaining accurate cost figures for mental disorders associated with workplace factors is challenging, one recent estimate suggests that they led to absenteeism costs of £8bn, £17- 26bn in lost productivity and £8bn staff turnover costs (Deloitte MCS Limited, 2017). This also has adverse impacts on employers, other employees and the wider society.

Although mental health problems at work have been a growing concern in current times (Guarinoni et al., 2013), there is still a limited appreciation of the seriousness,

consequences and need for effective management of such problems in organisational life. Challenges in the workplace include, but are not limited to, understanding of the need for early interventions, treatment and management of early return-to-work (LaMontagne et al., 2014a; Loisel & Anema, 2013).

There are some studies on the effects of workplace interventions to support employees identified as having mental health problems (Fenton, Pinilla-Roncancio, Sing, Sadhra, & Carmichael, 2014). It has, however, been suggested that the economic case of workplace interventions to address CMDs is limited (Hamberg-van Reenen et al., 2012; McDaid, & Park, 2011; Roberts & Grimes, 2011) and not updated. I therefore undertook a systematic review to look at the economic evidence base of workplace interventions for common mental disorders. I aimed to document the setting and form of workplace interventions that have a focus on economic evaluation, as well, making an assessment of the quality of these evaluations.

2.2 Review methods

My review was restricted to economic evaluations of interventions initiated in the workplace to address common mental disorders seen among the employed: stress, as well as anxiety and depressive disorders. The interventions had to be targeted at employees who were at risk of (i.e. vulnerable to) or experiencing these problems (including being on sick leave). Interventions might involve collaboration with other sectors such as primary care or specialist mental health care as long as this care was a part of a workplace-initiated intervention. Diagnostic criteria were study-dependent, and might include DSM-IV or ICD-10 codes or specific diagnostic tools. Economic evaluations could be conducted alongside randomised controlled trials or quasi-experimental studies. Economic modelling studies drawing on data from previous controlled studies were also eligible. I also documented recent economic evaluation study protocols.

2.2.1 Search process

The review was restricted to publications in English between January 2000 and June 2015. I searched published articles in the following databases: PubMed/MedLine, PsycINFO, CINAHL, PsycARTICLES, Web of Science, IBSS, EconLit, Business Source Complete

and ERIC. The search strategy combined terms related to the workplace and employees, with different types of interventions used to deal with mental health problems, and terms related to economic evaluation (CRD, 2009). This strategy was tailored to the specific functionality of each database and software platform. Potentially relevant articles were initially screened based on titles and abstracts, and the full texts were then retrieved for those deemed to meet inclusion criteria. The references of included studies were also scrutinised and additional full-texts obtained where relevant. The detail of the search strategy is presented in appendix 2.1.

2.2.2 Data extraction

At the full text stage, given the number of records identified, studies were first screened by one reviewer (RK). Those deemed eligible were then checked independently by my supervisors (DM or MK). Data were extracted from eligible studies on type of intervention, work outcomes such as absenteeism, work productivity and work limitations, as well as changes in clinical outcomes. Evidence on the category of economic evaluation – categorised as being one or more of cost-effectiveness analyses (CEA), cost-benefit analyses (CBA), cost-utility analyses (CUA) or cost-consequence analyses (CCA) – was documented. Principal findings of the economic evaluation and comprehensive data on resource use and costs were extracted. The cost data of the included studies were converted to US dollars for the year 2014 with necessary adjustment in price inflation.

2.2.3 Methodological quality assessment

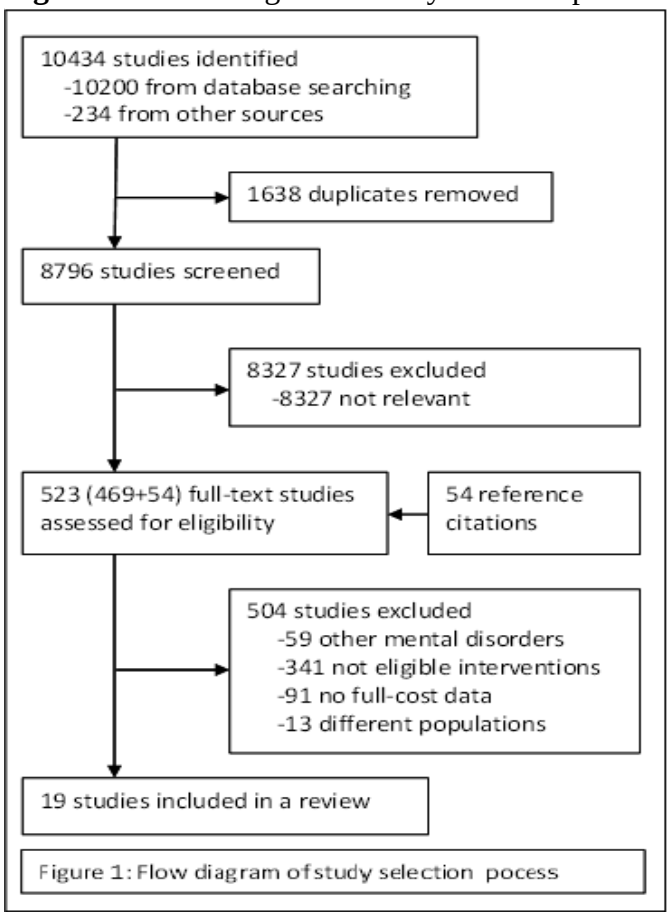
I followed the Consensus Health Economic Criteria (CHEC) list for the assessment of the methodological quality of economic evaluations linked to empirical trials – modelling studies cannot be graded using this checklist (Evers, Goossens, de Vet, van Tulder, & Ament, 2005). This list contains 19 yes/no questions; I adopted a recommended convention (Uegaki et al., 2010) which categorised high-quality studies as those which met 14 of these 19 categories. Those meetings 11-13 check list points were considered as moderate quality and the remainder were categorised as being low quality. This approach had been used in preceding review of economic evaluations in the workplace (Hamberg-van Reenen et al., 2012). To give an indication of the strength of the effectiveness estimates used in these studies, I also reported effect sizes for key outcomes in terms of standardised mean

difference (SMD), a commonly used and absolute measure for reporting intervention effects (Faraone, 2008; Takeshima, 2014; Tian, 2007).

2.3 Results

The PRISMA flowchart in Figure 1 indicates that 10,434 articles were initially identified of which 10,200 were from database searches and 234 from other sources. After duplicates were removed 8796 articles were screened, leaving 523 potentially relevant articles. A further 54 full text studies were obtained based on the references of these studies. 478 articles were excluded after full-text screening leaving 12 studies and 7 study protocols (Figure 1). Ten of the economic evaluations were linked to empirical effectiveness studies and two were modelling studies.

Figure 2.1 Flow diagram of study selection process



2.3.1 Study characteristics

Tables 4.1 and 4.2 summarise the key findings from these 12 studies, five of which were from the Netherlands, four from the USA, two from the United Kingdom and one from Canada. The empirical studies linked to these economic analyses ranged in size from 75 participants (McCraty, Atkinson, Lipsenthal, & Arguelles, 2009) to 617 participants (Noben et al., 2014). Of these 12 studies, five concentrated on employees on sick leave because of their mental health (Arends et al., 2013; Dewa, Hoch, Carmen, Guscott, & Anderson, 2009; Goorden et al., 2014; Rebergen et al., 2009; van Oostrom et al., 2010), while another four were targeted at those still working, but identified as having high-level stress or common mental disorders (Knapp, McDaid, & Parsonage, 2011; Noben et al., 2014; Schneider et al., 2012; Wang et

al., 2006). Three studies were targeted at workers who had not been subject to any screening process, but may have been vulnerable to problems in mental health because of the nature of their work (Bittman, Bruhn, Stevens, Westengard, & Umbach, 2003; Lerner et al., 2012; McCraty et al., 2009).

Most included economic evaluations were set in large-size enterprises. The definition of small-size enterprise was less than 50 employees, medium-size enterprise between 50 and less than 250 employees, and large-size enterprise as 250 & above employees; this definition can be found elsewhere (Rhodes, 2015). Ten of the evaluations were set in public sector organisations and two in private sector organisations. There were two modelling studies: one (Wang et al., 2006) based on a hypothetical cohort of 40-years old US workers and the other study (McDaid, King, & Parsonage, 2011) assuming a hypothetical cohort of white collar employees in a large enterprise. Other workplaces included social security agencies (Arends et al., 2013; Goorden et al., 2014), an insurance company (Dewa et al., 2009), health services (Noben et al., 2014), multiple workplaces in both health care and other sectors (Schneider et al., 2012; van Oostrom et al., 2010), the police (Rebergen et al., 2009), state government (Lerner et al., 2012), a youth correction centre (McCraty et al., 2009) and a long-term care centre (Bittman et al., 2003).

As Tables 4.1 and 4.2 indicate, workplace-initiated interventions included collaborative care (Dewa et al., 2009; Goorden et al., 2014), an e-mental health intervention (Noben et al., 2014), a problem-solving intervention (Arends et al., 2013; van Oostrom et al., 2010), cognitive behavioural therapy (Lerner et al., 2012; Schneider et al., 2012), stress management training (McCraty et al., 2009), counselling (Rebergen et al., 2009), enhanced depression care (McDaid et al., 2011; Wang et al., 2006) and recreational music making (Bittman et al., 2003). The comparators for these interventions were either treatment as usual, routine care, no treatment or wait-list control. In most studies, the participants in the control condition were generally treated by occupational physicians.

Eight of the ten empirical studies involved randomised controlled trials, with the other two being quasi-experimental studies. The duration of studies ranged from twelve weeks (Schneider et al., 2012) to one year (Arends et al., 2013; Goorden et al., 2014; Rebergen et al., 2009; van Oostrom et al., 2010). Four studies (Arends et al., 2013; Noben et al., 2014; Rebergen et al., 2009; van Oostrom et al., 2010) reported that the data analysis was done

based on an intention-to-treat assumption, which meant that the results were reported for all participants, including dropouts and those lost to follow-up, and not just the participants who completed the intervention. Details of the seven protocol papers for relevant ongoing studies are reported in Table 3.

Methodological quality of the included empirical studies was assessed based on scoring of the CHEC list criteria. On average 68% of the criteria were met. Out of ten eligible studies, five were classified as high-quality, one as moderate-quality and four as poor-quality. The assessment of the methodological quality of each study is presented in appendix 2.2.

2.3.2 Economic evaluation results

Notwithstanding variations in methodological approach and in quality, these studies suggest that workplace-initiated programmes to support people experiencing work-related stress, anxiety disorders and depression are worth investing in. I now look in more detail at the specific findings for individual studies.

There is much focus currently on health awareness and early diagnosis to manage mental health problems and the role that can be played by e-health applications, such as mobile phone and computer-delivered mental health literacy and counselling programmes. Two economic evaluations of these types of intervention were identified. In the UK, one RCT compared the use of an online cognitive behavioural therapy programme known as MoodGYM against information on websites providing information on mental health, for employees identified as having depressive symptoms working in one large private sector company, British Telecom, and two public sector organisations, Transport for London and the National Health Service (NHS) (Schneider et al., 2012). But, this study was limited by a short time-frame and a high level of sample attrition. Delivered over six weeks, only 171 of 318 people completed the course and just 102 had 12-week follow-up data. MoodGYM was not associated with better outcomes than the comparison group, nor was it any more cost-effective; the intervention was, however, viewed favourably by participants.

In the Netherlands, a cluster randomised controlled trial focused on 633 hospital nurses screened and classified as vulnerable to depression or anxiety disorders (Noben et al., 2014). After the screening test, they were randomised to receive either occupational

physician treatment, use of different preventive e-mental health interventions, or no further intervention. E-mental health interventions included programmes to encourage good mental health, practical skills to become resilient with work-related stress, addressing depressive symptoms, reducing symptoms of panic disorders and reducing risky alcohol consumption. This study found that the use of e-health interventions was not cost-effective, partly because of the poor rate of uptake. It was less costly but also less effective than taking no action. In contrast, provision of occupational physician care was dominant (more effective and less costly compared to controls).

Several evaluations, in addition to this Dutch study among nurses, have looked at the role of occupational physician services. Another promising Dutch study evaluated guideline-based occupational physician (OP) care for 240 police who had taken days of work because of mental disorders (Rebergen et al., 2009). This was compared with usual care, which typically meant a referral to a psychologist. OPs received 3 days of training focusing on early initiation of counselling using cognitive behavioural approaches to help workers with problem-solving techniques. They found that the intervention was significant in reducing health care costs with reference to usual care, but this had no effect in reducing sick-leave days. From an employer perspective, the intervention gave $2.5 in monetary benefits for every $1 spent.

Table 2.1 Primary data-based workplace-initiated interventions studies related to CMDs in employees

Author/Year of Publication **Country of study**	**Intervention (I)** **Comparator (C)**	**Study population** **Duration of study**	**Study design** **Type of analysis**	**Perspective** **Price year**	**Main resource and cost results**	**Effectiveness results**	**Synthesis of costs and effects**	**Sensitivity analysis** **Intention-to-treat**
Economic evaluations with RCTs								
(Goorden et al., 2014) Netherlands	I: Collaborative care-consisting of manual guided self-help, 6-12 sessions of problem solving, a workplace intervention and if necessary, medication C: Care as Usual (CAU) - Care provided by occupational physicians	126 employees (65 in intervention and 61 in control groups), who were absent from work for 4-12 weeks due to major depressive disorder 12 months	RCT CUA	Societal perspective 2014 US$	Average total health care cost (per person per year) Collaborative care: $ 4985; CAU: $5880 Average total productivity costs (per person per year) Collaborative: $12922 (SD: $14628) CAU: $14861 (SD: $23958)	Quality of life scores improved significantly in both groups after one year follow up period (Collaborative care: 0.11 (95% CI: 0.07–0.14) and CAU: 0.16 (95% CI: 0.11–0.19)) but the difference in scores between groups were not statistically significant: 0.05 QoL score (95% CI: -0.11 to 0.00)	Intervention: lower cost and less effective ICER: $18647/QALY	Yes Not stated
(Noben et al., 2014) Netherlands	I1: Referral to occupational physician I2: Referral to one of several e-mental health programmes (depending on the nature of mental health problem): promotion of mental fitness & wellbeing; coping with stress; coping with depressive symptoms; panic disorder and risky alcohol consumption. C: Control condition: No further action	633 nurses (e-mental health 212, OP care 2010 and usual care 211) in a hospital screened and identified as being at risk of common mental health problems. None of the nurses were on sick leave. 6 months	RCT (Pragmatic clustered randomised trial) CEA	Societal perspective 2014 US$	At 6 months average total costs per participant were: I1: $1602, including $128 in health care costs, absenteeism $296 and presenteeism $1159 I2: $1740 including $130 in health care costs, absenteeism $291 and presenteeism $1286 C: $2217 including $125 in health care costs, absenteeism $473 and presenteeism $1604	Work Functioning as measured by Nurses Work Functioning Questionnaire Work functioning in C: 20.4% compared with 23.7% for I1 and 15.7% for I2.	I1: Dominant compared to control with better outcomes and lower costs 12: Less effective, but less costly than controls	Yes Yes
(Arends et al., 2013) Netherlands	I: 2-day training for occupational physicians to empower more structured use of guidelines. C: Occupational physicians who did not receive this training	158 workers (I: 80, C: 78) aged between 18 and 63, diagnosed with a CMD by their occupational physicians (OP) at the start of sickness absence and willing to return to work 12 months	Clustered-RCT CEA CBA	Societal and employer's perspective 2014 US$	Mean total training costs for SHARP at work intervention per worker was $845. Mean (SD) total health care cost: SHARP at work: $5326 SD: $12024) CAU: $3071(SD: $3017) Mean (SD) costs of lost productivity by friction cost approach:	The mean effect difference in sickness absence days between the SHARP –at work and CAU groups was 55 (95% CI: 2.85 to 106.09) days, in favour of SHARP-at work group.	ICER: $13555 per 1% percent reduction in sickness absence. ICER: $3596 per one day of sickness absence avoided. NMB: $7105	Yes Yes

Author/Year of Publication Country of study	Intervention (I) Comparator (C)	Study population Duration of study	Study design Type of analysis	Perspective Price year	Main resource and cost results	Effectiveness results	Synthesis of costs and effects	Sensitivity analysis Intention-to-treat
					SHARP-at work: $36037 (SD: $18571) CAU: $31014 (SD: $23096)			
(Schneider et al., 2012) UK	I: Computerised CBT, MoodGYM-modularised web-based course designed to last for 5 weeks C: Attentional control-five websites with general information about mental health	637 (I: 318, C: 319) employees aged 18 and above were enrolled from three UK based companies 12 weeks	RCT CUA	Societal and employer's perspective 2014 US$	Total costs per participant (including lost work) at baseline MoodGYM: $2542 (SD: $5436) Control: $2663 (SD: $5436) Total costs per participant (including lost work) at 5-week period MoodGYM: $192 (SD: $694) Control: $229 (SD: $1398)	Quality of Life was measured using the EQ-5D. No evidence for a difference in the average treatment effect on the Work and Social Adjustment Scale score (effect - 0.47, 95% CI: - 1.84; 0.90, P=0.5) Participants in the MoodGYM arm had fewer days off work during the intervention period, but this was not statistically significant.	MoodGYM was not associated with any improvement in quality of life. There was also no difference in costs between treatment and comparator groups.	Yes Yes
(Lerner et al., 2012) USA	I: Work and health initiative (WHI) intervention provided over the phone by EAP counsellor trained in WHI methods which includes work coaching and modification, care co-ordination and CBT strategies. C: CAU	79 working age employees (I: 103, C: 105), aged 18 to 62 years, with major depressive disorders 4 months	Early-stage RCT Cost Consequence analysis	Employer's perspective 2014 US$	Annual mean productivity cost saving from WHI programme = $3842 per participants (unadjusted) Annual increase in lost productivity cost in CAU= $3165 per participant (unadjusted)	Work performance indicators improved in the range 20% - 50%; improved work productivity loss for an average of 3.5 percentage points; productivity loss due to absences improved 7.1% and depression severity mean scores reduced by 5.4, all effectiveness outcomes were statistically significant at p <0.01 in the WHI intervention compared to CAU.	The new programme was superior to CAU. The estimated cost savings through productivity gains from WHI intervention compared to CAU were $6487 per participant annually (adjusted)	Yes No
(van Oostrom et al., 2010) Netherlands	I: Standard occupational physician care plus referral to return to work coordinator. C: Standard occupational physician care	145 employees with distress and who were sick-listed for 2-8 weeks 12 months	RCT CEA CBA	Societal Employers' perspectives 2014 US$	No obvious differences in mean health care costs between groups: I $4108 C: $3540. Mean costs of occupational health services significantly higher in intervention group: $1779 vs $1029. Mean costs of lost productivity by the human capital approach were $1801 (95% CI: $$4163 to $8122), higher costs in the intervention group	No significant differences in duration of sick leave until RTW: Intervention group: 133 (SD: 109) days; CAU: 134 (SD: 108) days No significant difference was observed in QALYs (measured using EuroQoL 5D) between the intervention and the comparator.	The intervention was not found to be cost effective, with higher costs and no difference in effectiveness outcomes. However, subgroup analysis restricted to employees self-motivated to return to work would generate a net monetary benefit of $8012 to the employer.	Yes Yes

Author/Year of Publication Country of study	Intervention (I) Comparator (C)	Study population Duration of study	Study design Type of analysis	Perspective Price year	Main resource and cost results	Effectiveness results	Synthesis of costs and effects	Sensitivity analysis Intention-to-treat
(Rebergen et al., 2009) Netherlands	I: An activating counselling guideline-based care (GBC) by occupational physicians C: CAU with minimal occupational physician input and easy access to a psychologist	240 police workers on sick leave due to mental health problems. 125 intervention group and 115 in control group 12 months	RCT CEA CBA	Societal and employer's perspectives 2014 US$	Average total health care costs were I: $3052 (SD: $2898) C: $3790 (SD: $2265). Indirect cost due to lost productivity (net) by human capital approach: GBC: $20,080 (SD: $14,662) CAU: $20,205 (SD: $15,493.	There was no significant difference in mean sick leave days between the groups. I: 113 (SD: 83) days; C: 114 (SD: 87) days	The intervention could be cost- effective as it was associated with lower health care costs, with no difference in outcomes between the two groups From a company perspective, NMB was $4066	Yes Yes
(Bittman et al., 2003) USA	I: Recreational music making (RMM) – 6 sessions of group drumming and keyboard accompaniment C: No intervention	112 long-term care workers Wesbury United Methodist Retirement Community Intervention: 6 weeks; follow-up: 12 weeks	Randomised crossover study ROI	Employer's perspective 2014 US$	Average RMM intervention costs were $1,843 per year Average cost per staff turnover = $10,150	46% improvement in burnout and mood dimensions; 18.3% reduction in staff turnover	ROI = $61 return per dollar spent	No No
(Dewa et al., 2009) Canada	I: Treated in a collaborative mental health care (CMHC) programme during disability episode C: Care as Usual (no CMHC)	126 employees (I: 73, C: 51) who received short-term disability benefits for psychiatric disorders 1 year	Quasi-experimental CEA	Employer's perspective 2014 US$	Average cost: CMHC: $2259 (median: $2173) Control: $396 higher than CMHC Difference in costs was not statistically significant (t = 1.69, df = 93.37, P = 0.09).	Higher rate of return-to-work (chi sqr = 8.06, df = 1, P = 0.005) and a lower rate of long-term disability leave (chi sqr = 12.84, df = 1, P < 0.001) in CMHC compared to control group. Average number of days on short-term disability leave was significantly shorter for the CMHC group (t = 2.17, df = 108.49, P = 0.03).	Disability benefits' savings from the CMHC program were $562 per person (at zero WTP), less costly than the control group.	Yes No
(McCraty et al., 2009) USA	I: Intervention group received training in emotion self-regulation techniques intended to reduce stress and health risk factors C: wait-list control group	75 correctional officers from the Northern California Youth Correctional Centre in Stockton participated in the study 6 months follow up	Quasi-experimental with random-ly assigned groups Cost-consequences analysis	Health systems perspective 2014 US$	Estimated average annual health care cost per employee: Intervention: $7,995 Pre-intervention: $7,758.	There were significant increases in productivity, motivation, goal clarity, and perceived support (p- <0.05).	Average annual savings of $1,438 per employee from intervention compared to control mainly through increased productivity.	No No

Table 2.2 Model-based economic evaluation of intervention studies related to CMDs in employees

Author/year of publication Country of study	**Intervention (I) Comparator (C)**	**Study population Duration of study**	**Study design Type of analysis**	**Perspective Price year**	**Main resource and cost results**	**Effectiveness results**	**Synthesis of costs and effects**	**Sensitivity analysis**
(McDaid et al., 2011) UK	I: Workplace-based enhanced depression care-Screening followed by CBT (6 sessions over a 12-week period) for those suffering from or at risk of depression C: Taking no action	Hypothetical population of 500 employees in a white-collar enterprise 1 year	Decision Analytic Modelling ROI	A business perspective 2014 US$	The intervention costs were estimated at $66 per employee per year.	Reduction in absenteeism and presenteeism. Depression outcomes were not recorded.	The gain arising from reduced presenteeism and absenteeism of $64,086 in year one, which clearly outweighs the intervention costs.	Not stated
(Wang et al., 2006) USA	I: Brief training to physicians and care managers in enhanced care practices to provide high-quality depression care C: CAU group received no contacts with the regular care manager during the initial or continuing phases of the intervention	A national sample of 198 workers employed in a range of positions by companies, and 1000 hypothetical cohorts were generated. 2 years	Cost Benefit Model alongside RCT (Simulation) CUA CBA ROI	An employer perspective 2014 US$	It was estimated that enhanced depression training and treatment cost was $ 102,640 in year 1 and $23459 in year 2 (estimation was based on 1000 workers).	Improved self-reported productivity and absenteeism	ICER: $26,514/QALY Average net benefit Year 1: $40 per worker Year 2: $341 per worker ROI: $3 for every dollar invested	Yes

Table 2.3 Study protocols for economic evaluation of interventions related to CMDs in employees

Author/ Publication year/country of study	**Intervention (I) Comparator (C)**	**Study population Duration of study**	**Study design Type of analysis**	**Perspective/ Price year**	**Measures of main resource and cost results**	**Measures of effectiveness results**	**Measures of costs and effects**	**Sensitivity analysis/ Intention-to-treat**
(Audhoe, Nieuwenhuijsen, Hoving, Sluiter, & Frings-Dresen, 2015) The Netherlands	I: Brain-work Intervention (social and medical interventions, including counselling and refer for treatment) C: CAU (receive counselling as usual)	300 sick-listed workers (150 in each arm) due to mental health problems for Dutch Social Security Agency (SSA) 12 Months follow up	Controlled Clinical Trial Cost benefit study	Insurer's perspective Not stated	The cost associated with brain-work interventions will be training and educational costs of the professional, wage of professionals and intervention costs itself. The usual care cost will include the wage of professional and intervention costs (if applied)	Duration of sick leave Proportion of workers return-to-work SSA transfer to RTW Paid duration during follow-up Degree of participation Psychological complaints (GHQ-12) Self-efficacy for return to work	Incremental cost and benefits The benefits will be the savings in sickness and unemployment benefits claims	Not stated Yes
(Ebert et al., 2014) Germany	I: GET.ON Stress (minimal guided and unguided occupational stress management interventions) C: CAU (wait-listed control)	Currently employed workers aged 18 and above with ≥22 perceived stress score (n=408, 136 each for all three arms) 6-months follow-up	RCT CEA CUA CBA	Societal, An employer perspective Not stated	The cost will be collected using the German version of the Trimbos and institute of Medical Technology Assessment Cost Questionnaire for Psychiatry (TiC-P) questionnaire	Perceived stress at post-treatment Depression symptoms measured by the CES-D Emotional exhaustion Work engagement Quality of Life (EQ-5D)	CEA: Cost/health outcomes CUA: Costs/QALY gain CBA: Incremental net-benefit	Yes Yes
(Lammerts, Vermeulen, Schaafsma, van Mechelen, & Anema, 2014) The Netherlands	I: participatory supportive RTW programme (guidance by RTW coordinator and insurance physician, inventory of obstacles for RTW, brainstorm session, preparation for implementation, placement in a matching competitive workplace, evaluation, and training of the professionals) C: CAU (usual occupational health care)	172 (86 for each group) sick-listed employees (18-65 years) due to mental health problems without permanent contract 12-months follow-up	RCT ROI	Social insurer's and societal perspectives Not stated	Costs will be measured based on social insurer's and societal perspectives. Direct costs include, health care utilisation costs, OHC and investment in vocational rehabilitation Indirect costs include paid sickness benefit costs	**Primary outcome:** Duration until first sustainable RTW **Secondary outcome:** Duration of sickness benefit Severity of mental disorder symptoms (4SDQ) Perceived general health status (SF-36) Quality of life (Euroqol) Work limitations (WLQ) Health care utilization (Tic-P) Patient satisfactions	ROI of the intervention will be calculated	Yes Yes
(Yuan, Liu, Tang, & Zhang, 2014) Hong Kong	I: Happy@Work training (individualised self-learning, web-based programme covering four psychological components, hope, efficacy, optimism and resilience)	354 or more full-time workers (especially for large and medium size companies)	RCT	Employers' perspective	Cost of investment of intervention Average costs of Happy@Work training	**Primary outcome:** Individuals' psychological capital level **Secondary outcomes:** Individuals' well-being,	Return on Investment (ROI)	Yes Yes

Author/ Publication year/country of study	Intervention (I) Comparator (C)	Study population Duration of study	Study design Type of analysis	Perspective/ Price year	Measures of main resource and cost results	Measures of effectiveness results	Measures of costs and effects	Sensitivity analysis/ Intention-to-treat
	C: CAU (wait-list control)	3 months	ROI	Not stated	Average costs in control group	depressive symptoms, work engagement and productivity		
(Heber et al., 2013) Germany	I: The intervention group will receive the web-based stress-management training "GET.ON Stress" C: Wait list for a six month	548 employees from the general working population aged 18 years or older with stress problems 1-year follow-up	RCT CEA CUA	Societal perspective	The study will estimate direct medical cost, direct-non-medical costs, and indirect costs such as lost productivity using TiC-P questionnaire	Primary outcome is perceived stress. Secondary outcomes are the effects of depression, anxiety, emotional exhaustion, emotion regulation, work engagement, and absenteeism /presenteeism	Incremental Cost-effectiveness Ratio (ICER) for CEA. For cost-utility analyses, costs per quality-adjusted life years (QALYs)	Stated Not stated
(Thiart et al., 2013)	I: A guided self-help online sleep training (GET.ON Recovery)- C: A waitlist-control condition	128 German teachers with significant clinical insomnia complaint (Insomnia Severity Index ≥15) and work-related rumination (Irritation Scale, sub-scale Cognitive Irritation ≥15) 6 months follow up	RCT CEA	Societal perspective	Direct and indirect cost will be calculated. Presenteeism, absenteeism, health care utilisation costs will be obtained from Trimbos /iMTA questionnaire for costs associated with psychiatric illness (TiC-P)	The primary outcome measure will be insomnia severity Secondary outcomes include sleep effort, sleep hygiene, sleep quality, work stress, depressive symptoms, worrying, work-related rumination, recovery experiences, recovery activities, teacher self-efficacy, work engagement, work satisfaction, **health related quality of life**.	Quality adjusted life year gain will be obtained from SF-6D, To obtain CEA, ICER will be calculated.	Stated Not stated
(Geraedts, Kleiboer, Wiezer, van Mechelen, & Cuijpers, 2013) The Netherlands	I: A web-based guided self-help course- Happy @Work (6 weekly lessons) based on problem solving technique, cognitive therapy, and a guideline to help employee with stress symptoms C: Care as usual-this group will not receive treatment or support from the researchers, but can take any help they want from others.	Employees with an increased level of depressive symptoms from companies with white collar workers, aged 18 years and older, who willing to participate in the study (n=200) 12-months follow-up	RCT CEA CBA	Societal and employer perspective	A revised version of the Trimbos and iMTA Questionnaire on Costs Associated with Psychiatric Illness (TiC-P) will be used to collect data on direct and indirect costs from the intervention	Primary outcome is depressive symptoms as measured by the Center for Epidemiological Studies Depression – scale (CES-D). Secondary outcome measures such as work performance as measured by WHO Health and Work Performance Questionnaire (HPQ); burn-out symptoms as measured by the Maslach Burnout Inventory-General Scale (MBI); anxiety symptoms as measured by Hospital Anxiety and Depression Scale (HADS); quality of life as assessed with the EQ-5D.	The ICER is expressed in terms of additional costs per clinically significant change in depressive symptom severity (cost-effectiveness analysis) and in terms of Quality Adjusted Life Years (QALY) (cost-utility analysis) In CBA, the costs of the intervention will be compared to the benefits in absenteeism, depression and work performance	Not stated Not stated

Fidelity in the use of the Netherlands Society of Occupational Medicine's guidelines on OP support to help 158 workers (from many different employers) who were taking days of work associated with CMDs to return to work has also been the subject of economic evaluation in the Netherlands (Arends et al., 2013). A specific two-day training course, known as SHARP, was provided to OPs to help them better structure their treatment in line with the national guideline. The training recommended five steps the OPs should recommend to employees in their treatment to aid return to work: making lists of problems or opportunities after return to work, thinking about alternatives, jot down resolutions, discoursing the resolutions and formulating plan of action, and finally assessing these plan of action (Arends, 2013). Employees in the comparison group received support from OPs who had not undergone the two-day training course, but nonetheless would have been fully aware of the national guideline. The SHARP group had substantially higher health care costs compared to usual care ($5326 vs $3071), but also had significantly better outcomes for rates of return to work while lower future recurrence of sick leave. From a company perspective, there was no positive return on investment. This intervention did not appear to be cost-effective with an incremental cost of $13,555 per 1% reduction in recurrent sickness absence. The authors did, though, note that excluding one high-cost individual outlier from the analysis would lead to the intervention becoming cost-saving compared to usual care.

Another controlled trial study in the Netherlands, looking at 145 employees from a large steel company, a university and a medical centre of a hospital compared standard OP care with OP care plus referral to their company's return to work (RTW) coordinator (van Oostrom et al., 2010). The RTW coordinator intervention consisted of three meetings within two weeks, the first with the employee to identify obstacles to RTW, the second with the supervisor to discuss these obstacles and the third between all three parties to discuss alternatives and agree on implementation plan. The RTW intervention had no substantial effect on time until return to work. Moreover, no substantial change was observed in quality of life outcomes, and higher health care costs were recorded in the RTW group. From the employer's perspective, there was also no financial advantage realised because of the intervention. However, sub-group analysis restricted to employees who were self-motivated to return to work suggested that the approach could be cost-effective if targeted at this group.

In Canada, Dewa et al. (2009) examined the economic case for comprehensive care in mental health for employees experiencing short-term disability with mental health problems. They observed savings of $562 per person from the CMHC programme compared to usual care. The CMHC programme consisted of collaborative care concepts which include psychological examination, immediate treatment by a psychiatrist, psychological support from primary care physicians, and the accessibility of psychiatric visit in standard care group.

In the US, a study by Goorden et al. (2014) found that the ICER of workplace intervention was $18,647 per QALY gained with reference to usual care delivered by the occupational physicians. The intervention consisted of 6-12 visits to deliver problem-solving therapy and anti-depressant treatment as needed, provided through a care manager and consultant psychiatrist. The purpose of a PST was to deliver problem-solving skills to employees.

In the US the cost-benefits of a recreational music making (RMM) programme were compared with usual care (Bittman et al., 2003). The intervention comprised six sessions of group empowerment drumming and making music with a keyboard, complemented by a series of mind-body wellness exercises. The findings from this study showed that the intervention yielded a $61 return on every dollar invested.

Two US studies estimated the cost-consequence of interventions for common mental disorders among employees, both showing considerable savings compared to controls. One (Lerner et al., 2012) evaluated the cost-consequences of a telephone work and health initiative, including work coaching, care coordination and CBT strategies for workers with major depressive disorders. The intervention was compared with usual occupational physician care. The results pointed out that the initiative was effective as compared to control, with an estimated annual saving of $6,487 per participant through productivity gains. In another study (McCraty et al., 2009), correctional officers were trained in emotion-focused self-regulating techniques for stress reduction on a two-day ‘power to change performance’ training programme and found that this intervention was cost-saving (mean benefit of $1,438 per participant per year) due to the reduction in stress and other health risk factors compared to wait-list controls.

Two studies (McDaid et al., 2011; Wang et al., 2006) were based on modelling approaches. The first study (McDaid et al., 2011) showed a total benefit arising from reduced absenteeism and improved productivity of $64,086 in one year among 500 employees. This was a workplace-based enhanced depression care intervention, including response to a questionnaire and six sessions of cognitive behavioural therapy (CBT) over 12 weeks for those identified as experiencing or at risk of anxiety and/or depression.

The second study (Wang et al., 2006) estimated $26,514 per QALY gain with the intervention. From the employer standpoint, the intervention gave a net profit of $3,531 over five years. The intervention consisted of one-time screening and care management of those identified as positive for depression. The care management intervention was a telephone conversation between managers and employees. In both intervention and usual care groups, the depression treatment involved visits to either a primary care physician, psychiatrist or therapist.

2.3.3 Study protocols of economic studies

Seven recent protocols were identified: three each from the Netherlands and Germany and one from Hong Kong. Participants will be recruited from different sources: Dutch Social Security Agency (Audhoe et al., 2015; Lammerts et al., 2014), health insurance companies (Ebert et al., 2014; Heber et al., 2013), medium and large-sized companies (Geraedts et al., 2013; Yuan et al., 2014) and the ministry of education (Thiart et al., 2013). Five study protocols (Ebert et al., 2014; Geraedts et al., 2013; Elena Heber et al., 2013; Thiart et al., 2013; Yuan et al., 2014) state that the study will emphasize interventions for currently working employees and the remainder (Audhoe et al., 2015; Lammerts et al., 2014) will focus on sick-listed employees. The follow-up periods of the studies will be 3 months (Yuan et al., 2014), six months (Ebert et al., 2014; Thiart et al., 2013) and twelve months (Audhoe et al., 2015; Geraedts et al., 2013; Heber et al., 2013; Lammerts et al., 2014). Four protocols (Ebert et al., 2014; Geraedts et al., 2013; Heber et al., 2013; Thiart et al., 2013) will assess cost-effectiveness, two (Lammerts et al., 2014; Yuan et al., 2014) will assess return-on-investment and one study (Audhoe et al., 2015) will assess cost and benefit of a study, and all economic evaluations will be in RCTs. The intervention costs of such studies will be analysed based on societal, and/or employer or insurers' perspectives.

Five protocols (Ebert et al., 2014; Geraedts et al., 2013; Heber et al., 2013; Thiart et al., 2013; Yuan et al., 2014) indicate that a reduction in mental illness or stress-related symptoms will be the primary outcome, and the remaining protocols (Audhoe et al., 2015; Lammerts et al., 2014) will assess productivity-related costs. Five protocols (Ebert et al., 2014; Geraedts et al., 2013; Heber et al., 2013; Lammerts et al., 2014; Thiart et al., 2013) state that studies will evaluate cost-utility and the remainder will assess incremental benefits in terms of savings (Audhoe et al., 2015) and return on investment (Yuan et al., 2014). Four protocols (Audhoe et al., 2015; Ebert et al., 2014; Lammerts et al., 2014; Yuan et al., 2014) state that the study will assume intention-to-treat principles, but the remaining protocols (Geraedts et al., 2013; Heber et al., 2013; Thiart et al., 2013) do not discuss this analysis issue. Three protocols (Ebert et al., 2014; Lammerts et al., 2014; Yuan et al., 2014) mention sensitivity analysis while the remaining protocols (Audhoe et al., 2015; Geraedts et al., 2013; Heber et al., 2013; Thiart et al., 2013) do not. These studies are all currently underway; details are given in Table 3.

2.3.4 Effect size of the study from the quantitative findings

Out of twelve included studies, only eight had information to calculate effect size. From these eight studies, a total of 20 outcome measures were included. I estimated the effect size of different outcomes in terms of standardised mean difference (SMD). Twelve outcome parameters had a small effect size (<0.5), six had a medium effect size (0.5 - 0.79) and the remaining two had a large effect size (0.8 or more). The intervention appears to be effective in six studies, but not effective in two studies (Table 4).

Five studies (Arends et al., 2013; Lerner et al., 2012; McCraty et al., 2009; Rebergen et al., 2009; Schneider et al., 2012) indicated that the workplace intervention was beneficial in reducing mental health problems and cultivating productivity and quality of life. Two studies (Arends et al., 2013; Lerner et al., 2012) showed that the intervention was more effective with a moderate to large effect size (SMD= 0.5 or more) and that the difference was statistically significant. In contrast, two studies (Goorden et al., 2014; van Oostrom et al., 2010) showed that the control condition was superior in decreasing mental illness symptoms or sickness absence, or improving quality of life. In these studies, the effect sizes were small (<0.5) and the difference was not significant. Dewa et al. (2009) identified

that collaborative care in mental health was effective in improving average return to work and reducing disability leave; the differences in both cases were statistically significant.

Table 2.4 Summary effect sizes of intervention outcomes in standardised mean difference

Study	Outcome measure	Participant	Effect Size- (95% CI) – Cohen's d	Size	Effective
Gorden	Quality of Life using EQ-5D	126	-0.17(-0.52; 0.18)	Small	-ve
Arends	Incidence of recurrent sickness absence	158	-0.57 (-0.96; -0.18)	Medium	+ve
Schneider	WSAS	231	-0.10 (-0.36; 0.16)	Small	+ve
	PHQ scale	219	-0.14 (-0.41; 0.12)	Small	+ve
	CORE 10	230	-0.13 (-0.39; 0.13)	Small	+ve
	GAD scale	221	-0.26 (-0.53; 0.01)	Small	+ve
	WSAS+PHQ+CORE+GAD combined		-0.14 (-0.27; -0.01)	Small	+ve
Van Osborn	Sick leave until lasting RTW	145	-0.01 (-0.33; 0.32)	Small	+ve
	QALY gain	145	-0.06 (-0.39; 0.26)	Medium	-ve
Rebergen	Productivity loss - net sick leave days	240	-0.01 (-0.27; 0.24)	Small	+ve
Dewa	Average return to work	124	0.53 (0.16; 0.89)	Medium	+ve
	Long term disability leave	124	-0.68(-0.31; -1.05)	Medium	+ve
Lerner	WLQ Score	72	-0.84 (-1.34; -0.33)	Large	+ve
	% at-work productivity loss	72	-0.71 (-1.21; -0.22)	Medium	+ve
	% at-work productivity loss due to absenteeism	72	-0.67 (-1.17; -0.17)	Medium	+ve
	PHQ 9 symptoms severity	72	-0.94 (-1.45; -0.44)	Large	+ve
McCraty	Stress symptoms	69	-0.22 (-0.70; 0.26)	Small	+ve
	Anxiety	69	-0.45 (-0.94; 0.03)	Small	+ve
	Depression	69	-0.48 (-0.97; 0.01)	Small	+ve
	Stress + Anxiety + Depression combined		-0.37 (-0.65; -0.10)	Small	+ve
	Productivity gain	69	0.35 (-0.14; 0.83)	Small	+ve
	Job involvement	69	0.08 (-0.40; 0.56)	Small	+ve

Note: WSAS= Work and Social Adjustment Scale, PHQ= Patient Health Questionnaire, CORE 10= Clinical Outcome in Routine Evaluation, GAD= Generalised Anxiety and Depression, RTW= Return to Work, QALY= Quality Adjusted Life Year, WLQ= Work Limitation Questionnaire.

2.4 Discussion

This review has contributed to understanding about the economic case to invest in the workplace interventions to prevent and/or treat CMDs. It found that the majority of workplace-initiated interventions for the prevention and treatment of CMDs among employees are potentially cost-effective. As Table 4.1 shows, seven of the ten empirical studies were either cost-saving, generating a positive return on investment or had an incremental cost per QALY increase that seems to be cost-effective. Those studies that took a return on investment perspective suggest employers could benefit financially from improved productivity, lower sickness absence and better staff retention. Two further studies may be cost-effective depending on whether the incremental cost per reduction in sickness absence would be judged as value for money to a business or society (Arends et

al., 2013) or whether the intervention could in future be targeted on workers who were more motivated to return to work (van Oostrom et al., 2010). One study was found neither to be effective nor to have any impact on costs (Schneider et al., 2012). As Table 4.2 indicates, both modelling studies were favourable. One modelling study (D McDaid et al., 2011) found that the intervention was cost-saving, while the other showed that the intervention was cost-effective at a willingness-to-pay (WTP) of below $30,000 per QALY. This second modelling study (Wang et al., 2006) also performed a cost-benefit analysis and found that there was a positive monetary benefit of the intervention to employers.

There is wide variation in intervention effect across studies. Effect sizes could be calculated for eight studies with six studies (18 out of 20 outcomes) demonstrated favourable effects of new intervention compared with control. It seems to be the case that psychological and behavioural interventions help employees to lessen the severity of CMDs. Variation in intervention effects could be associated with sample size, type of intervention and outcome measures. While this review only included studies that had an economic analysis, previous effectiveness reviews suggest that different types of workplace interventions such as multi-component interventions and psychosocial interventions can be effective (Wagner et al., 2016).

I restricted the review to English language articles only; and I did not have the resources to thoroughly search corporate (‘grey’) literature on workplace interventions. There are also further favourable economic evaluations which were not included in the review because of an inappropriate comparison group (Iijima, Yokoyama, Kitamura, Fukuda, & Inaba, 2013) or language (Namba, 2012). Other studies (Brouwers, de Bruijne, Terluin, Tiemens, & Verhaak, 2007; Lagerveld, Blonk, Brenninkmeijer, Wijngaards-de Meij, & Schaufeli, 2012; Lo Sasso, Rost, & Beck, 2006; Rost, Smith, & Dickinson, 2004; Schene, Koeter, Kikkert, Swinkels, & McCrone, 2007; Kimi Uegaki et al., 2010) also estimated the cost-effectiveness of mental health intervention among employees, but these studies recruited participants from primary health care settings rather than workplaces.

One previous review of economic studies was only able to find limited evidence supporting the economic case for workplace interventions (Hamberg-van Reenen et al., 2012), noting a number of methodological limitations. I also found methodological

limitations in the analyses, including small sample size, high loss to follow-up, short follow-up periods, cross-contamination between comparators, and baseline differences in the individual characteristics between study groups (e.g., gender imbalances, disease severity, occupational types). I also found that there was variation in the methodological aspect of the study: five of the ten studies were high-quality, one moderate-quality and the remainder low-quality. These findings suggested that half of the economic evaluations were of poor methodological quality. Additionally, some studies did not perform sensitivity analyses to account for uncertainty around estimates of parameters which might result in biases in the study findings.

The participants in the studies were recruited from various sources: companies, social security agencies, police forces, a youth correctional centre, a retirement community centre and state government offices. However, the types of employees and occupational status were not classified in most studies. This might limit the identification of effective and economically worthwhile interventions for specific occupational groups and levels, and the ability to generalise findings to other settings.

The evaluations in the review took place in large workplaces, which are more likely to have their own dedicated occupational health services. When looking at small- and medium-size enterprises, not to mention the self-employed, it may be difficult to replicate such sophisticated workplace health promotion programmes without significant support from government or health insurers. It is not insignificant that the majority of economic studies are from the Netherlands, where employers are legally obliged to fund sickness benefits for up to two years of sick leave (Arends et al., 2013; OECD, 2007). Such an obligation might make employers cognisant of the potential advantages of implementing effective interventions to improve presence at work or early return to work, or truly to implement promotional interventions for the improvement in health and wellbeing of their employees. Moreover, employers are also interested in whether such interventions are worth financing. This may be one of the possible reasons for the growing economic literature on workplace mental health interventions in the Netherlands.

2.5 Conclusions

Notwithstanding the limitations of the evidence base, I found examples of workplace-initiated interventions for employees at risk of or experiencing common mental disorders which might potentially be of economic benefit to employers and society. But due to the limitations and poor quality of these studies, the evidence is inconclusive with regards to the cost-effectiveness of workplace interventions for common mental disorders. The studies included are very heterogeneous; differences in obligations on employers to fund sickness benefits may lead to very different levels of motivation to invest in workplace mental health promotion programmes. If governments shoulder much of the cost of absenteeism or permanent withdrawal from the labour market, they may also have incentives to provide support or fiscal incentives to employers to invest in workplace mental health measures. This could particularly be the circumstance for small- and medium-sized businesses. The question remains as to what interventions are most effective in different workplace contexts and at what cost. It is also important to know who bears these costs and how that might influence implementation. Efforts to stimulate more high-quality economic evaluations, considering innovative approaches, are needed in this area.

Chapter 3

3. Associations between Anxiety and Depressive Disorders and Employment following Economic recession in England in 2008

3.1 Introduction

Employees with mental health problems may be more vulnerable to employment difficulties during economic recession (Ayuso-Mateos, Barros, & Gusmão, 2013). A study using Danish cohort data indicates that job insecurity may be associated with poor mental health for working people (Cottini & Ghinetti, 2016).

The UK unemployment rate increased following economic recession in 2008. It peaked in 2011, and then has been gradually falling, and now is at its lowest levels since the early 1970s (Office for National Statistics, 2017a). Annual reports from the Health Survey for England (HSE) – which I describe in more detail below – also showed that the prevalence of mental health problems increased in 2011 compared to 2008 and then decreased in 2014 (Aresu et al., 2009; Boniface et al., 2012; Bridges, 2015). Several studies indicate that people out of a job are prone to poor mental health (Drydakis, 2015; Paul & Moser, 2009; Strandh, Winefield, Nilsson, & Hammarström, 2014; Urbanos-Garrido & Lopez-Valcarcel, 2015) and there may be reverse causality, a two-way causality in a cause-and-effect relationships, between unemployment and mental health problems (Butterworth, Leach, Pirkis, & Kelaher, 2012).

A study using individual-level data from the Eurobarometer surveys 2006 and 2010 conducted in 27 EU countries showed that unemployment among people with mental health conditions during economic recession was substantially increased (Evans-Lacko et al., 2013). It has also been suggested in another study that the likelihood of developing mental health problems is associated with unemployment (Flint, Shelton, Bartley, & Sacker, 2013).

As I have described earlier in this thesis, there is a lot of evidence that mental health problems are common reasons for employment difficulties; indeed, it is now widely

reported that they are the most common causes of absence and lower performance while at work (Chong, Vaingankar, Abdin, & Subramaniam, 2013). The costs of lost productivity and staff turnover associated with mental health problems to employers are very high.

It is clear from this study and others reported in chapter 1 that there are many links between mental health problems and employment difficulties, probably running in both causal directions. This makes it important to explore the effect of anxiety and depressive disorders on employment and what other factors may influence any such associations. It is also pertinent to examine whether employment experiences affect mental health. In this chapter, I study these possible associations between employment and mental health condition(s) during a period in which the UK economy went from relative prosperity in 2008 to recession in the period to 2011, and then into relative recovery by 2014. I focus on England and use data from the annual Health Survey for England for three years, 2008, 2011 and 2014.

This study will address the following research questions;

General research question: What is the association between mental health status and employment following the economic recession in England?

Specific research questions:

- What is the effect of mental health status (particularly depression and anxiety) on employment?
- Does this effect differ with individual characteristics, particularly gender?
- If there is an effect, does it change during an economic recession?
- Does employment status affect anxiety or depression among employed people, and does this association differ during an economic recession?
- If there are associations between mental health and employment, are they dependent in part on the different characteristics of individuals, such as gender?

3.2 Methods

3.2.1 Study design

In this study, individual-level data on demographic and socioeconomic circumstances, including employment status and health-related data were extracted from the Health Survey for England (HSE) to examine the association(s) between mental health and employment, and whether the broader macroeconomic situation has an impact. The HSE is one of the largest nationally representative regular surveys in England: it collects information every year from a sample drawn from the general population living in private households. The HSE is a cross-sectional survey that uses a multi-stage sampling design with appropriate stratification.

To explore the effect of macroeconomic circumstances following economic recession, data were examined for three different years: 2008, 2011 and 2014. In the HSE, participants are selected from the post code file and the post code sectors were the primary sampling unit (PSU). Sampling weights were generated to address non-response bias and the probability of selection. Participants are 16 years of age or older, and have agreed to participate in the HSE survey. All interviewers were fully trained on how to conduct interview session and record information, and they were accompanied by supervisors in the early stage of field work. A total of 22,619 people in 2008, 10,617 in 2011 and 10,080 in 2014 responded to the core stage interview, representing 64%, 66% and 55% response rates, respectively.

The focus of my study is on the mental health of the working population aged between 16 and 64 years. By excluding people aged over 64 years, the final sample sizes for this study were 11,628 in 2008, 6535 in 2011 and 6008 in 2014. These very large sample sizes, surveys conducted at regular intervals and the richness of employment information in the survey were the key reasons for using the HSE data. Full details of the survey methodology have been published in HSE reports (Aresu et al., 2009; Boniface et al., 2012; Bridges et al., 2015).

3.2.2 Employment measures

The primary outcome measure for my initial analyses was the employment status of respondents, collected from a household questionnaire completed by the interviewer.

Employment status of respondents in the analyses will be categorised in two ways: (a) in work or not in work; and for those in work (b) employee or self-employed. These were both binary variables. As described above, I was interested to examine whether this employment status of working people can be affected by or itself affects mental health conditions, and whether the associations change with the macroeconomic condition of the country across the three different time periods, and adjusting for other covariates. I was also interested whether there were any differences in anxiety or depression effects on employment by gender.

3.2.3 Anxiety or depression conditions

The other key measure in my analyses was anxiety/depression dimension from the EQ-5D-3L tool, and this variable was also collected from a questionnaire.

EQ-5D-3L is the most commonly used tool to assess health-related quality of life, and it has been validated in individuals experiencing anxiety problem (König et al., 2010). EQ-5D consists of five dimensions of health: mobility, self-care, usual activities, pain or discomfort and anxiety or depression. Anxiety or depression is a psychological dimension while the other four capture the physical dimensions of health. Each dimension has three response options (level 1: no problem, level 2: some problem, and level 3: major problem) and the respondent can choose one out of them based on their self-perceived health status. The physical dimensions of the EQ-5D were considered as individual predictor variables in the multivariable regression models in this study.

3.2.4 Other health-related variables

Body mass index (BMI) is calculated simply by dividing weight (kilograms) with height (meters squared). The BMI is conventionally categorised as underweight (BMI less than 18.5), normal weight (BMI 18.5 to less than 25), overweight (BMI 25 to less than 30) and obese (BMI 30 and over) based on WHO guidelines (NHLBI Obesity Education Initiative Expert Panel, 1998). Alcohol consumption and smoking are 'Yes' or 'No' questions. Limiting longstanding illnesses is defined as any form of long-term physical illness, health problem or disability which may restrict an individual's normal day-to-day work (NHS Merseyside, 2013). This variable is categorised into two: longstanding illness coded as '1'

and no longstanding illness coded as ‘0’. The variable which measures morbidity of different health conditions is coded as ‘0’ for no morbidity and ‘1’ for morbidity.

3.2.5 Socio-demographic variables

Independent variables in the models were: age; gender; ethnicity (white, black, Asian, mixed and any other ethnic origin); marital status (single, married, separated, divorced, widow and cohabitee); educational achievement (categorised as National Vocational Qualification (NVQ) 4/NVQ5/degree or equivalent, higher education below degree, NVQ3/GCE A level equivalent, NVQ2/GCE 0 level equivalent, NVQ1/GCE other grade equivalent, foreign degree, and no qualification (Chou, 2007)); degree of urbanisation (urban, town and fringe, and village, hamlet and isolated dwellings (Aresu et al., 2009)); and area deprivation index, categorised into five percentile levels from least to most deprived. The composite deprivation index (Index of Multiple Deprivation) is based on seven domains of deprivation: income, employment, health condition and disability, education, housing and services, crime and disorders, and living environment (Aresu et al., 2009; Bridges et al., 2015).

3.2.6 Statistical analysis

For all three survey years, in univariate analysis, the mean values were computed for continuous variables and the proportion was calculated for categorical variables. For multiple regression analysis, all three data sets were combined. Regression models examine the association of the predictor variable with the response variable adjusting for other variables. The associations between employment (categorised as: in work or not in work; and employee or self-employed) and each explanatory variable including anxiety or depression as the main predictor variable were examined using generalised linear models (GLM). The link function in the GLM regression method is selected based on the response variable (Hardin & Hilbe, 2012). In this study, binomial distributional family with logit link function was used for binary response variable in the regression models. GLMs are most commonly used to model binary or count data where variables are not normally distributed. Coefficients in the GLM analyses indicate the likelihood of a respondent reporting an employment status with reference to the likelihood of reporting as unemployed. Marginal effects were calculated to assess the predicted value of the GLM

regression methods (Hardin & Hilbe, 2012). The modified Park test was employed to test heteroskedasticity in the GLM regression model. A regressor variable in the model is said to be heteroskedastic if the alpha coefficient of the estimated model is statistically significant (Pedace, 2013).

The ordinal response variable violates the assumption of linear regression models. There are several models that have been designed to analyse categorical response variables. One of the common models used to analyse an ordinal response variables is the logit version of the ordinal regression model often referred to as the proportional odds model (Long & Freese, 2001). This model is useful for understanding or predicting the effects of predictor variables on an ordinal qualitative response variable. Anxiety/depression from the EQ-5D was the other main outcome of interest in the study. As anxiety/depression was an ordinal categorical variable, ordinal logistic regression was used to fit the regression model in this study.

The regression models were adjusted for other predictors, including gender, age, marital status, education, ethnicity, household size, degree of urbanisation, household income, deprivation level, health-related quality of life, BMI, current drinking habit, limiting longstanding conditions, and health conditions such as carcinoma, neurological disorders, cardiovascular disorders and musculoskeletal disorders. I incorporated as many predictor variables as possible from the HSE data-sets which could be hypothesised to be associated with response and/or other predictor variables to reduce endogeneity issue in a model. In assessing the extent to which employment status may change over time, the categorical variable ‘year’ was included with other explanatory variables to allow me to test for differences between years. Subgroup analysis was undertaken to examine the potential effects of anxiety or depression on employment by gender using the same GLM regression methods.

Missing data are inevitable in surveys, and may result in sampling errors and data loss (Sterne et al., 2009). The consequence of missingness in numerous predictors may result in the elimination of a significant number of participants, leading to loss of precision and power (Sterne et al., 2009). In this study, missing data were addressed with multiple imputation using chained equations which allows inclusion of respondents with incomplete data in the analysis and improves the precision of the regression results. The majority of

missing data were judged to be missing at random (MAR). Multiple imputations were performed to address uncertainty in the primary analysis results due to missingness in data. Variance information of the multiply-imputed data for primary analyses were produced to assess whether imputation was well performed (Rubin, 1987). STATA v.14.2 was used to analyse the study results.

3.3 Results

3.3.1 General characteristics

Table 3.1 presents descriptive information on participants in the sample for each of the three different survey years (2008, 2011 and 2014). The average age of study participants was slightly higher for those people in the anxiety or depression group in each of the survey years. The proportion of men in the anxiety or depression group was lower than that of women.

A higher proportion of participants were separated or widowed, while a lower proportion of participants were divorced or cohabitees in 2011 compared to 2008 or 2014, for both people with and without anxiety or depression. A higher proportion of participants who were separated or divorced reported that they had anxiety or depression problems.

A higher proportion of participants with no educational qualification experienced anxiety or depression problems compared to people with educational qualifications, and this was consistent across all three survey years. No obvious changes were observed in mental health conditions with reference to participants' ethnic group, nor by reference to whether they lived in urban, town or village settings, nor by reference to household size. Again, these patterns were consistent across survey years. However, a higher proportion of participants from urban areas and living alone in a household mentioned that they experienced anxiety or depression. A higher proportion of participants from the most deprived areas experienced anxiety or depression problems compared to people from less deprived areas.

3.3.2 Employment status

In general, participants who were currently at work had better mental health than those who were currently not in work. In 2011 there was a higher proportion than in 2008 or 2014 of participants who were currently working who experienced anxiety or depression problems. More working age people worked as employees in 2011 and 2014 compared to 2008.

3.3.3 Anxiety or depression

As noted earlier, the status of anxiety or depression was measured using one item of the EQ-5D questionnaire. The proportion of people with moderate anxiety or depression was 16% in 2008, increased to 23% in 2011 and then had fallen to 17% in 2014. The proportion of severe cases was slightly higher (3%) in 2011 compared to 2008 (2%) and had reduced again to 2% in 2014. These proportions might be interpreted as indicating that macroeconomic situation in England had an impact on the mental health status of working age people.

3.3.4 General health status

The general health status of participants was better in 2014 compared to 2011. People with anxiety or depression problems had higher probability of difficulty in walking, self-care, usual activities and having more pain or discomfort than people having no mental health problems as measured by EQ-5D, but there was no obvious change in such health conditions between these two groups in 2011 or 2014 compared to 2008. Current drinking habits of participants with anxiety or depression were different in 2011 compared to 2008 and 2014 – self-reported alcohol consumption was lower in 2011 – but current alcohol consumption was stable across these years for people without anxiety or depression group. The proportion of limiting longstanding illness was lower in participants with anxiety or depression in 2011 compared to 2008, but higher in 2014. The prevalence of overall health conditions such as carcinoma, nervous system disorders, cardiovascular diseases and musculoskeletal disorders was lower in 2011 and 2014 compared to 2008. Poor health as reflected by these conditions was more common among respondents with anxiety or depression compared to those without these mental health problems.

Table 3.1 Descriptive analysis of the study variables by "with and without anxiety or depression" from the health survey for England (HSE) 2008, 2011 and 2014

Variables	HSE Year 2008				HSE Year 2011				HSE Year 2014			
	Anxiety/depression				Anxiety/depression				Anxiety/depression			
	Yes		No		Yes		No		Yes		No	
	Propn	SE	Propn	SE	Propn	SE	Propn	SE	Propn	SE	Propn	SE
Age (mean)	41.25	0.346	39.37	0.208	41.55	0.398	39.36	0.307	40.23	0.512	39.72	0.309
Gender: men	0.41	0.011	0.51	0.004	0.44	0.013	0.50	0.007	0.43	0.016	0.51	0.007
Marital status												
Single	0.27	0.012	0.26	0.007	0.27	0.013	0.26	0.010	0.33	0.018	0.27	0.010
Married	0.43	0.012	0.51	0.007	0.43	0.015	0.50	0.011	0.37	0.017	0.50	0.011
Separated	0.04	0.004	0.02	0.001	0.09	0.007	0.05	0.003	0.03	0.005	0.02	0.002
Divorced	0.10	0.006	0.05	0.002	0.02	0.003	0.01	0.002	0.10	0.009	0.05	0.003
Widow	0.02	0.003	0.01	0.001	0.15	0.012	0.16	0.009	0.03	0.004	0.01	0.001
Cohabitees	0.14	0.009	0.15	0.005	0.04	0.006	0.02	0.002	0.14	0.014	0.15	0.008
Highest education qualifications												
NVQ4/NVQ5/Degree or equivalent	0.18	0.010	0.25	0.006	0.24	0.013	0.29	0.010	0.25	0.017	0.33	0.010
Higher education below degree	0.11	0.007	0.12	0.004	0.09	0.007	0.12	0.006	0.09	0.009	0.12	0.006
NVQ3/GCE A level equivalent	0.18	0.010	0.20	0.006	0.17	0.011	0.21	0.008	0.19	0.014	0.20	0.009
NVQ2/ GCE 0 level equivalent	0.26	0.010	0.24	0.005	0.27	0.013	0.23	0.008	0.25	0.013	0.22	0.008
NVQ1/CSE other level equivalent	0.05	0.005	0.05	0.002	0.05	0.006	0.04	0.004	0.04	0.006	0.03	0.003
Foreign/other degree	0.00	0.001	0.01	0.001	0.01	0.002	0.01	0.001	0.01	0.003	0.00	0.001
No qualifications	0.22	0.010	0.01	0.005	0.18	0.011	0.11	0.006	0.17	0.012	0.11	0.006
Ethnicity or origin												
White	0.87	0.010	0.88	0.008	0.88	0.011	0.86	0.012	0.89	0.013	0.86	0.012
Black	0.03	0.004	0.03	0.003	0.02	0.004	0.03	0.005	0.02	0.004	0.03	0.004
Asian	0.08	0.009	0.07	0.007	0.07	0.010	0.09	0.010	0.07	0.011	0.09	0.009
Mixed	0.02	0.003	0.01	0.002	0.01	0.004	0.02	0.002	0.01	0.004	0.02	0.003
Any other ethnic background	0.01	0.002	0.01	0.001	0.01	0.002	0.00	0.001	0.01	0.003	0.01	0.002
Degree of urbanisation												

Variables	HSE Year 2008				HSE Year 2011				HSE Year 2014			
	Anxiety/depression				Anxiety/depression				Anxiety/depression			
	Yes		No		Yes		No		Yes		No	
	Propn	SE	Propn	SE	Propn	SE	Propn	SE	Propn	SE	Propn	SE
Urban	0.84	0.013	0.81	0.012	0.82	0.018	0.80	0.018	0.84	0.019	0.82	0.017
Town or fringe	0.08	0.009	0.09	0.008	0.08	0.012	0.09	0.011	0.08	0.013	0.08	0.010
Village or hamlet	0.07	0.008	0.10	0.008	0.10	0.012	0.11	0.013	0.07	0.012	0.10	0.011
Household size												
One	0.16	0.008	0.09	0.003	0.16	0.010	0.09	0.005	0.17	0.013	0.09	0.005
Two	0.33	0.012	0.32	0.007	0.31	0.014	0.30	0.010	0.30	0.016	0.29	0.009
Three	0.20	0.011	0.21	0.007	0.22	0.013	0.23	0.009	0.24	0.016	0.24	0.010
Four	0.18	0.011	0.24	0.007	0.22	0.015	0.26	0.011	0.19	0.015	0.25	0.010
Five and above	0.13	0.010	0.14	0.007	0.09	0.012	0.11	0.010	0.10	0.012	0.14	0.010
Deprivation score (quintiles)												
0.37->8.32 [least deprived]	0.17	0.012	0.22	0.011	0.18	0.016	0.21	0.016	0.17	0.017	0.23	0.017
8.32->13.74	0.17	0.011	0.20	0.009	0.19	0.015	0.21	0.013	0.16	0.016	0.19	0.013
13.74->21.22	0.19	0.012	0.20	0.008	0.21	0.015	0.22	0.013	0.19	0.017	0.19	0.012
21.22->34.42	0.20	0.012	0.21	0.009	0.20	0.015	0.18	0.012	0.24	0.018	0.20	0.013
34.42->85.46 [most deprived]	0.26	0.015	0.18	0.010	0.23	0.019	0.18	0.014	0.24	0.020	0.19	0.016
Employment status1												
Not in work	0.46	0.012	0.27	0.006	0.40	0.014	0.28	0.010	0.47	0.018	0.26	0.009
In work	0.54	0.012	0.73	0.006	0.60	0.014	0.72	0.010	0.53	0.018	0.74	0.009
Employment status2												
Self-employed	0.14	0.009	0.15	0.006	0.12	0.010	0.15	0.009	0.12	0.011	0.15	0.008
Employee	0.86	0.009	0.85	0.006	0.88	0.010	0.85	0.009	0.88	0.011	0.85	0.008
EQ-5D: Anxiety/depression												
Normal			0.82	0.004			0.75	0.006			0.81	0.006
Moderate	0.16	0.004			0.23	0.006			0.17	0.005		
Severe	0.02	0.001			0.03	0.002			0.02	0.002		
EQ-5D: Mobility												
No problem	0.73	0.01	0.93	0.003	0.74	0.01	0.92	0.004	0.73	0.01	0.93	0.004

Variables	HSE Year 2008				HSE Year 2011				HSE Year 2014			
	Anxiety/depression				Anxiety/depression				Anxiety/depression			
	Yes		No		Yes		No		Yes		No	
	Propn	SE	Propn	SE	Propn	SE	Propn	SE	Propn	SE	Propn	SE
Some problem	0.27	0.01	0.07	0.003	0.26	0.01	0.08	0.004	0.27	0.01	0.07	0.004
Major problem	0.005	0.002	0.001	0.0003	0.002	0.001	0.001	0.001	0.005	0.002	0.001	0.0004
EQ-5D: Self-care												
No problem	0.88	0.007	0.99	0.001	0.91	0.008	0.99	0.002	0.87	0.01	0.99	0.002
Some problem	0.11	0.01	0.01	0.001	0.09	0.01	0.01	0.002	0.12	0.01	0.01	0.002
Major problem	0.01	0.002	0.0004	0.0002	0.003	0.001	0.001	0.001	0.01	0.003	0.0002	0.0002
EQ-5D: Usual Act												
No problem	0.71	0.01	0.94	0.003	0.69	0.01	0.92	0.005	0.65	0.02	0.94	0.004
Some problem	0.25	0.01	0.06	0.003	0.27	0.01	0.08	0.004	0.31	0.02	0.06	0.004
Major problem	0.04	0.004	0.01	0.001	0.04	0.005	0.005	0.001	0.04	0.01	0.003	0.001
EQ-5D: Pain/discomfort												
No problem	0.50	0.01	0.79	0.005	0.47	0.01	0.76	0.01	0.49	0.02	0.80	0.01
Some problem	0.41	0.01	0.20	0.005	0.44	0.01	0.22	0.01	0.41	0.02	0.18	0.01
Major problem	0.10	0.01	0.01	0.001	0.09	0.01	0.01	0.002	0.09	0.01	0.01	0.002
BMI category												
Underweight (BMI: <18.5)	0.02	0.004	0.02	0.002	0.02	0.004	0.02	0.003	0.02	0.007	0.02	0.003
Normal weight (BMI: 18.5 - <25)	0.38	0.012	0.40	0.006	0.36	0.015	0.40	0.010	0.36	0.021	0.41	0.011
Overweight (BMI: 25 - <30)	0.33	0.011	0.36	0.006	0.34	0.014	0.36	0.008	0.29	0.018	0.35	0.010
Obese (BMI: 30 and over)	0.27	0.011	0.23	0.006	0.28	0.013	0.22	0.008	0.32	0.019	0.23	0.009
Current drinking alcohol												
No	0.23	0.011	0.16	0.007	0.21	0.012	0.18	0.010	0.26	0.015	0.21	0.010
Yes	0.77	0.011	0.84	0.007	0.79	0.012	0.82	0.010	0.74	0.015	0.79	0.010
Limiting longstanding illness												
Yes- Limiting	0.40	0.012	0.13	0.004	0.33	0.014	0.11	0.006	0.42	0.018	0.11	0.006
Yes-Non-limiting	0.18	0.009	0.18	0.005	0.18	0.011	0.16	0.006	0.16	0.012	0.15	0.006
No	0.43	0.012	0.69	0.006	0.49	0.016	0.73	0.008	0.42	0.018	0.74	0.008
Neoplasms and benign growths												

Variables	HSE Year 2008				HSE Year 2011				HSE Year 2014			
	Anxiety/depression				Anxiety/depression				Anxiety/depression			
	Yes		No		Yes		No		Yes		No	
	Propn	SE	Propn	SE	Propn	SE	Propn	SE	Propn	SE	Propn	SE
No	0.98	0.003	0.99	0.001	0.97	0.005	0.99	0.001	0.98	0.005	0.99	0.001
Yes	0.02	0.003	0.01	0.001	0.03	0.005	0.01	0.001	0.02	0.005	0.01	0.001
Nervous system disorders												
No	0.93	0.005	0.97	0.002	0.94	0.006	0.98	0.002	0.94	0.008	0.98	0.003
Yes	0.07	0.005	0.03	0.002	0.06	0.006	0.02	0.002	0.06	0.008	0.02	0.003
Cardio-vascular system disorders												
No	0.89	0.007	0.93	0.003	0.90	0.008	0.95	0.003	0.94	0.008	0.98	0.003
Yes	0.11	0.007	0.07	0.003	0.10	0.008	0.05	0.003	0.06	0.008	0.02	0.003
Musculoskeletal system disorders												
No	0.77	0.010	0.90	0.003	0.79	0.011	0.91	0.005	0.78	0.013	0.91	0.005
Yes	0.23	0.010	0.10	0.003	0.21	0.011	0.09	0.005	0.22	0.013	0.09	0.005

Note: Propn represents proportion. The results are presented in proportion otherwise specified in variable list.

3.3.5 Multivariable analysis results

Regression result for association between anxiety or depression and employment status as employed or unemployed: The GLM regression method was used to explore the association between currently being in work and anxiety or depression, and with adjustment for other relevant predictors. The results of the analysis showed that there was a lower likelihood of being in the work in 2011 and higher likelihood of being in the work in 2014 as compared to 2008, but the difference was not significant in either case. Some and major anxiety or depression were significantly associated with lower likelihood of being in work as compared to not having mental health issues (p= <0.001). Adding interaction terms 'year' with 'anxiety or depression' in the model showed that people experiencing anxiety and depressive disorders had a higher likelihood of being in work in 2011 and lower likelihood of being in work in 2014 when compared to 2008, but the difference was significant only for major anxiety or depression group in 2011.

Table 3.2 GLM for employment status as "In Work" or "Not in Work" by anxiety or depression status and other covariates

Employment - In Work	**Basic GLM (n=18138)**			**GLM with Multiply-imputed data (n=23866)**		
	Coef.	**SE**	**P>t**	**Coef.**	**SE**	**P>t**
Survey Year						
2011	-0.102	0.062	0.098	-0.113	0.056	0.043
2014	0.003	0.073	0.965	0.037	0.059	0.532
Anxiety or Depression						
Some	-0.346	0.071	<0.001	-0.311	0.065	<0.001
Major	-1.332	0.232	<0.001	-1.299	0.204	<0.001
Interact: Year & Anxiety						
2011*Some	0.193	0.111	0.083	0.178	0.101	0.077
2011*Major	0.882	0.307	0.004	0.973	0.271	<0.001
2014*Some	-0.003	0.139	0.981	-0.003	0.112	0.981
2014*Major	-0.132	0.418	0.751	0.015	0.321	0.964
Sex of respondent	0.545	0.042	<0.001	0.619	0.037	<0.001
Age in year	-0.005	0.002	0.034	-0.001	0.002	0.683
Marital status						
Married	1.400	0.072	<0.001	1.263	0.060	<0.001
Separated	1.535	0.088	<0.001	1.417	0.077	<0.001
Divorced	1.061	0.120	<0.001	0.986	0.101	<0.001
Widowed	0.998	0.095	<0.001	0.894	0.083	<0.001
Cohabitees	1.132	0.138	<0.001	1.132	0.110	<0.001

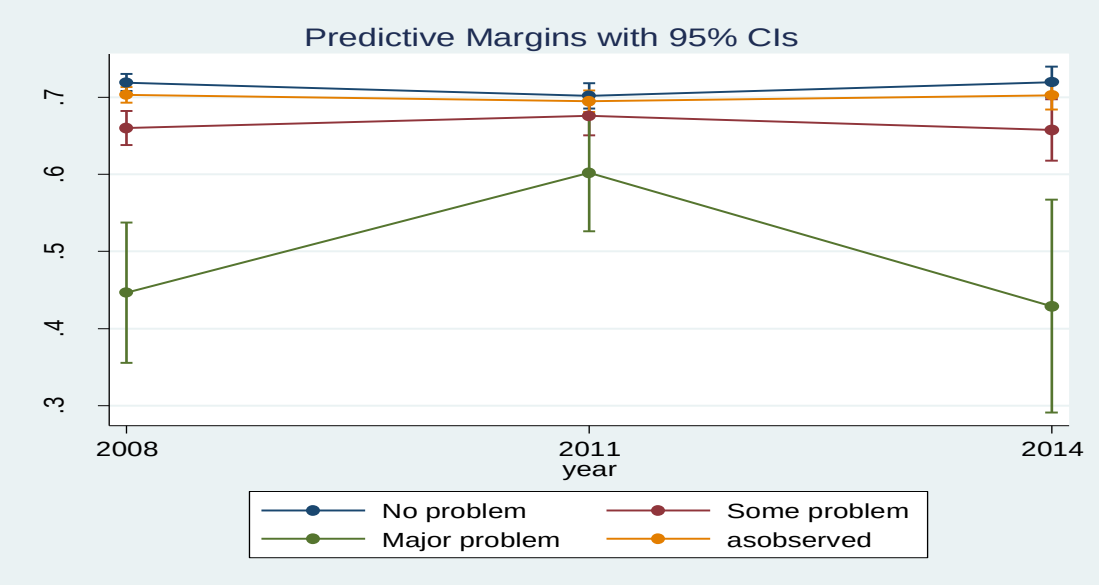
Employment - In Work	Basic GLM (n=18138)			GLM with Multiply-imputed data (n=23866)		
	Coef.	SE	P>t	Coef.	SE	P>t
Highest qualification						
Higher education below degree	-0.392	0.080	<0.001	-0.383	0.069	<0.001
NVQ3/GCE A Level equivalent	-0.764	0.071	<0.001	-0.721	0.063	<0.001
NVQ2/GCE O Level equivalent	-0.740	0.064	<0.001	-0.727	0.056	<0.001
NVQ1/CSE other grades equivalent	-0.827	0.101	<0.001	-0.842	0.088	<0.001
Foreign/other	-1.532	0.215	<0.001	-1.253	0.193	<0.001
No qualification	-1.365	0.075	<0.001	-1.390	0.063	<0.001
Ethnicity						
Black	-0.200	0.123	0.105	-0.140	0.115	0.225
Asian	-0.153	0.090	0.087	-0.247	0.071	0.001
Mixed	-0.160	0.152	0.294	-0.204	0.129	0.114
Any other ethnic group	-1.117	0.237	<0.001	-1.056	0.162	<0.001
Degree of urbanisation						
Town & fringe	0.078	0.077	0.308	0.049	0.067	0.467
Village, hamlet	-0.177	0.073	0.015	-0.218	0.064	0.001
Household size						
2	-0.604	0.082	<0.001	-0.483	0.070	<0.001
3	-0.479	0.084	<0.001	-0.390	0.072	<0.001
4	-0.668	0.091	<0.001	-0.577	0.077	<0.001
5 and above	-1.153	0.116	<0.001	-0.951	0.100	<0.001
Deprivation score						
8.32->13.74	0.040	0.073	0.583	0.006	0.062	0.928
13.74->21.22	0.095	0.072	0.187	0.047	0.065	0.467
21.22->34.42	-0.014	0.072	0.845	-0.021	0.063	0.741
34.42->85.46 [most deprived]	-0.223	0.075	0.003	-0.220	0.065	0.001
EQ-5D: Mobility						
Some problem	-0.344	0.080	<0.001	-0.338	0.069	<0.001
Major problem	-0.495	0.855	0.563	-0.382	0.583	0.513
EQ-5D: Self Care						
Some problem	-0.983	0.136	<0.001	-0.790	0.117	<0.001
Major problem	-1.038	0.678	0.126	-0.858	0.526	0.106
EQ-5D: Usual Act						
Some problem	-0.310	0.082	<0.001	-0.296	0.072	<0.001
Major problem	-1.074	0.243	<0.001	-0.915	0.187	<0.001
EQ-5D: Pain or Discomfort						<0.001
Some problem	0.163	0.054	0.003	0.193	0.049	<0.001
Major problem	-0.505	0.145	0.001	-0.353	0.123	0.004
BMI category						
Normal (bmi: 18.5 - <25)	0.735	0.147	<0.001	0.619	0.153	<0.001
Over-weight (bmi: 25 - <30)	1.030	0.150	<0.001	0.870	0.148	<0.001
Obese (bmi: >=30)	1.057	0.151	<0.001	0.879	0.160	<0.001

Employment - In Work	Basic GLM (n=18138)			GLM with Multiply-imputed data (n=23866)		
	Coef.	**SE**	**P>t**	**Coef.**	**SE**	**P>t**
Limiting longstanding illness						
Non-limiting longstanding illness	0.533	0.073	<0.001	0.656	0.063	<0.001
No longstanding illness	0.577	0.071	<0.001	0.669	0.061	<0.001
Current drinking habit	0.543	0.057	<0.001	0.540	0.048	<0.001
Neoplasms	-0.079	0.187	0.674	-0.270	0.159	0.089
Nervous systems problems	-0.119	0.107	0.264	-0.193	0.088	0.028
Cardiovascular diseases	-0.563	0.080	<0.001	-0.586	0.070	<0.001
Musculoskeletal problems	0.244	0.075	0.001	0.179	0.065	0.006
Constant term	-0.420	0.206	0.041	-0.561	0.194	0.005

Greater age, being female, single, having lower qualifications or foreign degree, ethnic origin other than white, living in a village, living in an area in either of the lowest two deprivation quintiles, having poor health-related quality of life (difficulty in mobility, self-care, usual activities and severe pain or discomfort), being underweight, having a limiting longstanding illness, having health problems such as carcinoma, nervous and cardiovascular disorders were all significantly associated with lower likelihood of being in work. Having a current drinking habit was significantly associated with a higher likelihood of being in work (β=0.543, $p<0.001$). The primary analysis results were also supplemented by the analysis results using multiply-imputed data, this could be due to random nature of missing data.

It is clear from the following graph that the effect of anxiety or depression on employment differs by survey years. The proportion of people with major anxiety or depression in work increased in 2011 compared to 2008, and decreased in 2014, and the confidence intervals around the mean value was wider compared to people without anxiety or depression in all three years. Similarly, the proportion of people with some anxiety or depression who were in work was also higher in 2011 and slightly lower in 2014 as compared to 2008, and the confidence intervals were now much narrower than for major anxiety or depression cases. For people without anxiety or depression, the proportion of people in work was lower in 2011 and nearly equal to 2008 levels in 2014, and the confidence intervals of the mean value was much narrower than for people with some anxiety or depression.

Figure 3.1 Predicted mean employment over study years with anxiety or depression



The validity of the GLM analysis of employment status was tested using the Modified Park Test. The test result showed that the estimate of the alpha coefficient (employment: In Work) was significant (p=<0.001). After multiple imputation, the test was performed to assess within imputation variance of the coefficient for survey years and anxiety or depression. The result indicated that the difference was not significant for survey years (F=2.72, p= 0.066) but it was statistically significant for anxiety or depression (F=28.88, p= <0.001).

Variance information estimation of multiply-imputed data: Table 3.3 presents the variance information of multiply-imputed data for employment with anxiety or depression and other predictors. Variance information was estimated to assess how well the imputation was performed. Within imputation, variance measures the expected variation in the absence of missing data, while between imputation variance measures the uncertainty that results from missing data. Total variance measures the within, between and additional sources of sampling variance. In the analysis of multiply-imputed data for employment, the within imputation variance was wider for major anxiety or depression cases and health-related quality of life. Relative increase in variance (RVI) is the percentage increase in sampling variance associated with missing data. The missing data were higher for anxiety or depression, health-related quality of life and BMI category which gave higher RVI figures. The fraction of missing information (FMI) is correlated to RVI. We need to consider increasing the number of imputations if the FMI percentage would be higher. Better

efficiency can be achieved with fewer imputations if the percentages of missing data is lower (Rubin, 1987). I ran five imputations and achieved a better efficiency as the overall relative efficiency of the imputation model was above 96%. Detailed information on imputation variance is presented in Table 3.3.

Table 3.3 Variance information of multiply-imputed data for employment as "In Work" or "Not in Work"

Employment: In Work	**Imputation variance**			**RVI**	**FMI**	**Rel. Eff.**
	Within	**Between**	**Total**			
Survey Year						
2011	0.003	0.000	0.003	0.008	0.008	0.998
2014	0.003	0.000	0.003	0.023	0.023	0.995
EQ-5D: Anxiety or Depression						
Some	0.004	0.000	0.004	0.054	0.052	0.990
Major	0.040	0.001	0.042	0.036	0.035	0.993
Interaction: Year & Anxiety						
2011*Some	0.010	0.000	0.010	0.051	0.050	0.990
2011*Major	0.071	0.002	0.073	0.038	0.037	0.993
2014*Some	0.012	0.001	0.012	0.062	0.060	0.988
2014*Major	0.096	0.006	0.103	0.072	0.070	0.986
Sex of respondent	0.001	0.000	0.001	0.006	0.006	0.999
Age in year	0.000	0.000	0.000	0.002	0.002	1.000
Marital status						
Married	0.004	0.000	0.004	0.004	0.004	0.999
Separated	0.006	0.000	0.006	0.003	0.003	0.999
Divorced	0.010	0.000	0.010	0.004	0.004	0.999
Widowed	0.007	0.000	0.007	0.003	0.003	0.999
Cohabitees	0.012	0.000	0.012	0.003	0.003	0.999
Highest qualification						
Higher education below degree	0.005	0.000	0.005	0.004	0.004	0.999
NVQ3/GCE A Level equivalent	0.004	0.000	0.004	0.002	0.002	1.000
NVQ2/GCE O Level equivalent	0.003	0.000	0.003	0.001	0.001	1.000
NVQ1/CSE other grades equivalent	0.008	0.000	0.008	0.010	0.010	0.998
Foreign/other	0.037	0.000	0.037	0.003	0.003	0.999
No qualification	0.004	0.000	0.004	0.004	0.004	0.999
Ethnicity						
Black	0.013	0.000	0.013	0.001	0.001	1.000
Asian	0.005	0.000	0.005	0.003	0.003	0.999
Mixed	0.017	0.000	0.017	0.002	0.002	1.000
Any other ethnic group	0.026	0.000	0.026	0.007	0.007	0.999
Degree of urbanisation						
Town & fringe	0.004	0.000	0.005	0.005	0.005	0.999
Village, hamlet	0.004	0.000	0.004	0.004	0.004	0.999

Employment: In Work	Imputation variance			RVI	FMI	Rel. Eff.
	Within	Between	Total			
Household size						
2	0.005	0.000	0.005	0.007	0.007	0.999
3	0.005	0.000	0.005	0.005	0.005	0.999
4	0.006	0.000	0.006	0.010	0.010	0.998
5 and above	0.010	0.000	0.010	0.003	0.003	0.999
Deprivation score						
8.32->13.74	0.004	0.000	0.004	0.001	0.001	1.000
13.74->21.22	0.004	0.000	0.004	0.002	0.002	1.000
21.22->34.42	0.004	0.000	0.004	0.001	0.001	1.000
34.42->85.46 [most deprived]	0.004	0.000	0.004	0.007	0.007	0.999
EQ-5D: Mobility						
Some problem	0.005	0.000	0.005	0.063	0.061	0.988
Major problem	0.285	0.046	0.340	0.193	0.173	0.967
EQ-5D: Self Care						
Some problem	0.013	0.001	0.014	0.059	0.057	0.989
Major problem	0.217	0.049	0.276	0.271	0.231	0.956
EQ-5D: Usual Act						
Some problem	0.005	0.000	0.005	0.092	0.088	0.983
Major problem	0.033	0.001	0.035	0.045	0.044	0.991
EQ-5D: Pain or Discomfort						
Some problem	0.002	0.000	0.002	0.085	0.081	0.984
Major problem	0.015	0.001	0.015	0.045	0.044	0.991
BMI category						
Normal (bmi: 18.5 - <25)	0.016	0.006	0.023	0.490	0.362	0.932
Over-weight (bmi: 25 - <30)	0.005	0.022	0.366	0.293	0.945	
Obese (bmi: >=30)	0.016	0.008	0.026	0.559	0.397	0.927
Limiting longstanding illness						
Non-limiting longstanding illness	0.004	0.000	0.004	0.004	0.004	0.999
No longstanding illness	0.004	0.000	0.004	0.001	0.001	1.000
Current drinking habit	0.002	0.000	0.002	0.006	0.006	0.999
Neoplasms	0.025	0.000	0.025	0.001	0.001	1.000
Nervous systems problems	0.008	0.000	0.008	0.003	0.003	0.999
Cardiovascular diseases	0.005	0.000	0.005	0.003	0.003	0.999
Musculoskeletal problems	0.004	0.000	0.004	0.014	0.014	0.997
Constant term	0.031	0.006	0.038	0.226	0.198	0.962

Regression results for gender differences in employment with anxiety or depression status:

The GLM analysis was also performed to examine whether there were gender differences in employment with anxiety or depression and other predictors. The analysis results indicated that there was a lower likelihood of being in work for both genders in 2011 as compared to 2008. But there were gender differences in the likelihood of being in work in

2014: women were less likely and men were more likely to be in work with reference to 2008. However, in both cases the difference was not significant. Both genders with anxiety or depressive disorders were less likely to be in work compared to no anxiety or depression, and the difference was significant with a p-value of <0.01. It was also noted that people with major anxiety or depression problems were more affected than people with some problems for both genders. The interaction of survey years and anxiety or depression in the model yielded different results. There was a higher likelihood that people with anxiety or depression were in work in 2011 for both genders compared to 2008.

Table 3.4 GLM for gender differences in employment with anxiety or depression

Employment - In Work	**GLM for Women (n=13,225)**			**GLM for Men (n=10,613)**		
	Coef.	**SE**	**P>t**	**Coef.**	**SE**	**P>t**
Survey Year						
2011	-0.105	0.068	0.121	-0.118	0.087	0.176
2014	-0.026	0.065	0.696	0.092	0.096	0.339
Anxiety or Depression						
Some	-0.318	0.077	<0.001	-0.302	0.121	0.014
Major	-1.161	0.225	<0.001	-1.403	0.355	<0.001
Interaction: Year & Anxiety						
2011*Some	0.208	0.121	0.087	0.100	0.184	0.589
2011*Major	1.080	0.309	<0.001	0.855	0.468	0.069
2014*Some	0.096	0.136	0.481	-0.107	0.192	0.577
2014*Major	-0.056	0.377	0.881	-0.085	0.605	0.889
Age in year	0.005	0.002	0.034	-0.012	0.003	<0.001
Marital status						
Married	0.767	0.072	<0.001	2.034	0.097	<0.001
Separated	1.078	0.086	<0.001	1.903	0.122	<0.001
Divorced	0.748	0.116	<0.001	1.146	0.195	<0.001
Widowed	0.710	0.097	<0.001	0.910	0.145	<0.001
Cohabitees	0.775	0.124	<0.001	1.691	0.178	<0.001
Highest qualification						
Higher education below degree	-0.385	0.084	<0.001	-0.411	0.114	<0.001
NVQ3/GCE A Level equivalent	-0.553	0.070	<0.001	-0.971	0.105	<0.001
NVQ2/GCE O Level equivalent	-0.709	0.066	<0.001	-0.780	0.098	<0.001
NVQ1/CSE other grades equivalent	-0.869	0.114	<0.001	-0.785	0.144	<0.001
Foreign/other	-1.354	0.185	<0.001	0.225	1.183	0.849
No qualification	-1.634	0.078	<0.001	-1.141	0.104	<0.001
Ethnicity						
Black	-0.017	0.130	0.896	-0.451	0.193	0.019
Asian	-0.518	0.086	0.000	0.004	0.127	0.975

Employment - In Work	GLM for Women (n=13,225)			GLM for Men (n=10,613)		
	Coef.	SE	P>t	Coef.	SE	P>t
Mixed	-0.312	0.168	0.064	-0.113	0.234	0.629
Any other ethnic group	-1.221	0.223	<0.001	-1.057	0.262	<0.001
Degree of urbanisation						
Town & fringe	0.046	0.078	0.562	0.049	0.112	0.660
Village, hamlet	-0.281	0.074	<0.001	-0.119	0.106	0.262
Household size						
2	-0.332	0.084	<0.001	-0.938	0.115	<0.001
3	-0.338	0.087	<0.001	-0.670	0.117	<0.001
4	-0.504	0.095	<0.001	-0.902	0.126	<0.001
5 and above	-0.966	0.112	<0.001	-1.208	0.156	<0.001
Deprivation score						
8.32->13.74	0.010	0.067	0.883	-0.004	0.106	0.967
13.74->21.22	0.077	0.074	0.296	0.005	0.101	0.959
21.22->34.42	0.051	0.071	0.478	-0.122	0.099	0.216
34.42->85.46 [most deprived]	-0.135	0.077	0.079	-0.368	0.100	<0.001
EQ-5D: Mobility						
Some problem	-0.403	0.088	<0.001	-0.232	0.117	0.047
Major problem	-0.257	0.914	0.778	-0.479	0.829	0.566
EQ-5D: Self Care						
Some problem	-0.573	0.150	<0.001	-0.932	0.190	<0.001
Major problem	-	-	-	-0.260	0.712	0.715
EQ-5D: Usual Act						
Some problem	-0.161	0.088	0.069	-0.456	0.125	<0.001
Major problem	-0.742	0.238	0.002	-1.023	0.297	0.001
EQ-5D: Pain or Discomfort						
Some problem	0.142	0.057	0.012	0.221	0.089	0.013
Major problem	-0.413	0.159	0.009	-0.422	0.203	0.039
BMI category						
Normal (bmi: 18.5 - <25)	0.454	0.147	0.002	0.692	0.222	0.002
Over-weight (bmi: 25 - <30)	0.615	0.150	<0.001	1.050	0.218	<0.001
Obese (bmi: >=30)	0.580	0.153	<0.001	1.137	0.230	<0.001
Limiting longstanding illness						
Non-limiting longstanding illness	0.564	0.078	<0.001	0.806	0.105	<0.001
No longstanding illness	0.492	0.076	<0.001	0.970	0.104	<0.001
Current drinking habit	0.562	0.054	<0.001	0.436	0.081	<0.001
Neoplasms	-0.014	0.193	0.940	-0.768	0.256	0.003
Nervous systems problems	-0.145	0.109	0.185	-0.321	0.154	0.037
Cardiovascular diseases	-0.484	0.092	<0.001	-0.713	0.107	<0.001
Musculoskeletal problems	0.128	0.084	0.128	0.210	0.104	0.043
Constant term	-0.238	0.205	0.246	0.193	0.299	0.518

Greater age was associated with a higher likelihood for women and lower likelihood for men of being in work, and the differences were significant for both genders (p= <0.001).

Regarding marital status, single people were significantly associated with a lower likelihood of being in work as compared to other status, and in terms of gender, men were more affected than women.

Lower educational qualification was associated with a lower likelihood of being in work for both genders; the difference was significant ($p = <0.05$). In terms of gender, women with national educational qualification and men with foreign degree qualifications were associated with a higher likelihood of being in work compared to other educational levels. But women with no qualifications had lower likelihood of being in work compared to men.

Regarding ethnic origin, black women and Asian men were more likely to be in work than their counterparts with reference to white ethnic group. People living in a village were less likely to be in work compared to people living in urban cities; in terms of gender, women were more affected than men. There was a lower likelihood of being in work for people living in households with more than one person, and men were more affected than women. This could be due to women with educational qualifications have a higher likelihood of being in work as compared to men. Women from the most deprived areas and men from the second lowest and most deprived areas were less likely to be in work, with the reference group being people living in the least deprived area.

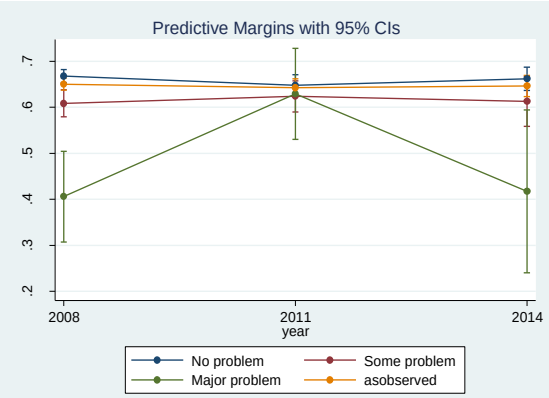
Poor health-related quality of life was linked to a lower likelihood of being in work; in general, men were more affected than women. In terms of BMI, people in the normal, overweight and obese categories had a higher probability of being in work in comparison with underweight people; and this pattern was more favourable for men than women. People with no limiting longstanding conditions were more likely to be in work, and this pattern was more favourable for women than men.

Neoplasms, nervous systems and cardiovascular problems were linked to lower probabilities of being in work; this outcome was worse for men compared to women. People with musculoskeletal problems were associated with higher likelihood of being in work; this outcome was worse for women. Current drinking habit was linked to higher chances of being in the work, especially for women.

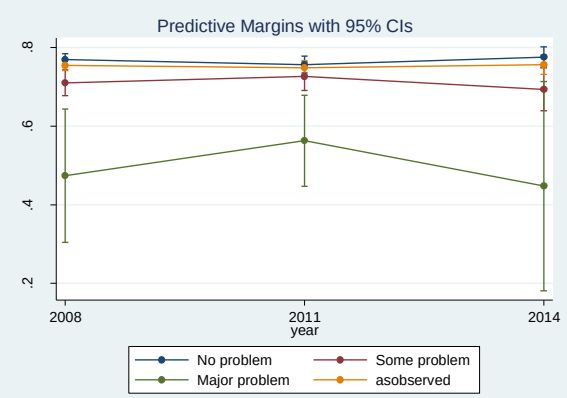
Figure 3.2 shows the difference in predicted means for people currently in employment with anxiety or depression status for each of the three study years. In comparison to people with no anxiety or depression problems, people with major problems were more likely to be in work in 2011, and the proportion was much higher for women than men. A slightly higher proportion of men with some anxiety or depressive disorders were in work in 2011 as compared to women. There was a lower proportion of people with no anxiety or depressive disorders in work in 2011 as compared to 2008 and 2014, and this finding applied to both genders.

Figure 3.2 Predicted mean employment with anxiety or depression over study years by gender

Women



Men



Regression results for anxiety/depression and its association with being in employment: Ordinal logistic regression analysis was undertaken to examine the association between anxiety/depression as dependent variable (measured with the EQ-5D) and with employment and other relevant predictors. The details of analysis results are presented in Table 3.5. In brief, there was a higher likelihood of anxiety or depression in working people in 2011 and 2014 compared to 2008. The difference was significant ($p<0.01$) for both 2011 and 2014. The results indicate that the probability of anxiety or depression was higher in 2011 following economic recession in 2008, but the difference had reduced by 2014, although had not returned to pre-recession levels. This could be interpreted as suggesting that work was associated with better mental health, since the difference was significant ($p<0.001$). People currently at work were more likely in 2011 ($p<0.01$) and less likely in 2014 to be anxious or depressed, when compared to 2008 as the reference year.

Table 3.5 Ordinal logistic regression to assess the association of anxiety or depression with employment status

Anxiety or depression	Ordinal logit (n=18138)			Ordinal Logit with Multiply-imputed data (n=23866)		
	Coef.	**SE**	**P>t**	**Coef.**	**SE**	**P>t**
Survey Year						
2011	0.275	0.084	0.001	0.247	0.077	0.002
2014	0.239	0.102	0.019	0.161	0.083	0.054
Employment						
In work	-0.430	0.066	<0.001	-0.398	0.061	<0.001
Interaction: Year & In Work						
2011* In Work	0.296	0.103	0.004	0.260	0.092	0.005
2014*In Work	-0.148	0.127	0.243	-0.086	0.104	0.409
Sex of respondent	-0.311	0.045	<0.001	-0.256	0.046	<0.001
Age	-0.009	0.002	<0.001	-0.008	0.002	<0.001
Marital status						
Married	-0.153	0.074	0.039	-0.210	0.066	0.001
Separated	0.070	0.084	0.401	-0.005	0.078	0.949
Divorced	0.442	0.112	<0.001	0.441	0.101	<0.001
Widowed	0.264	0.099	0.008	0.207	0.090	0.022
Cohabitees	0.026	0.122	0.834	-0.025	0.105	0.810
Highest qualification						
Higher education below degree	-0.101	0.080	0.209	-0.071	0.071	0.317
NVQ3/GCE A Level equivalent	-0.022	0.070	0.757	-0.011	0.064	0.865
NVQ2/GCE O Level equivalent	0.035	0.065	0.588	0.076	0.060	0.208
NVQ1/CSE other grades equivalent	-0.047	0.108	0.660	-0.037	0.099	0.707
Foreign/other	-0.591	0.277	0.033	-0.421	0.245	0.087
No qualification	0.030	0.072	0.675	0.079	0.068	0.250
Ethnicity						
Black	-0.362	0.137	0.008	-0.337	0.124	0.007
Asian	-0.053	0.094	0.576	-0.104	0.089	0.246
Mixed	-0.147	0.192	0.444	-0.156	0.164	0.344
Any other ethnic group	-0.141	0.223	0.529	-0.221	0.203	0.279
Degree of urbanisation						
Town & fringe	-0.001	0.075	0.993	-0.036	0.070	0.612
Village, hamlet	-0.092	0.074	0.215	-0.082	0.068	0.232
Household size						
2	-0.282	0.079	<0.001	-0.244	0.070	0.001
3	-0.295	0.086	0.001	-0.242	0.080	0.003
4	-0.373	0.092	<0.001	-0.344	0.084	<0.001
5 and above	-0.458	0.105	<0.001	-0.425	0.098	<0.001
Deprivation score						
8.32->13.74	0.058	0.071	0.415	0.059	0.064	0.355
13.74->21.22	0.066	0.070	0.342	0.066	0.062	0.286
21.22->34.42	0.085	0.069	0.223	0.089	0.063	0.158

Anxiety or depression	Ordinal logit (n=18138)			Ordinal Logit with Multiply-imputed data (n=23866)		
	Coef.	SE	P>t	Coef.	SE	P>t
34.42->85.46 [most deprived]	0.242	0.070	0.001	0.208	0.066	0.002
EQ-5D: Mobility						
Some problem	0.025	0.081	0.754	-0.002	0.073	0.978
Major problem	0.782	0.599	0.192	0.240	0.501	0.632
EQ-5D: Self Care						
Some problem	0.532	0.123	<0.001	0.514	0.102	<0.001
Major problem	1.608	0.489	0.001	1.129	0.357	0.002
EQ-5D: Usual Act						
Some problem	0.726	0.082	<0.001	0.808	0.073	<0.001
Major problem	1.411	0.219	<0.001	1.336	0.175	<0.001
EQ-5D: Pain or Discomfort			<0.001			
Some problem	0.807	0.057	<0.001	0.809	0.050	<0.001
Major problem	1.322	0.129	<0.001	1.256	0.110	<0.001
BMI category						
Normal (bmi: 18.5 - <25)	-0.056	0.162	0.729	-0.011	0.173	0.949
Over-weight (bmi: 25 - <30)	-0.038	0.165	0.816	0.023	0.188	0.904
Obese (bmi: >=30)	-0.013	0.164	0.937	0.054	0.186	0.775
Limiting longstanding illness						
Non-limiting longstanding illness	-0.538	0.078	<0.001	-0.444	0.071	<0.001
No longstanding illness	-1.090	0.076	<0.001	-1.009	0.073	<0.001
Current drinking habit	-0.058	0.059	0.322	-0.038	0.053	0.472
Neoplasms	-0.465	0.161	0.004	-0.402	0.134	0.003
Nervous systems problems	-0.413	0.102	<0.001	-0.383	0.097	<0.001
Cardiovascular diseases	-0.125	0.078	0.109	-0.155	0.070	0.027
Musculoskeletal problems	-0.747	0.077	<0.001	-0.688	0.068	<0.001
/Cut1 (constant for some problem)	-0.034	0.214	0.873	0.177	0.208	0.397
/Cut2 (constant for major problem)	2.861	0.222	<0.001	2.980	0.217	<0.001

Men were less likely to be anxious or depressed than women (adjusting for other characteristics) (p=<0.001). Likewise, a greater age was associated with lower likelihood of being anxious or depressed (p=<0.01). Similarly, married people were less likely to be anxious or depressed than single people, while people who were separated, divorced, widowed or cohabiting were more likely to be anxious or depressed than single people.

Regarding educational qualifications, people with higher qualifications below university degree, A level and CSE other grades equivalent and those with foreign degrees were less likely to be anxious or depressed compared to people with higher qualification above university degree. But people with GCE O-level equivalent or no qualifications were more

likely to be anxious or depressed compared to people with a university degree or higher qualifications.

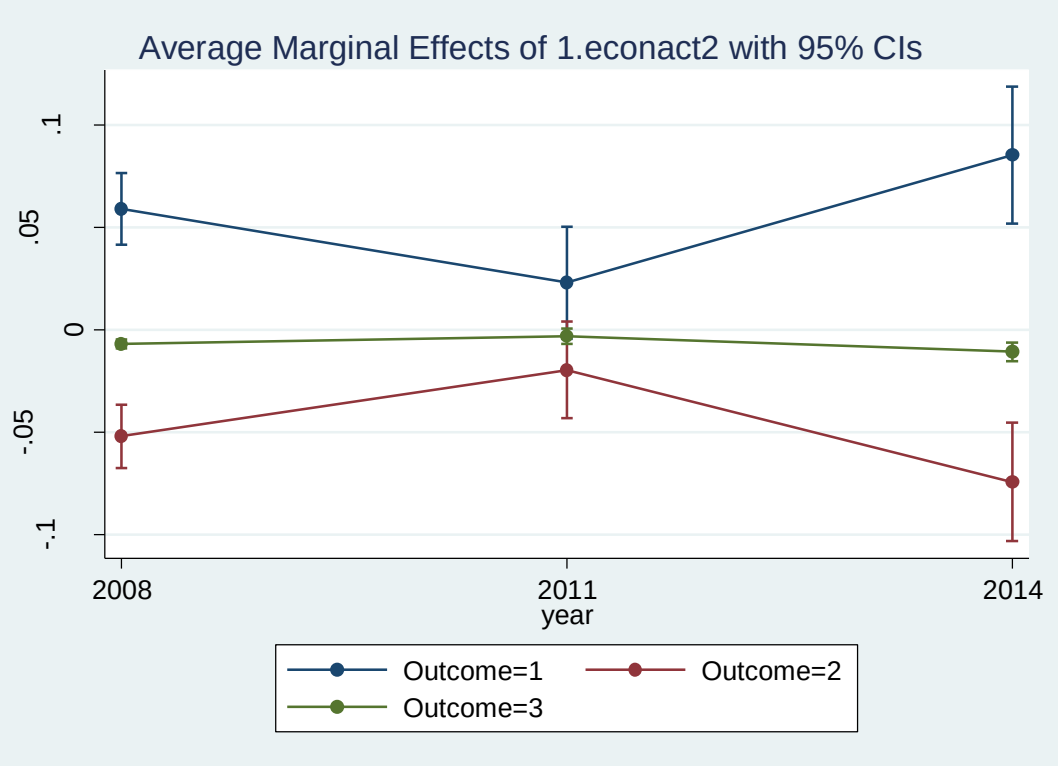
Ethnic minorities groups were less likely to be anxious or depressed, and the difference was significant in the case of the black ethnic group (p=<0.01). Similarly, people living in towns and villages were less likely to be anxious or depressed compared to people living in urban areas. People living in a household with more than one member were less likely to be anxious or depressed compared to people living alone (p<0.01). The analyses also indicated that people from deprived areas have a higher chance of being anxious or depressed. People with a better (non-mental health) health-related quality of life such as no problem in mobility, self care, usual act and no pain or discomfort were less likely to be anxious or depressed compared to people with poor quality of life. A BMI score >=18.5 was associated with lower likelihood of being anxious or depressed compared to a BMI score below 18.5 (underweight). Likewise, people with no problem linked to a limiting condition were less likely to be anxious or depressed as compared to people with limiting longstanding illness (p= <0.001). People with a current drinking habit had a lower likelihood of being anxious or depressed. People who were experiencing health problems such as carcinoma, nervous and cardiovascular disorders and musculoskeletal problems were less likely to be anxious or depressed compared to people with no such problems.

To test the ordinal logistic regression, I ran an adjusted Wald test after running the model. This was performed to test whether there was a difference in regression coefficients with survey years and employment status. The test result suggest that the estimated regression coefficient for year was significant (p=<0.001) for both survey years and among employed people. This indicates that there is heteroskedasticity in the regression coefficient with these predictors.

Figure 3.3 shows the predicted probability of anxiety or depression in the three different cross-sectional study years among people currently in employment. In general, there was a higher probability of being in work for people without anxiety or depression across all three study years. The 2008 economic recession had a negative impact on employment, but the probability of being employed improved after 2011 and surpassed the pre-recession levels by 2014 (outcome 1). The probability of being in work for people with some anxiety or depression was higher during recession compared to pre-recession levels, but again

decreased during the recovery phase and in 2014 the probability of being in work for this group was below the pre-recession levels (outcome 2). For major anxiety or depression cases, the probability of being at work was stable over time, and remained higher than people with moderate problems across all three study years (outcome 3).

Figure 3.3 Probability of anxiety or depression among employed people over survey years



Regression results for association between anxiety or depression and employment status as an employee or self-employed: The GLM regression method was employed to explore the association of being an employee or as a self-employed person with anxiety or depression, adjusting for other potential influences. The detail results from the GLM regression are demonstrated in Table 3.6. The results indicated that people were more likely to work as an employee (rather than as self-employed) in 2011 and 2014 compared to 2008 in the complete case analysis, but the analysis of the multiply-imputed data suggested opposite results. People with some anxiety or depression were less likely and those with major problems were more likely to work as an employee by comparison to people with no anxiety or depression problems. The interaction of survey years with anxiety or depression status showed that people were more likely to work as an employee in 2011 and 2014 compared to people with no such problems.

Table 3.6 GLM for the association of employment as "Employee" or "Self-employed" with anxiety/depression

Employment - Employee	**Basic GLM (n=17730)**			**GLM with Multiply-imputed data (n=23225)**		
	Coef.	**Std. Err.**	**P>t**	**Coef.**	**Std. Err.**	**P>t**
Survey Year						
2011	0.017	0.088	0.851	-0.015	0.081	0.856
2014	0.035	0.096	0.718	-0.031	0.082	0.708
Anxiety or Depression						
Some	-0.035	0.088	0.688	-0.039	0.085	0.642
Major	0.335	0.287	0.242	0.435	0.277	0.117
Interaction: Year & Anxiety						
2011*Some	0.211	0.143	0.141	0.173	0.143	0.230
2011*Major	0.400	0.526	0.447	-0.147	0.454	0.747
2014*Some	0.075	0.166	0.650	0.107	0.140	0.444
2014*Major	0.993	0.665	0.136	0.562	0.603	0.358
Gender: Men	-0.074	0.036	0.039	-0.047	0.032	0.139
Age in year	-0.018	0.003	<0.001	-0.017	0.003	<0.001
Marital status						
Married	-0.028	0.102	0.782	-0.030	0.088	0.731
Separated	0.157	0.124	0.207	0.086	0.109	0.430
Divorced	0.119	0.152	0.432	0.182	0.129	0.160
Widowed	0.209	0.125	0.094	0.200	0.112	0.075
Cohabitees	0.074	0.174	0.669	0.015	0.166	0.928
Highest qualification						
Higher education below degree	-0.067	0.084	0.430	-0.105	0.074	0.153
NVQ3/GCE A Level equivalent	-0.218	0.079	0.006	-0.222	0.070	0.001
NVQ2/GCE O Level equivalent	-0.175	0.077	0.022	-0.168	0.069	0.015
NVQ1/CSE other grades equivalent	-0.317	0.124	0.011	-0.265	0.112	0.018
Foreign/other	0.004	0.263	0.988	-0.141	0.238	0.554
No qualification	-0.235	0.096	0.015	-0.257	0.086	0.003
Ethnicity						
Black	0.783	0.243	0.001	0.827	0.205	<0.001
Asian	-0.343	0.138	0.013	-0.428	0.120	<0.001
Mixed	-0.139	0.270	0.607	-0.250	0.217	0.250
Any other ethnic group	-0.023	0.413	0.956	-0.266	0.296	0.369
Degree of urbanisation						
Town & fringe	0.024	0.115	0.832	0.037	0.104	0.724
Village, hamlet	-0.493	0.103	<0.001	-0.521	0.090	<0.001
Household size						
2	0.197	0.103	0.057	0.168	0.092	0.068
3	0.059	0.119	0.619	0.130	0.105	0.213
4	-0.068	0.131	0.606	-0.055	0.114	0.625

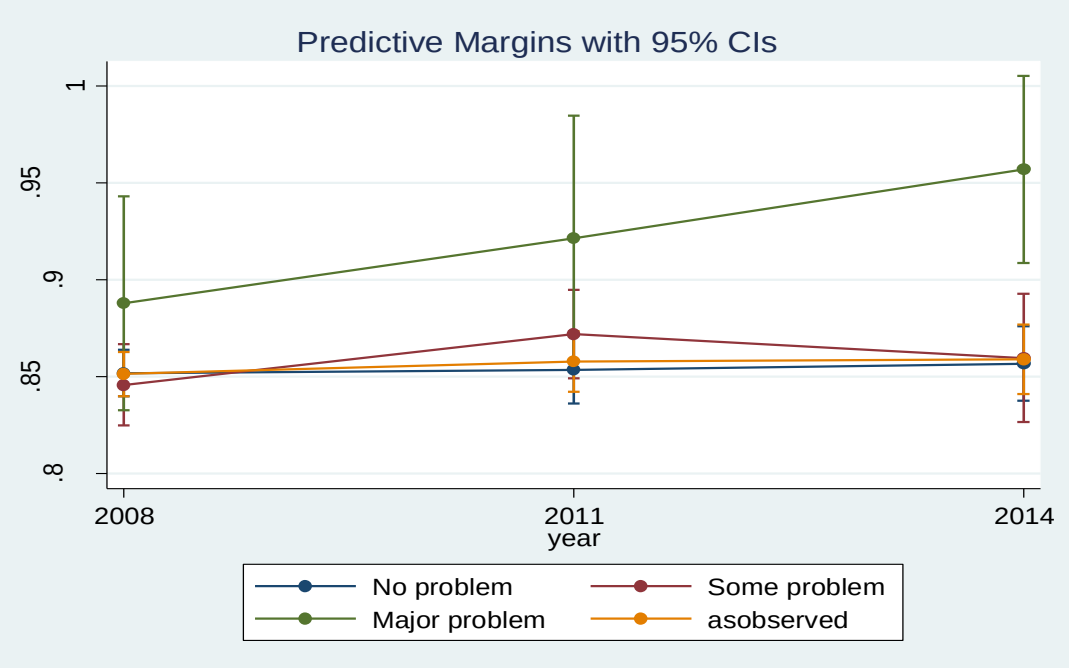
Employment - Employee	Basic GLM (n=17730)			GLM with Multiply-imputed data (n=23225)		
	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t
5 and above	-0.255	0.150	0.089	-0.294	0.132	0.025
Deprivation score						
8.32->13.74	-0.171	0.095	0.072	-0.131	0.086	0.129
13.74->21.22	0.051	0.099	0.608	0.051	0.091	0.575
21.22->34.42	0.063	0.107	0.556	0.115	0.097	0.237
34.42->85.46 [most deprived]	0.288	0.128	0.024	0.365	0.111	0.001
EQ-5D: Mobility						
Some problem	0.111	0.103	0.279	0.093	0.101	0.358
Major problem	1.114	1.058	0.292	0.919	0.814	0.260
EQ-5D: Self Care						
Some problem	0.121	0.187	0.515	0.046	0.174	0.790
Major problem	-0.344	0.592	0.561	-0.277	0.460	0.547
EQ-5D: Usual Act						
Some problem	0.049	0.112	0.661	0.113	0.104	0.281
Major problem	-0.289	0.285	0.311	-0.017	0.262	0.949
EQ-5D: Pain or Discomfort						
Some problem	-0.145	0.067	0.030	-0.151	0.058	0.009
Major problem	0.191	0.202	0.344	0.104	0.189	0.584
BMI category						
Normal (bmi: 18.5 - <25)	-0.224	0.225	0.319	-0.159	0.214	0.460
Over-weight (bmi: 25 - <30)	-0.235	0.232	0.313	-0.200	0.218	0.361
Obese (bmi: >=30)	-0.142	0.236	0.548	-0.116	0.225	0.609
Limiting longstanding illness						
Non-limiting longstanding illness	0.039	0.094	0.680	-0.026	0.087	0.768
No longstanding illness	-0.146	0.096	0.130	-0.161	0.086	0.062
Current drinking habit	0.165	0.075	0.028	0.147	0.066	0.025
Neoplasms	-0.452	0.184	0.014	-0.202	0.171	0.238
Nervous systems problems	0.279	0.169	0.099	0.221	0.141	0.116
Cardiovascular diseases	0.021	0.103	0.839	0.098	0.091	0.283
Musculoskeletal problems	0.076	0.096	0.429	0.095	0.084	0.258
Constant term	2.847	0.283	<0.001	2.735	0.265	<0.001

Greater age, being male, married, lower qualification, Asian, mixed and any other ethnic groups, living in a village, more than three household members, people from the second least deprived area, better health-related quality of life such as no problem in walking, selfcare or usual activity, BMI score equal to or above 18.5, no limiting conditions and people experiencing carcinoma had a higher likelihood of working as self-employed. People who have current drinking habit were more likely to work as an employee than to be self-employed ($p<0.05$). The analysis of multiply-imputed data also supports these findings.

The validity of the GLM analysis of employment status (employee or self-employed) was tested using the Modified Park Test. The test showed that the estimate of the alpha coefficient (employment: employed) is significant p<0.001). After multiple imputations, the test was performed to assess within imputation variance of the coefficient for survey years and anxiety or depression. The result indicated that the difference was not significant for survey years (F=2.72, p= 0.066) but it was statistically significant for anxiety or depression (F=28.88, p <0.001).

It is clear from the following graph that the effect of anxiety or depression on employment 'type' differs by study years. A higher proportion of people with major anxiety or depression who worked as an employee as compared to some and no problem cases for all three study years. It was found that a lower proportion of people with moderate conditions worked as an employee in 2008, but this proportion was higher in 2011 and then again slightly lower in 2014, but it was still above the base year 2008. The details are presented in figure 3.3.

Figure 3.4 Predicted mean employees with anxiety or depression over survey years



Variance information estimation for employment status as an employee or self-employed for multiply-imputed data: The imputation model for employment status as employee or self-employed was tested for an imputation variance to assess how well the imputation was

performed. The variance information in Table 3.7 showed that the within imputation variance was higher for major anxiety or depression cases, black, mixed or any other ethnic groups, health-related quality of life and BMI category. These higher values resulted in higher overall imputation variance. Similarly, the RVI percentage was higher for some anxiety or depression cases, health-related quality of life and BMI category. As FMI is directly correlated with RVI, the FMI percentage for these variables was also higher. The overall relative efficiency of the imputation model was 96%, which was the power of the imputation method.

Table 3.7 Variance information with multiply-imputed data for employment as "employee" or "Self-employed"

Employment: Employee	**Imputation variance**			**RVI**	**FMI**	**Rel. Eff.**
	Within	**Between**	**Total**			
Survey Year						
2011	0.006	0.000	0.007	0.029	0.029	0.994
2014	0.007	0.000	0.007	0.005	0.005	0.999
Anxiety or Depression						
Some	0.007	0.000	0.007	0.082	0.078	0.985
Major	0.073	0.003	0.077	0.051	0.050	0.990
Interaction: Year & Anxiety						
2011*Some	0.017	0.003	0.021	0.223	0.196	0.962
2011*Major	0.197	0.008	0.207	0.049	0.048	0.991
2014*Some	0.018	0.001	0.020	0.067	0.064	0.987
2014*Major	0.241	0.102	0.364	0.507	0.371	0.931
Sex: male	0.001	0.000	0.001	0.004	0.004	0.999
Age in year	0.000	0.000	0.000	0.003	0.003	0.999
Marital status						
Married	0.008	0.000	0.008	0.001	0.001	1.000
Separated	0.012	0.000	0.012	0.001	0.001	1.000
Divorced	0.017	0.000	0.017	0.002	0.002	1.000
Widowed	0.013	0.000	0.013	0.000	0.001	1.000
Cohabitees	0.028	0.000	0.028	0.000	0.000	1.000
Highest qualification						
Higher education below degree	0.005	0.000	0.005	0.000	0.000	1.000
NVQ3/GCE A Level equivalent	0.005	0.000	0.005	0.000	0.000	1.000
NVQ2/GCE O Level equivalent	0.005	0.000	0.005	0.001	0.001	1.000
NVQ1/CSE other grades equivalent	0.012	0.000	0.012	0.002	0.002	1.000
Foreign/other	0.057	0.000	0.057	0.000	0.000	1.000
No qualification	0.007	0.000	0.007	0.002	0.002	1.000
Ethnicity						

Employment: Employee	Imputation variance			RVI	FMI	Rel. Eff.
	Within	Between	Total			
Black	0.042	0.000	0.042	0.000	0.000	1.000
Asian	0.014	0.000	0.014	0.001	0.001	1.000
Mixed	0.047	0.000	0.047	0.001	0.001	1.000
Any other ethnic group	0.088	0.000	0.088	0.001	0.001	1.000
Degree of urbanisation						
Town & fringe	0.011	0.000	0.011	0.000	0.000	1.000
Village, hamlet	0.008	0.000	0.008	0.000	0.000	1.000
Household size						
2	0.009	0.000	0.009	0.001	0.001	1.000
3	0.011	0.000	0.011	0.001	0.001	1.000
4	0.013	0.000	0.013	0.001	0.001	1.000
5 and above	0.017	0.000	0.017	0.002	0.002	1.000
Deprivation score						
8.32->13.74	0.007	0.000	0.007	0.000	0.000	1.000
13.74->21.22	0.008	0.000	0.008	0.000	0.000	1.000
21.22->34.42	0.009	0.000	0.009	0.000	0.000	1.000
34.42->85.46 [most deprived]	0.012	0.000	0.012	0.000	0.000	1.000
EQ-5D: Mobility						
Some problem	0.008	0.002	0.010	0.269	0.229	0.956
Major problem	0.588	0.062	0.662	0.127	0.118	0.977
EQ-5D: Self Care						
Some problem	0.027	0.003	0.030	0.131	0.122	0.976
Major problem	0.200	0.010	0.212	0.059	0.057	0.989
EQ-5D: Usual Act						
Some problem	0.009	0.001	0.011	0.180	0.162	0.969
Major problem	0.058	0.009	0.069	0.190	0.170	0.967
EQ-5D: Pain or Discomfort						
Some problem	0.003	0.000	0.003	0.032	0.031	0.994
Major problem	0.027	0.007	0.036	0.304	0.254	0.952
BMI category						
Normal (bmi: 18.5 - <25)	0.037	0.007	0.046	0.232	0.203	0.961
Over-weight (bmi: 25 - <30)	0.039	0.007	0.048	0.222	0.195	0.962
Obese (bmi: >=30)	0.040	0.009	0.051	0.272	0.231	0.956
Limiting longstanding illness						
Non-limiting longstanding illness	0.007	0.000	0.007	0.044	0.043	0.991
No longstanding illness	0.007	0.000	0.007	0.043	0.042	0.992
Current drinking habit	0.004	0.000	0.004	0.001	0.001	1.000
Neoplasms	0.029	0.000	0.029	0.002	0.002	1.000
Nervous systems problems	0.020	0.000	0.020	0.002	0.002	1.000
Cardiovascular diseases	0.008	0.000	0.008	0.004	0.004	0.999
Musculoskeletal problems	0.007	0.000	0.007	0.006	0.006	0.999
Constant term	0.059	0.009	0.070	0.182	0.164	0.968

Regression results for gender differences in employment as an employee or self-employee with anxiety or depression: The GLM regression method was employed to analyse whether there was any difference in employment status (employee or self-employed) with anxiety or depression by gender. The analysis suggested that women were less likely and men were more likely to work as an employee (relative to working as self-employed) in 2011 and 2014 as compared to 2008. Women with some anxiety or depression problems were less likely to work as an employee, but those with major problems were more likely to work as an employee as compared to those having no such problems. Men with some and major anxiety or depression problems were more likely to work as an employee as compared to those having no such problems. The interaction of anxiety or depression with study years showed that women with both some and major anxiety or depression (except 2011) problems were more likely to work as an employee in 2011 and 2014 as compared to 2008. This case was also valid for men except those with major problems in 2011 and some problems in 2014 where there was a higher likelihood of being self-employed as compared to 2008.

Table 3.8 GLM for gender differences in employment as an employee with anxiety or depression

Employment - Employee	**GLM for Women (n=12,855)**			**GLM for Men (n=10,370)**		
	Coef.	**Std. Err.**	**P>t**	**Coef.**	**Std. Err.**	**P>t**
Survey Year						
2011	-0.088	0.089	0.322	0.050	0.097	0.605
2014	-0.125	0.090	0.162	0.063	0.098	0.524
Anxiety or Depression						
Some	-0.110	0.107	0.306	0.031	0.133	0.812
Major	0.267	0.374	0.477	0.562	0.467	0.230
Interaction: Year & Anxiety						
2011*Some	0.180	0.169	0.288	0.185	0.226	0.416
2011*Major	-0.173	0.507	0.733	-0.043	0.718	0.953
2014*Some	0.235	0.176	0.183	-0.026	0.223	0.907
2014*Major	0.432	0.653	0.509	0.924	1.047	0.386
Age in year	-0.013	0.003	<0.001	-0.021	0.003	0.000
Marital status						
Married	-0.231	0.105	0.028	0.210	0.111	0.060
Separated	-0.045	0.123	0.716	0.242	0.130	0.064
Divorced	0.250	0.176	0.155	0.050	0.181	0.781
Widowed	0.237	0.152	0.118	0.063	0.154	0.684
Cohabitees	-0.073	0.174	0.674	0.067	0.203	0.740
Highest qualification						
Higher education below degree	-0.008	0.105	0.938	-0.192	0.099	0.052

Employment - Employee	GLM for Women (n=12,855)			GLM for Men (n=10,370)		
	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t
NVQ3/GCE A Level equivalent	-0.135	0.090	0.133	-0.305	0.097	0.002
NVQ2/GCE O Level equivalent	-0.110	0.086	0.200	-0.223	0.095	0.019
NVQ1/CSE other grades equivalent	-0.072	0.155	0.640	-0.420	0.145	0.004
Foreign/other	0.024	0.253	0.925	-0.995	0.643	0.122
No qualification	-0.132	0.104	0.203	-0.369	0.109	0.001
Ethnicity						
Black	0.870	0.225	<0.001	0.765	0.244	0.002
Asian	-0.383	0.127	0.003	-0.490	0.138	<0.001
Mixed	0.223	0.263	0.395	-0.617	0.281	0.028
Any other ethnic group	-0.334	0.330	0.311	-0.113	0.463	0.808
Degree of urbanisation						
Town & fringe	-0.003	0.107	0.979	0.079	0.119	0.506
Village, hamlet	-0.512	0.092	<0.001	-0.521	0.107	<0.001
Household size						
2	0.041	0.128	0.750	0.113	0.125	0.366
3	-0.061	0.137	0.656	0.140	0.141	0.318
4	-0.222	0.144	0.122	-0.066	0.147	0.653
5 and above	-0.503	0.161	0.002	-0.269	0.167	0.108
Deprivation score						
8.32->13.74	-0.142	0.091	0.120	-0.125	0.103	0.223
13.74->21.22	0.040	0.096	0.674	0.060	0.108	0.581
21.22->34.42	0.171	0.105	0.104	0.058	0.113	0.610
34.42->85.46 [most deprived]	0.353	0.122	0.004	0.376	0.127	0.003
EQ-5D: Mobility						
Some problem	0.115	0.133	0.388	0.076	0.145	0.602
Major problem	1.070	1.154	0.354	0.741	1.150	0.520
EQ-5D: Self Care						
Some problem	0.244	0.255	0.340	-0.075	0.225	0.740
Major problem	-0.603	0.590	0.308	0.145	0.769	0.851
EQ-5D: Usual Act						
Some problem	0.161	0.122	0.188	0.088	0.167	0.602
Major problem	0.167	0.388	0.668	-0.147	0.344	0.670
EQ-5D: Pain or Discomfort						
Some problem	-0.090	0.072	0.210	-0.220	0.085	0.010
Major problem	0.013	0.242	0.956	0.156	0.284	0.584
BMI category						
Normal (bmi: 18.5 - <25)	-0.096	0.262	0.715	-0.234	0.347	0.502
Over-weight (bmi: 25 - <30)	-0.173	0.277	0.535	-0.265	0.348	0.448
Obese (bmi: >=30)	-0.005	0.259	0.985	-0.250	0.361	0.491
Limiting longstanding illness						
Non-limiting longstanding illness	0.001	0.109	0.995	-0.051	0.128	0.689

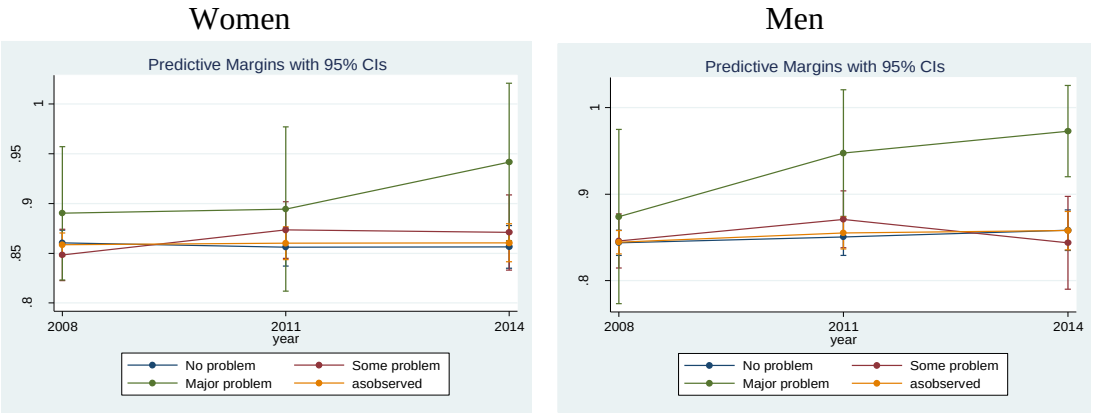
Employment - Employee	GLM for Women (n=12,855)			GLM for Men (n=10,370)		
	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t
No longstanding illness	-0.163	0.108	0.133	-0.166	0.129	0.197
Current drinking habit	0.122	0.073	0.094	0.186	0.095	0.050
Neoplasms	-0.338	0.205	0.100	-0.025	0.274	0.928
Nervous systems problems	0.122	0.189	0.519	0.342	0.212	0.107
Cardiovascular diseases	0.066	0.124	0.593	0.146	0.124	0.240
Musculoskeletal problems	-0.003	0.112	0.976	0.165	0.123	0.180
Constant term	2.806	0.327	<0.001	2.869	0.406	<0.001

Greater age was associated with higher likelihood of being self-employed for both genders. Women who were divorsed and widowed were less likely, and married, separated and cohabitees were more likely to work as an employee as compared to those who were single. In the case of men, all other marital statuses were more likely to work as an employee compared to those who were single. People with lower qualifications were less likely to work as employees, but women with foreign degrees have higher chances and men with such degrees have lower chances to work as an employee as compared to those with higher degree qualifications. Women from black and mixed ethnic groups were more likely to work as an employee, while Asian and any other ethnic groups were less likely to work as an employee as compared to white women. Men from black ethnic group were more likely to work as an employee, but men from other ethnic groups had lower probability to work as an employee compared to white men. People living in a village were less likely to work as an employee (this was true for both genders) as compared to people living in urban areas. In a household where there were more than three members, individuals were less likely to work as an employee as compared to people living alone, and again this held for both genders. Both genders from less deprived areas were more likely to work as an employee, compared to people from least deprived areas. Better health-related quality of life such as no problem in walking, self care or usual activity was associated with a higher likelihood of being self-employed. A higher BMI score was associated with a higher likelihood of being self-employed as compared to people with a BMI less than 18.5 (underweight category), and this was found for both genders. People with no limiting conditions were more likely to be self-employed as compared to people having a longstanding limiting illness; this result applies to both genders. Similarly, women who were experiencing problems with carcinoma or musculoskeletal problems were less likely to work as an employee, while those with nervous or cardiovascular problems were more likely to work as an employee as compared to women without such

problems. The impact on employment was also similar for men except in the case of musculoskeletal where men with such problems were more likely to work as an employee. People having current drinking habit were associated with higher likelihood to remain as an employee for both genders.

Figure 3.5 shows the predicted values of employment status with anxiety or depression over the three study years. This showed that there was a higher proportion of people with major anxiety or depression who worked as an employee in each of the study years and this was in incremental fashion. The proportion was also higher for people who worked as an employee in 2011 but was lower in 2008 and 2014. For people without such problems, there was a trivial reduction in the percentage of people who worked as an employee. Regarding gender, the incremental proportion of people with major anxiety or depression problems was much higher in men compared to women in 2011 and 2014. In 2014, a higher proportion of women with some problems as compared to women with no problems and men with no problems as compared to some problems worked as an employee.

Figure 3.5 Predicted mean of employees with anxiety or depression over study years by gender



Regression results for anxiety/depression as a secondary outcome with employment status as an employee: The ordinal logistic regression method was employed to assess the effects of employment on anxiety or depression condition among the sample of working age people. The likelihood of anxiety or depression was higher in 2011 compared to 2008, but relatively lower in 2014. Employees were less likely to experience anxiety or depression as compared to self-employed. The interaction of employee with survey years showed that there was a higher likelihood of people being anxious or depressed in 2011 and 2014 as compared to 2008.

Table 3.9 Ordinal logistic regression for anxiety or depression with employment as an employee or self-employed

Anxiety or Depression	Ordinal Logit (n=17730)			Ordinal Logit with Multiply-imputed data (n=23225)		
	Coef.	**SE**	**P>t**	**Coef.**	**SE**	**P>t**
Survey Year						
2011	0.237	0.136	0.082	0.297	0.145	0.046
2014	-0.032	0.155	0.836	-0.089	0.131	0.498
Employment						
Employee	-0.038	0.088	0.665	-0.031	0.084	0.714
Interaction: Year & Employee						
2011*Employee	0.289	0.145	0.046	0.163	0.146	0.267
2014*Employee	0.224	0.167	0.179	0.235	0.140	0.095
Gender: men	-0.346	0.046	<0.001	-0.304	0.043	<0.001
Age in year	-0.007	0.002	0.001	-0.008	0.002	<0.001
Marital status						
Married	-0.272	0.074	<0.001	-0.277	0.072	<0.001
Separated	-0.035	0.083	0.674	-0.066	0.079	0.408
Divorced	0.357	0.113	0.002	0.364	0.104	0.001
Widowed	0.191	0.100	0.056	0.155	0.090	0.083
Cohabitees	-0.091	0.123	0.460	-0.128	0.111	0.250
Highest qualification						
Higher education below degree	-0.094	0.080	0.241	-0.064	0.072	0.376
NVQ3/GCE A Level equivalent	0.025	0.071	0.725	0.030	0.065	0.645
NVQ2/GCE O Level equivalent	0.077	0.065	0.233	0.116	0.059	0.049
NVQ1/CSE other grades equivalent	-0.047	0.111	0.674	-0.029	0.112	0.796
Foreign/other	-0.502	0.277	0.070	-0.317	0.247	0.199
No qualification	0.130	0.074	0.077	0.156	0.066	0.019
Ethnicity						
Black	-0.357	0.143	0.012	-0.362	0.135	0.009
Asian	-0.038	0.097	0.694	-0.114	0.094	0.229
Mixed	-0.132	0.194	0.499	-0.074	0.176	0.675
Any other ethnic group	0.043	0.234	0.855	-0.075	0.254	0.771
Degree of urbanisation						
Town & fringe	-0.029	0.076	0.699	-0.035	0.072	0.621
Village, hamlet	-0.099	0.075	0.190	-0.091	0.069	0.190
Household size						
2	-0.232	0.080	0.004	-0.232	0.073	0.002
3	-0.240	0.088	0.007	-0.231	0.082	0.005
4	-0.298	0.093	0.001	-0.301	0.086	<0.001
5 and above	-0.307	0.109	0.005	-0.325	0.099	0.001
Deprivation score						
8.32->13.74	0.047	0.071	0.506	0.052	0.063	0.403
13.74->21.22	0.041	0.071	0.559	0.055	0.068	0.417
21.22->34.42	0.054	0.070	0.439	0.063	0.066	0.345

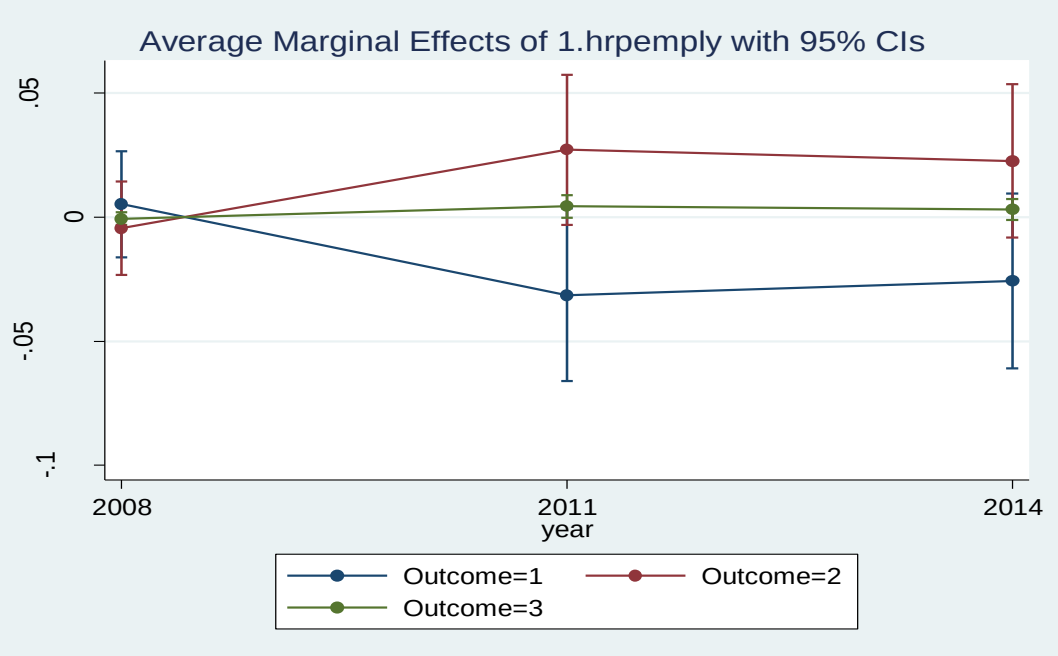
Anxiety or Depression	Ordinal Logit (n=17730)			Ordinal Logit with Multiply-imputed data (n=23225)		
	Coef.	SE	P>t	Coef.	SE	P>t
34.42->85.46 [most deprived]	0.221	0.072	0.002	0.197	0.071	0.007
EQ-5D: Mobility						
Some problem	0.050	0.082	0.540	0.003	0.073	0.967
Major problem	0.222	0.670	0.740	0.244	0.478	0.610
EQ-5D: Self Care						
Some problem	0.628	0.127	<0.001	0.650	0.107	<0.001
Major problem	1.547	0.520	0.003	1.272	0.331	<0.001
EQ-5D: Usual Act						
Some problem	0.727	0.083	<0.001	0.811	0.073	<0.001
Major problem	1.505	0.228	<0.001	1.353	0.188	<0.001
EQ-5D: Pain or Discomfort			<0.001			
Some problem	0.803	0.057	<0.001	0.805	0.051	<0.001
Major problem	1.314	0.131	<0.001	1.256	0.110	<0.001
BMI category						
Normal (bmi: 18.5 - <25)	-0.039	0.167	0.815	-0.062	0.157	0.692
Over-weight (bmi: 25 - <30)	-0.037	0.169	0.826	-0.036	0.158	0.818
Obese (bmi: >=30)	-0.023	0.170	0.891	-0.025	0.154	0.869
Limiting longstanding illness						
Non-limiting longstanding illness	-0.582	0.079	<0.001	-0.487	0.069	<0.001
No longstanding illness	-1.118	0.077	<0.001	-1.042	0.068	<0.001
Current drinking habit	-0.099	0.060	0.095	-0.069	0.054	0.207
Neoplasms	-0.486	0.166	0.004	-0.420	0.143	0.004
Nervous systems problems	-0.371	0.104	<0.001	-0.350	0.094	<0.001
Cardiovascular diseases	-0.072	0.078	0.360	-0.080	0.073	0.273
Musculoskeletal problems	-0.750	0.079	<0.001	-0.689	0.070	<0.001
/Cut1 (constant for some problem)	0.235	0.232	0.312	0.342	0.227	0.135
/Cut2 (Constant for major problem)	3.156	0.238	<0.001	3.165	0.224	<0.001

Regarding gender, men were less likely to be affected by anxiety or depression as measured by EQ-5D compared to women (p<0.001). Greater age was linked to a lower probability of people experiencing anxiety or depressive disorders (p=0.001). Married people, separated and cohabitees were less likely and widowed and divorced people were more likely, to be affected by anxiety or depression as compared to single people. People with higher education below degree, CSE other grade equivalent and with foreign degree were less likely, and people with GCE qualifications or no qualifications were more likely, to be affected by anxiety or depression as compared to people with higher education above degree. People from white ethnic group were more likely to be affected by anxiety or

depression as compared to other ethnic groups. People living in towns and villages were less likely to be affected by anxiety or depression as compared to those living in urban areas. People living alone were more likely to be affected by anxiety or depression as compared to people living with others (household with more than one member). There was a higher chance of anxiety or depressive disorders for people living in more deprived areas. Better health-related quality of life such as no problem in walking, self care, usual activity and pain or discomfort was related to a lower probability of anxiety or depressive disorders. A higher BMI scores was associated with lower likelihood of anxiety or depression as compared to BMI scores less than 18.5 (underweight category). Similarly, people with no limiting conditions, current drinking habits, health-related problems such as carcinoma, nervous disorder or cardiovascular disorders, musculoskeletal problems were linked to lower odds of anxiety or depressive disorders.

The marginal effects of work status as an employee on anxiety or depression over the study years are presented in Figure 3.5. There was a higher probability that employees were less likely to be affected by anxiety or depression as compared to self-employed in 2008. But, the probability of anxiety or depression problems among employees was higher in 2011 and 2014.

Figure 3.6 Probability of anxiety or depression on employees over survey years



3.4 Discussion

This study was conceived with the aim of assessing the effects of common mental disorders on employment in the short-term and (relatively) long-term following economic recession in 2008 in England. The descriptive analyses suggested that people who were currently in work have better mental health status than those who were out of the work. The problem of anxiety or depression was higher and the proportion of people working as an employee (rather than being self-employed) was also higher during the recession period.

The multivariable analyses suggest that there was significant correlation between employment and anxiety or depressive disorders. People who have experienced anxiety or depression were less likely to be in work, where men with such problems were more affected than women.

People experiencing some anxiety or depression problems were less likely and those with major problems were more likely to work as an employee. In relation to gender, men with such problems were less likely to be affected. During economic recession, people with anxiety or depressive disorders have a higher probability to work as an employee rather than being self-employed. Furthermore, employees were less likely to suffer from anxiety or depression in comparison to those who were self-employed.

My findings that people are less likely to be employed following economic recession in 2008 replicates the findings of the review conducted by Goodman and Mance (2011). The difference was statistically significant for 2011 compared to 2008, but not in 2014. This indicates that the short-term impact of economic recession is more intensive than the long-term impact. This could be due to the fact that the negative impact of recession gradually normalises over times. The Centre for Economic Performance reported that there were wide gaps in terms of employment between women (69%) and men (82%) in 2014, but this report also suggested that men in employment fell gradually during recession as compared to women (Azmat, 2015). The result of this report also complements my study findings described in this chapter. The reason why employment rate for men falls during recession may be due to the nature of business where employment of men is more common.

It is evident that workforce participation is good for mental health and wellbeing as reported by Olesen, Butterworth, Leach, Kelaher, and Pirkis (2013). My study also suggests that employment is good for people's mental health and wellbeing. The possible explanation could be that an increase in social functioning, purpose in life and physical attainment may be associated with employment, and this may have an impact on psychological wellbeing among employed people. There can be substantial adverse consequences of mental health problems on employment as evident from a population-based study conducted by Mojtabai et al. (2015) which concurs with my study finding. It is also evident from the latest review that economic recession and unemployment are associated with poor mental health and wellbeing, including common mental disorders (Frasquilho et al., 2016).

The effect of anxiety or depression on employment over the study years is little bit surprising. It was observed that anxiety or depression was associated with higher likelihood of people being in work during recession. This could be due to increase in anxiety or depression episodes after economic recession. Job insecurity and reduced wages as a result of recession may increase such mental health problems. Another possibility may be due to introduction of the national apprenticeship service in 2009 and dramatic growth of apprenticeships service (Mirza-Davies, 2015). It is evident that younger people have been more affected with anxiety or depression during economic recession and the apprenticeship service is targeted to younger people.

There was a decrease in the proportion of men in work during recession and the younger age group were more affected. This finding is consistent with the study by Escriba-Aguir and Fons-Martinez (2014). It was found that people who were single had a lower probability of being in work. Possible explanations may be younger age, less experience and no family responsibilities.

Higher qualifications are associated with better employment outcomes as suggested by the Education for All (EFA) team (2013); this concurs with my study findings. It is evident from my study that people living outside urban areas have a lower likelihood of being in work. This could be due to worse job opportunities in rural areas.

A briefing paper from the House of Commons suggests that the percentage of unemployed members in a household is increasing (Guinness, 2016), which supports my study finding that households with more than one member are associated with poor likelihood of being in work. It could be possible that more adults in a household are likely to be associated with a higher number of dependent members in the household.

The study findings showed that people from deprived areas were more likely to be in work compared to people from the least deprived areas. This could be due to increase in job placement and apprenticeships through local authorities after 2008 economic recession to mitigate unemployment in deprived areas of the UK (Tunstall & Fenton, 2009). Another possibility could be an introduction of a welfare reform programme after economic recession which emphasises active labour market and family support programmes, expansion of mental health services and debt management programmes (Faculty of Public Health, 2010). The present study identified that better health-related quality of life such as no problem in walking, self care, usual activity or having no pain/discomfort was linked to higher likelihood of being in a job which was also suggested by McCaffrey, Kaambwa, Currow, and Ratcliffe (2016). A survey of adult working age population from the UK showed that unemployment was associated with being underweight (Hughes & Kumari, 2017), and my study also finds this result.

My study showed that having a longstanding illness led to poor attachment to work; this finding has been reported by the 2003 Scottish Health Survey data (Brown et al., 2012). My study indicated that current alcohol consumption was linked to higher chances of remaining in work. Similarly, a cross-sectional study from Puerto Rico also suggested that non-participation in the workforce was associated with lower likelihood of drinking alcohol (Caetano, Vaeth, Mills, & Canino, 2016). The possible explanations could be that people in employment may engage in social gathering and may have extra money to spend for drinking.

It is evident that health-related problems can have an impact on employment. A meta-analysis found that cancer survivors have the higher probability of being out of work by comparison to healthy controls (de Boer, Taskila, Ojajarvi, van Dijk, & Verbeek, 2009) and my study corroborated this finding. Neurological problems such as epilepsy are associated with higher probability of being out of work - as suggested by Lim, Wo, Wong,

and Tan (2013) for example - and my study also concurred with this finding. A hospital-based study found that cardiovascular disease was linked to a lower probability of being in employment (Civil, Ilhan, & Yildirim, 2013) and my study replicates this finding. The present study suggests that people experiencing musculoskeletal disorders were more likely to be in work. This evidence reproduces the study finding by Stephen Bevan (2015). The possible explanation may be that people in work may experience such problems due to work-related physical strains compared to people out of work.

There are several limitations to this study. First, one of the potential limitations is a detection bias for the main predictor variable. The data for anxiety or depression were collected from the self-reported EQ-5D questionnaire which could lead to over- or under-estimation of anxiety or depression cases as there was no clinical diagnosis. I employed interaction of anxiety or depression with survey years in the model to assess the consistency of self-reported anxiety or depression status. Second, the cross-sectional nature of the data could not establish the causality between response and predictor variables (Stranges, Samaraweera, Taggart, Kandala, & Stewart-Brown, 2014). I used data from the three cross-sectional surveys and those survey years were interacted with anxiety or depression variable in the models as noted earlier in detection bias to observe changes over times. Third, there was missing data for some variables which could influence the study results. I have addressed this problem using multiple imputation methods, and I assessed whether imputation was well performed.

In conclusion, anxiety or depressive disorders are clearly linked to lower chances of being in work, and for those people remaining in work, those with some mental health problems are less likely and those with major problems are more likely to work as an employee rather than as self-employed. Following the economic recession in 2008, there was increase in anxiety or depression problems among people in work. Also, during economic recession, people with anxiety or depressive disorders were more likely to be in work, while in the long-term people with some problems are less likely and those with major problems are more likely to be in work. In terms of gender, men with anxiety or depressive disorders are less likely to be in work compared to women. Moreover, people with anxiety or depression problems are more likely to work as an employee following economic recession. Compared to women, men with some anxiety or depression are less likely and those with major problems are more likely to work as an employee. Employment is

supportive of good mental health, and employees are less likely to experience anxiety or depression with reference to self-employed. This could be due to the fact that people in employment can benefit from employment rights and income security. Further studies are needed to establish potential causality in this association and to evaluate suitable workplace interventions for common mental health problems to improve employees' mental health and organisations' productivity.

Chapter 4

4. Transferability of Economic Data to Evaluate Cost-effectiveness of a Workplace Intervention to Prevent Sickness Absence in the English Context

4.1 Introduction

Anxiety and depressive disorders, known as common mental disorders (CMDs), are frequent sources of lost productivity, sickness absence, staff turnover and disability benefit claims (Beck et al., 2011; Bridger, Day, & Morton, 2013; Knudsen, Harvey, Mykletun, & Øverland, 2013; Salkever, Shinogle, & Goldman, 2003). Important work-related factors contributing to CMDs are work overload, emotional demands, role conflicts, and poor relationships with line-manager and colleagues (Bronkhorst, Tummers, Steijn, & Vijverberg, 2015; Freimann & Merisalu, 2015). The Adult Psychiatry Morbidity Survey 2014 in England revealed that 18-19% of people aged 16- 64 years experienced CMDs at some point in any given year (McManus, Bebbington, Jenkins, & Brugha, 2016), and a Dutch-based study showed that 19% of people with CMDs had a recurrent sickness absence (Koopmans et al., 2011). This has resulted in loss of £33- £42 billion each year to UK business, of which about one-fourth was attributed to sickness absence (Deloitte MCS Limited, 2017). A recent article showed that about £14 billion was associated with disability benefit payments in 2014/15 in the UK (Banks, Blundell, & Emmerson, 2015), and another study from the UK, which analysed government data from 1995 to 2014, found that about half (47%) of disability benefit claims were associated with mental disorders (Viola & Moncrieff, 2016).

Reduction of sickness absence associated with mental health problems should therefore be a target of business organizations. Several preventative interventions targeting mental health problems to reduce sickness absence associated with mental disorders have been suggested. One of them was a problem-solving intervention (SHARP-at work) to reduce recurrent sickness absence, developed and implemented in the Netherlands (Arends, 2013). The economic evaluation results of study of SHARP-at work showed that the intervention

was effective with additional costs when compared to care as usual (CAU) (Arends et al., 2013).

There is little evidence on the economic case for workplace interventions to prevent sickness absence in UK workplace settings, which could make employers reluctant to invest in the mental health and wellbeing of their employees. New evidence can be obtained by doing an economic evaluation of such interventions. The evidence from such research could encourage employers and government bodies to establish priorities to implement interventions in this area. To my knowledge, there are no published studies in the UK which explore cost-effectiveness of workplace interventions for employees to prevent recurrent sickness absence due to CMDs.

Economic evaluations take time and resources to conduct. One option, therefore, is to consider whether findings can be transferred from one context to another, including between different geographical settings. Use of data, methods and/or results of already completed interventions or published papers can be a time- and cost-saving strategy compared to conducting a new study; indeed, it has been suggested as the only option when a local study is not feasible (Boulenger et al., 2005).

Replication of economic data from one country to another to evaluate cost-effectiveness of health intervention has the potential to use health care and other resources more efficiently but we need to take precaution in transferring economic data (Goeree et al., 2007). The review paper by Goeree et al. (2007) identified five different factors that need to be considered for economic evaluation data transferability: patient characteristics, the health problems being studied, the provider, the health care systems and methods used for the study. Other criteria identified from the 40 studies in the same review paper were the sources of medical usefulness, service use and unit cost data for transferability of economic data. The authors suggested that at least substitution of health service practice and unit cost information are needed for transferability of economic evaluation results.

A study from the Netherlands (Welte, Feenstra, Jager, & Leidl, 2004) showed that transferring economic evaluation results between countries is feasible, although assessment of the transferability of outcomes and necessary adjustment is needed. This study grouped the factors that are associated with transfer of economic data into individual characteristics,

methodological rigor and health systems perspectives. The impact of the differences in economic results between countries can be assessed through effectiveness, resource use, productivity loss and return to scale parameters. Adjustment is needed for the analysis of economic data, ranging from discounting to variation in medical practices. In circumstances where full patient-level data is available from a study, it is possible to substitute cost parameters relevant to the decision country to calculate new economic evaluation results, holding intervention effects and resource use data at the same levels as in the original study. There are limited studies about the effects of simply valuing the study country's resource use data using decision country-specific unit cost. In the case of partial data availability from a study, a model-based adjustment in economic evaluation would be necessary (Glick, Doshi, Sonnad, & Polsky, 2015).

My study aimed to explore the feasibility of transferring economic data from the Dutch to the English context to evaluate the cost-effectiveness of the problem-solving intervention to prevent recurrent sickness absence associated with common mental health problems.

4.2 Methods

4.2.1 Study strategy

In pursuit of this research aim, I communicated with researchers of the original study to access individual patient-level data from the Dutch study on SHARP-at work for the prevention of recurrent sickness absence. I then applied English unit cost data to resource/service use data collected in the Dutch study. No adjustments to the outcome data were made; i.e. I assumed that the effectiveness findings from the Dutch study transfer directly to the English context. To calculate the costs of lost productivity, I used sickness absence data at follow-up from the Netherlands and employed unit cost data (one-day average salary of UK employees in 2015) to calculate sickness absence costs. Finally, I recalculated incremental costs and effects of the intervention using multi-variable analysis to generate cost-effectiveness results, analysed from a societal and then from an employer’s perspective.

4.2.2 Study location and participants

The intervention was replicated in an English workplace setting. This study used data from the Dutch-based problem-solving intervention to prevent RSA among employees. Details of inclusion and exclusion criteria have been described elsewhere (Arends, van der Klink, & Bültmann, 2010). In brief, participants were employed in a paid job, aged between 18 and 63 years, on sick leave for at least two weeks with CMDs and wanting to return to work. Participants were diagnosed by the occupational physician at the earliest period of their sickness leave. Participants were excluded if they had: a sickness absence of more than a year, prior sickness leave associated with CMD within three months period, severe mental disorders or work disability associated with somatic complaints. They were also excluded if they were pregnant or were near to retirement or resignation, or if they had no knowledge of the Dutch language.

4.2.3 Study design/measurement of effectiveness

The original study was conducted within a clustered-RCT. The design of the study has been reported elsewhere (Arends et al., 2010). In brief, employees who were on sick leave with CMDs and willing to return to work were eligible for trial entry. A total of 212 employees were recruited and 158 of them agreed to participate in the study. The participants were randomized into the SHARP-at work group (n=80) or the care-as-usual (CAU) group (n=78). Occupational physicians in the treatment arm were provided with two days of training on problem-solving (the SHARP-at work) intervention, followed by three feedback sessions. Participants in the treatment arm were provided with the problem-solving intervention over a one-year period, while participants in the CAU group received standard OP care over this period. All other health care services were delivered as per local clinical practice.

This replication study used patient-level data (resource use and effects data) from the Dutch SHARP-at work intervention. The monetary valuation of resource use was taken from annual PSSRU unit cost compendium (Curtis & Burns, 2015), British National Formulary online (www.bnf.org) and online search for item-wise price of the alternative treatment services in the UK. It was assumed that the resource (service) use pattern and outcomes (recurrent sickness absence) transfer directly to England, although sensitivity

analyses were conducted to see how much the results change if slightly different assumptions were made about key parameters.

4.2.4 Assessment of transferability of economic evaluation results

Transferability in research can be defined as a method of transferring research data, methods and/or results from one geographical location to another after assessing the relevance of economic data to the new study setting. I assessed the suitability of transferring the original Dutch economic evaluation data to the English context by reference to criteria obtained from a review of several studies addressing the transferability of economic evaluation results. Those studies suggest five indicators which span three dimensions for what has been called 'eligibility' (although 'suitability' would be a better term): study location, health outcome and resource use data (Späth, Carrère, Fervers, & Philip, 1999). The Dutch study was assessed based on five indicators of the suitability for transferability of economic evaluation results which are briefly described in the following paragraphs:

Potential users: The perspective of the study is one of the important factors when deciding how to cost an intervention and its economic consequences as the resource components may be a cost from one perspective but may not be a cost from another perspective. The assessment of the original study was done based on the perspective mentioned by the original study authors, the range of cost data included in the study and the sources of cost data (Späth et al., 1999). The authors mentioned that the study was conducted from both societal and employers' perspectives, and the assessment of cost data also confirmed their evaluation perspectives.

Characteristics of study population: There is no doubt that the participant characteristics can influence the economic evaluation results. For example, participants' age, gender, occupational status, marital status and education levels can have significant influences on disease morbidity and mortality, and hence could also influence use of services, costs and outcomes. The participants in the original study were currently working employees on sick leave with CMDs who were willing to return to work.

Health and productivity related outcome data: The outcome data are necessary to assess the eligibility to transfer economic data to evaluate cost-effectiveness into another context. The health and related outcome data consist of efficacy and effectiveness of the intervention/therapy in controlled conditions, usually with RCTs. For the assessment of efficacy and effectiveness, primary outcome data on recurrent sickness absence (RSA) was considered. The outcomes in the original study were incidence of and time to RSA.

Resource use data: Resource use data may differ between and within countries because of the health care practice patterns and health care systems. Therefore, each resource use component, was identified and quantified. For example, in the original Dutch study, the authors included company social workers in occupational health care resource use component, which was not relevant in the English context and so I replaced it by occupational health workers.

Unit prices and discount rates: Prices and costs of health care delivery differ between countries and between different health systems. The cost of the healthcare resource use rest on volume of resource use and country-specific purchasing power parity. Discount rates were not applicable as the follow-up period of the study was not more than one year. Unit cost data of the Dutch study was replaced by the English unit cost data in this replication study.

4.2.5 Study perspectives

This study was conducted from both a societal and an employer's perspective. Within the societal perspective, the cost components comprised all the costs required for the management of employees with CMDs, including all health care costs to the NHS, out-of-pocket expenses, occupational care costs in the workplace, the average cost of training to OPs, and cost of lost productivity. From the employer perspective, the cost components comprised the cost of SHARP-at work training to occupational physicians (OPs), cost of occupational health care service to the employers and cost of lost productivity with CMDs.

4.2.6 Comparators

Stimulating **H**ealthy Participation **a**nd **R**elapse **P**revention at work (SHARP-at work) is a problem-solving intervention (Arends, van der Klink, van Rhenen, de Boer, & Bültmann, 2014). In this study, SHARP-at work intervention was introduced with the aim of avoiding RSA among employees experiencing CMDs. This intervention consisted of five steps: identification of problems/opportunities after return to work, brainstorming about such problems/opportunities, listing of available solutions and support needed to implement them, discoursing alternatives with line-manager and formulating action plan, and monitoring the action plan of the activities. This intervention recommended 2 to 5 visits by the OPs, each about 30 minutes, to the participants to complete intervention process. The OPs were trained in the SHARP-at work for two days, and there were three follow-up meetings to discuss their involvements on implementation of the SHARP intervention (Arends, 2013). The OPs who were participating in the study were aware of evidence-based guidelines for the clinical management of workers with mental disorders (OECD, 2014).

In contrast, participants in the CAU group were supported by OPs who did not receive training on the SHARP-at work, and those participants received one consultation about sickness absence relapse prevention from their OPs as per occupational health care guideline.

4.2.7 Choice of (health) outcomes

In the original study, two intervention effects were measured: incidence of recurrent sickness absence (RSA) and time to RSA. The authors defined RSA as at least 30 percentage point reduction in days of work per week. The incidence of RSA was calculated as the sum of new cases of RSA in a 12-month period. The time to RSA is measured in the mean number of days until RSA over the same period. In the replication study, both these outcome measures were used to calculate cost-effectiveness. Additionally, sickness absence was included as another outcome measure for the cost-effectiveness analysis.

4.2.8 Estimating resource use and costs

Costs data in this study was expressed in British pounds sterling at 2015 price levels. The unit cost data for health care and occupational health care utilization was taken from the PSSRU unit cost compendium (Curtis & Burns, 2015). Unit cost was then assigned to the resource use components of the original study. Total number of days off taken due to sickness during a 12-month follow-up period was considered as the basis to estimate sickness absence costs. These sickness absence days were multiplied by the one-day average salary (£118 per employee) for UK employees in 2015 to estimate sickness absence costs. The average costs per employee of the two-days SHARP-at work training was estimated using training resource use data from the study country (Netherlands) with some adjustment to the English context and multiplied by English unit cost data (British Medical Association, 2015; University of Cambridge, 2015). I assumed that a similar type of intervention can have similar resource use patterns in the Netherlands and England for a working age population with the same baseline characteristics.

4.2.9 Analytic methods

The primary endpoints of this replication study were sickness absence days, the incidence of RSA, time to RSA days and cost-effectiveness from both a societal and an employer's perspective in a 12-month follow-up period. Patient-level data to prevent RSA from the original study was accessed from the Dutch data owner of the problem-solving intervention by the Dutch study team.

The price year in the original study was 2009. In this replication study, unit cost data (2015) from the UK price reference values was employed. Costs were calculated separately for health care service use from a societal and an employer's perspective.

Data analysis was done in STATA 14 statistical software package. The proportion and mean of the baseline variables were estimated using simple descriptive analysis, such as tabulation and summary statistics by group functions. Resource use costs were estimated using t-test to associate the variance between two mean values. Training cost per participant was calculated manually using available unit cost data for training resource components. The histograms and kernel density plots were presented to visualise the

distribution of costs and effects data. The unadjusted mean costs and outcome measures for primary cost-effectiveness analyses were estimated using the summarise function. Nonparametric bootstrapping was used to estimate the 95% confidence intervals of the costs and effect measures. The bootstrapped data were used to present cost-effectiveness results in the cost-effectiveness acceptability curves and planes. Regression results were addressed for baseline socio-demographic characteristics including gender, age, marital status, educational qualification; diagnosis of CMDs, occupation, supervision role, work role functioning questionnaire (WRFQ) score (Abma, van der Klink, & Bültmann, 2013) and hospital anxiety and depression scale (HADS) score (Montazeri, Vahdaninia, Ebrahimi, & Jarvandi, 2003) to estimate incremental costs and incremental effects. The data analyses were conducted under an intention-to-treat assumption.

Missing data are inevitable in RCTs and these cases potentially undermine the validity of the research results. In this study, the resource use components (cost-related variables) have several missing values, while effects measures and baseline variables have few missing values. There are several statistical tools to address missing data. In this study two different methods were employed to address missing data: the expectation maximisation algorithm and multiple imputations. The expectation maximisation algorithm was used to replace missing values to those variables that have few data missing using SPSS 22 statistical software package. The expectation maximisation algorithm is a powerful tool to replace missing values in case of trivial missingness of data (Enders, 2001).

Multiple imputations using the chained equations (MICE) method was employed to deal with missing data for those variables that have several missing values. MICE is a flexible approach for handling missing data. It imputes multiple variables by using chained equations which allows researchers to impute missing values of a complex nature more easily (Berglund, 2015). To impute missing data using MICE, predictive mean matching (PMM) for continuous data and ordered logistic regression (ologit) to impute categorical data were employed. PMM is a partial parametric method of matching missing values to the observed values with the nearest predicted value. It combines the standard linear regression and the nearest-neighbour prediction approaches (StataCorp, 2013). After imputation of missing variables, multiple imputation diagnosis was performed to examine the distribution of observed, imputed and complete data for such variables. The distribution functions of data were displayed in the kernel density plots in the result sections. Then,

incremental costs and incremental effects of the multiply-imputed data were estimated using a seemingly unrelated regression (SUR). SUR is a regression method in which two or more unrelated outcome variables are predicted by sets of predictor variables (Keshavarzi, Ayatollahi, Zare, & Pakfetrat, 2012). This method was used to estimate group differences in sickness absence, incidence of RSA, the mean number of days until RSA, health care costs and occupational health care costs. The uncertainty around cost-effectiveness estimates after multiple imputations was explored using the cost-effectiveness acceptability curve.

Incremental cost-effectiveness ratios (difference in costs divided by the difference in outcomes between intervention and control groups) were calculated from both societal and employer's perspectives (Lave & Frank, 2005). From the societal perspective, the cost components comprised healthcare costs, occupational healthcare costs and the costs of lost productivity. From an employer's perspective, the cost components consisted of the occupational health care cost and the cost of lost productivity. Cost-effectiveness was assessed for three outcomes: sickness absence days, incidence of RSA and mean number of days until RSA. Incremental net benefit (INB) was also calculated by multiplying differences in effects by some willingness-to-pay threshold and subtracting from the cost differences between intervention and control.

Uncertainty around costs, effects and cost-effectiveness results was examined through sensitivity analyses of cost-effectiveness results, with adjustment for baseline characteristics. Two different sensitivity analyses were performed: one was sensitivity analysis to departure from missing at random (MAR) and other was sensitivity analysis excluding extreme outliers. The first type of sensitivity analysis was conducted to explore whether my conclusions were robust to plausible departures from MAR. The second type of sensitivity analysis was conducted to explore whether my cost-effectiveness results were impacted by extreme outliers.

4.2.10 Ethical considerations

This replication study was fully compliant with the data owner to sharing data in research work related to transferability of economic data to the UK to assess cost-effectiveness. It

also complies with UK Data Protection Act 1998. I also went through the LSE ethical approval process before carrying out this research work.

4.3 Results

4.3.1 Baseline features

Table 4.1 presents baseline features of the study sample. The average age of the participants was 42 years and this was two years higher for control group, although this difference was not significant between groups. The proportion of female participants in both study groups was higher than male participants and the between-group difference in female participants was about 15 percentage points higher in the intervention arm compared with the control arm. Eighty percent of the study participants were either married or living with a partner and the remainder were unmarried, and the proportion of married people was slightly higher in the intervention group. About half (49%) of the study population have their secondary education followed by higher education (39%) and the remainder with primary or lower education.

Participants in the study were selected from those who were on sick leave with CMDs during the selection process. For this study, CMDs was classified into six different groups and the participants were categorised into these groups based on the diagnosis made by the occupational physicians. Adjustment disorders were the frequent source of sickness absence in this study: 61 percent of participants at baseline were experiencing adjustment disorders and this proportion was 25 percentage points higher in the intervention arm. Emotional disorders and depressive disorders were respectively the second and the third leading causes of sickness absence in the study, where each group comprised 11% of all study participants. It is noted that the control arm of the trial included higher percentage of study participants in both disorder types. None of the participants in the intervention group were diagnosed as having a burnout problem, but 9% of the participants in the control group have burnout problems. Very few participants were diagnosed as having stress disorders. Other common mental disorders constituted about 10% of the total participant sample, and the proportion of the participants diagnosed with this problem was two percentage points higher in the control arm.

Participants in the study were selected from different occupational groups. Commercial service staff contributed the highest percentage (21.52%) followed by administrative staff (19.67%), managers (16.62%) and health service staff (15.29%). The remaining occupational groups include stock/transport staff (7.77%), ICT staff (5.10%), sales staff (4.5%), mechanic/repairman (4.5%), designer/planner (3.18%) and hotel/catering staff (1.88%). The participants in the commercial service, stock/transport, administrative and manager groups have significant differences between control and intervention groups. For example, commercial service staff in the intervention group was 14 % higher and stock/transport staff were 13 % higher in the control group. Ninety percent of study participants were in a regular job and the group differences of the participants were five percentage points in the treatment arm. Similarly, the participants with managerial responsibilities were also higher (1.5%) in the treatment arm and the total study participants with managerial responsibilities were 28 percent.

Data on sick leave absence days with CMDs was collected at baseline for the previous one year from the administrative records of the participants. The analysis of the administrative records showed that an average of 65 days was taken off work due to sick leave, but there was huge variation in the individual sick leave absence days. The intervention group took 15 more days of sick leave compared to CAU, but the between-group differences was not significant (p=0.056).

The baseline anxiety and depression status of study participants was measured by the Hospital Anxiety and Depression Scale (HADS) score (Montazeri et al., 2003). The average HADS score was 7.49 for anxiety and 7.19 for depression across all participants. No significant difference in the HADS score for anxiety (p=0.288) and depression (p=0.627) between groups was observed.

Table 4.1 Baseline characteristics of SHARP and CAU groups

Variables	**Entire sample**	**CAU (n=78)**	**SHARP (n=80)**	**Difference**	**p value**
Socio-demographic					
Age (mean (SD))	42.28 (9.63)	43.31 (9.82)	41.29 (9.39)	2.02 (1.53)	0.1881
Female	58.77%	51.28%	66.25%	-14.97%	
Married/Living together	80.21%	77.92%	82.50%	-4.58%	

Variables	Entire sample	CAU (n=78)	SHARP (n=80)	Difference	p value
Education					
Lower	12.31%	17.11%	7.50%	9.61%	
Secondary	48.82%	52.63%	45.00%	7.63%	
Higher	38.88%	30.26%	47.50%	-17.24%	
Diagnosis					
Adjustment disorders	61.28%	48.65%	73.91%	-25.26%	
Emotional disorders	11.83%	13.51%	10.14%	3.37%	
Depressive disorders	11.01%	16.22%	5.80%	10.42%	
Burnout	4.73%	9.46%	0.00%	9.46%	
Stress disorders	1.40%	1.35%	1.45%	-0.10%	
Other mental disorders	9.76%	10.81%	8.70%	2.11%	
Work-related characteristics					
Occupation					
Commercial service staff	21.52%	14.29%	28.75%	-14.46%	
Managers	16.62%	19.48%	13.75%	5.73%	
Administrative staff	19.67%	15.58%	23.75%	-8.17%	
ICT staff	5.10%	5.19%	5.00%	0.19%	
Sales staff	4.50%	6.49%	2.50%	3.99%	
Health care staff	15.29%	15.58%	15.00%	0.58%	
Hotel and catering staff	1.88%	0.00%	3.75%	-3.75%	
Stock and/ transport staff	7.77%	14.29%	1.25%	13.04%	
Designer/planner	3.18%	2.60%	3.75%	-1.15%	
Mechanic/repairman	4.50%	6.49%	2.50%	3.99%	
Hours contract (per wk) (mean (SD))	32.75 (7.1)	32.92 (7.35)	32.56 (7.01)	0.33 (1.13)	0.768
Regular work	89.58%	86.84%	92.31%	-5.47%	
Managerial responsibilities	28.37%	27.63%	29.11%	-1.48%	
Sick leave absence (mean (SD))	64.94 (47.2)	57.67 (42.24)	72.32 (50.97)	-14.65 (7.66)	0.056
Health-related characteristics					
HADS score					
Anxiety (mean (SD))	7.49 (3.66)	7.81 (3.45)	7.19 (3.87)	0.62 (0.58)	0.288
Depression (mean (SD))	7.12 (4.4)	7.28 (4.41)	6.95 (4.46)	0.34 (0.7)	0.627
SHARP = intervention group; CAU = care as usual group; HADS = Hospital Anxiety and Depression Scales					

4.3.2 Training costs

The average cost of a two-day SHARP-at work training in the UK context was estimated using available cost information. The trainer's costs were taken from a British Medical Association report (British Medical Association, 2015). Based on traditional calculation, an average of £20 per study participant in the intervention group was estimated to train

occupational physicians. The detailed calculation of training costs is presented in Table 4.2.

Table 4.2 Costs of a two-day training to OPs on SHARP-at work

Items	**No.**	**days**	**Rate/(hr)**	**total Hr**	**Total costs (£)**
Trainer costs	2	2	107	6	2568
Trainer's Prep costs	2	1	107	6	1284
Follow-up meeting	2	1	107	6	1284
Participants costs (OP)	10	2	50	6	6000
Stationery	12	1	25	1	300
Refreshments	12	2	50	1	1200
Hall rent	1	2	200	1	400
Total					13036
Overhead	20%				2607.2
Grand total					**15643.2**
Average costs per trainee					**1564.32**
Average costs per Participants	80				**19.554**

4.3.3 Resource use and costs

The service use data were taken from the SHARP intervention evaluation in the Netherlands. The differences in average costs for resource use components were tested using t-test.

The average total costs were higher in the treatment group compared to CAU from both societal and employer's perspectives. The average societal costs in the intervention group was £885, with a wide variation in individual costs items, while it was less than half this amount in CAU, although the difference was not significant. The average employer costs for the SHARP group was £62, which was three times higher than average cost in the control group, and the difference was significant ($p < 0.001$). This could be because more participants from the treatment arm visited occupational physicians and occupational health workers as compared to CAU. Some resource use components had lower costs in the treatment arm as compared to CAU, but the difference was not significant. The difference in the average healthcare costs between these groups was mainly due to hospitalisation costs of one participant in a psychiatric ward. The detail of item-wise costs information is presented in Table 4.3.

Table 4.3 Unit cost and resource use cost estimation for SHARP and CAU groups

Cost category	Unit cost	Combined		CAU group		SHARP group		Difference between CAU & SHARP		
		mean	SD	mean	SD	mean	SD	mean	SE	p value
GP	45	57.53	82.35	60.34	82.89	55.19	82.62	5.15	16.87	0.761
Community mental health care	189	143.24	361.26	159.60	394.72	128.52	331.65	31.08	74.56	0.678
Psychiatrist	53	7.51	26.58	10.24	33.92	4.91	16.80	5.33	5.49	0.334
Psychologist	51	29.10	36.71	26.27	33.85	31.64	39.33	-5.37	7.68	0.487
Occupational physician	54	28.85	28.06	22.40	28.67	34.78	26.41	-12.38	5.68	0.032
Occupational health worker	20	5.27	19.16	1.82	8.91	8.51	24.93	-6.69	3.98	0.096
Specialist	35.67	45.61	107.52	43.42	112.91	47.56	103.59	-4.14	21.87	0.850
Physiotherapist	34	60.61	132.26	63.26	118.36	58.29	144.55	4.97	27.78	0.858
Social worker	20	4.69	18.90	3.72	17.05	5.56	20.55	-1.83	3.99	0.646
Alternative medicine	variable	64.97	135.91	75.02	159.93	56.43	112.48	18.59	27.63	0.503
Day care facility	206	34.69	338.16	0.00	0.00	64.63	461.53	-64.63	69.63	0.356
Hospitalisation	395	226.52	1655.29	48.99	192.79	379.20	2249.71	-330.21	344.42	0.340
Prescription medicine	variable	39.77	88.16	39.73	79.01	39.82	96.78	-0.09	18.01	0.996
Self-medication	variable	29.24	66.14	42.13	80.30	18.33	49.46	23.81	13.40	0.079
Out-of-pocket	variable	17.27	52.97	13.55	46.72	20.42	58.00	-6.87	10.77	0.525
Intervention cost				0.00	0.00	20.00	0.00			
Total (societal) cost		689.29	2184.07	462.82	549.02	884.52	2947.14	-421.70	598.92	0.484
Total (employer) cost		42.98	38.88	21.95	27.87	62.21	37.73	-40.26	7.05	0.0001
Sickness absence cost (actual)	118/day	4987.51	4707.36	4606.41	4638.38	5359.08	4773.35	-752.68	749.03	0.317
Presenteeism cost (actual)	118/day	559.63	984.68	566.4	1011.64	552.02	966.25	14.38	215.26	0.947

4.3.4 Outcomes (productivity-related)

Table 4.4 shows the mean value of three different outcomes included in the study: sick leave, incidence of RSA and time-to-RSA. Average number of days at work over a 12-month follow-up period was higher in the CAU than the intervention arm, but the between-group difference was not significant. The incidence of RSA was higher in the CAU as compared to SHARP group. Similarly, time to RSA was 35 days earlier in CAU as compared to the treatment group. But the between-group differences were not significant for either of these outcome measures.

Table 4.4 Mean values of sickness absence (outcomes)

Outcomes	**Combined**		**CAU group**		**SHARP group**		**Diff between groups**		
	mean	**SD**	**mean**	**SD**	**mean**	**SD**	**mean**	**SE**	**p value**
No sick leave (days)	165.43	54.81	170.09	53.01	160.57	56.58	9.52	9.04	0.29
No RSA (rate)	0.50	0.50	0.46	0.50	0.54	0.50	-0.08	0.08	0.34
Time-to RSA (days)	258.63	119.57	241.09	123.47	275.73	113.82	-34.64	18.89	0.07
Note: RSA= Recurrent sickness absence									

4.3.5 Sickness absence and resource use cost distribution functions

The histogram and kernel density plots show the distribution of data. The histogram is visually frustrating because of the random distribution of data in the study and, therefore, kernel density plot is a popular tool to visualise the distribution of such data. In Figure 4.11, the area under the curve was slightly greater in the CAU than SHARP group, indicating that the participants in the CAU on average present more days at work. Figure 4.12 shows that the incidence of RSA was truncated in the treatment arm. Similarly, Figure 4.13 shows that the average recurrence of sick leave was quite early in the CAU as compared to SHARP group.

Figure 4.1 Probability distribution of sickness absence (outcomes)

Fig. 4.11 Number of days present at work

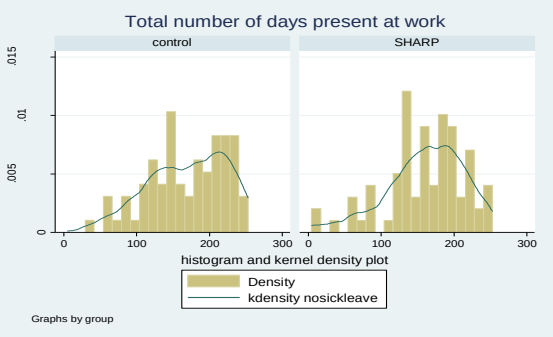


Fig. 4.12 Incidence of RSA

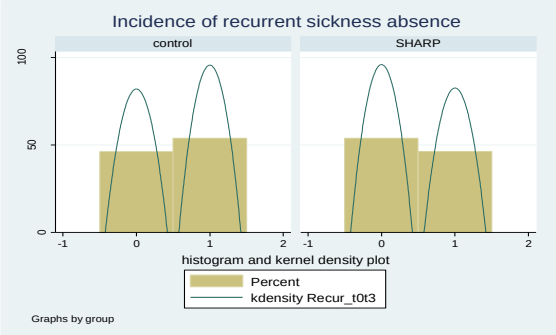


Fig. 4.13 Time to recurrent sickness absence

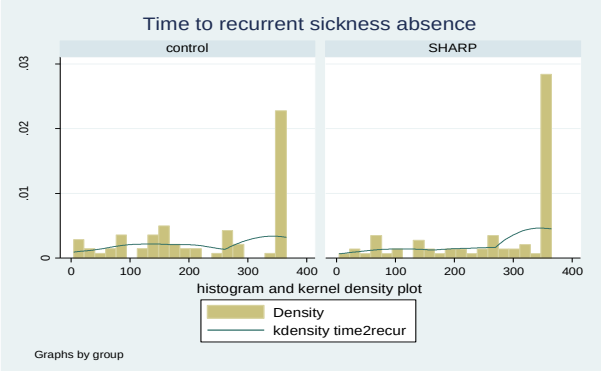


Figure 4.21 shows that the average societal costs were higher in the SHARP arm. We can see one extreme outlier in the figure, which influences the average societal costs in the SHARP group. This outlier was due to extreme day care and hospitalisation costs in one participant, which can be seen in Figure 4.22 and Figure 4.23.

Figure 4.2 Probability distribution of resource use costs

Fig. 4.21 Average total societal costs

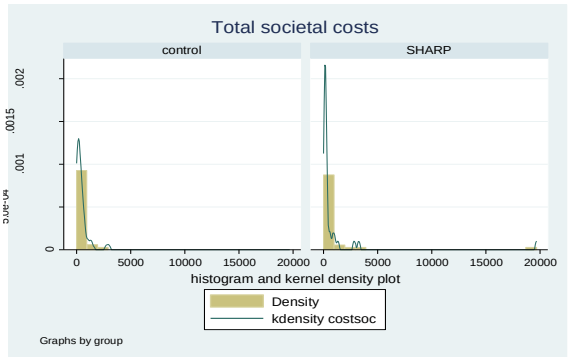


Fig. 4.22 Average day care service costs

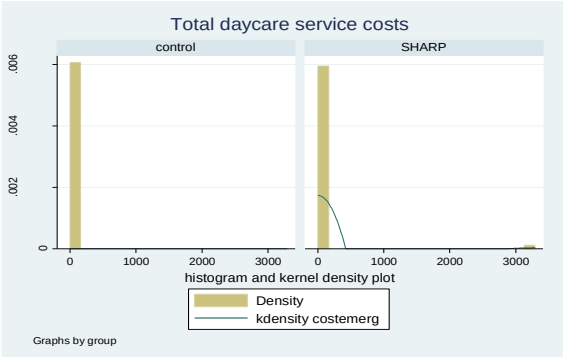


Fig. 4.23 Average hospitalisation costs

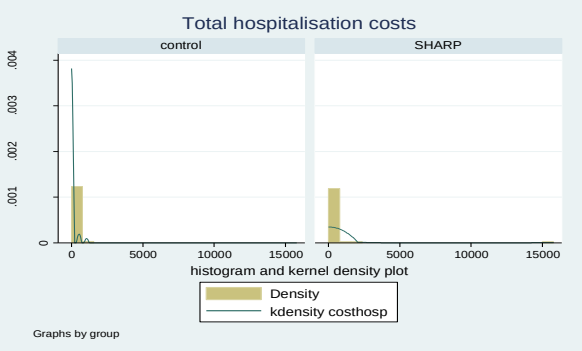


Fig. 4.24 Average total costs for employer

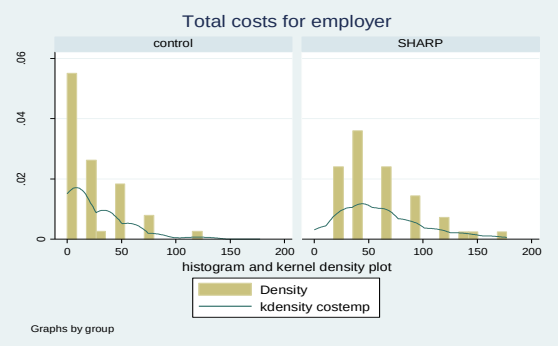


Figure 4.24 shows that the area under the curve of the kernel density plot was greater in the SHARP group as compared to CAU, indicating that the average total costs for employers were higher for the SHARP group. This could be due to a higher number of visits with occupational physicians in the SHARP group.

4.3.6 Cost-effectiveness results

Incremental cost-effectiveness ratio (ICER) and incremental net benefit (INB) were calculated from both societal and employer perspectives. From a societal perspective, the average cost in the treatment arm was higher than in the control arm and the average days of sickness absence was also higher, which indicated that CAU was dominant (**Table 4.5**). The cost-effective (CE) plane demonstrated that most of the bootstrap pairs were in the top-left quadrant (**Figure 4.31**). The cost-effectiveness acceptability (CEA) curve demonstrated that the probability of intervention in reducing sickness absence days being cost-effective was below 15% for a willingness-to-pay (WTP) margins varies from £0 and £1000, which indicated that the SHARP intervention was less cost-effective with reference to control (**Figure 4.32**). The results from the CE-plane and CEA curve confirmed the primary analysis result that CAU was dominant.

The percentage point reduction in incidence of RSA was lower in the SHARP group than in the control group, meaning that SHARP was more effective, but with higher costs. This resulted in an ICER of £7535 per one-unit improvement in RSA and an INB of £947 (**Table 4.5**). From the CE-plane it can be seen that more than two-thirds of the bootstrap pairs fell into top-right quadrant, indicating that the intervention was more effective with higher costs (**Figure 4.33**). I used different WTP threshold values (£0, £5000, £10,000,

£20,000 and £30,000) to present the CE results in the CE acceptability curve. The CEA curve showed the likelihood that SHARP was cost-effective was 20%, 40%, 55%, 70% and 75%, respectively, for WTP values of £0, £5,000, £10,000, £20,000 and £30,000 (**Figure 4.34**). The primary cost-effectiveness result was affirmed by the results of the CE-plane and CEA curve that the intervention targeted at delayed RSA could be cost-effective.

The SHARP intervention resulted in 35 days longer delay in RSA days compared with control, but again with higher intervention costs, giving an ICER of £17 per day delayed RSA and an INB of £3515. The willingness-to-pay threshold number of sickness days avoided and time-to RSA were determined based on one day salary of UK employee in 2014 (average annual salary was £26,500 in 2014). The cost-effectiveness plane showed that most CE pairs fell into the top-right quadrant (**Figure 4.35**). Similarly, the CEA curve indicated that the likelihood of SHARP being cost-effective was 70% and 80% at WTP values of £118 and £200, respectively (**Figure 4.36**). The results from both the CE-plane and CEA curve confirmed the primary cost-effectiveness result. In addition, the results of non-parametric bootstrapped 95% confidence interval showed that the between-group differences in both costs and effects were not statistically significant for any of the three outcome measures.

Table 4.5 Cost-effectiveness results from both societal and employer perspectives

Statistics	Mean difference between SHARP and CAU							
	Costs	95% CI		Effects	95% CI		ICER	INB
Societal perspective								
No SA	572.40	-483.77	1628.57	-8.58	-25.26	8.10	-66.72	-1584.80
No RSA	572.40	-483.77	1628.57	0.08	-0.08	0.24	7535.37	946.83
Time to RSA	572.40	-483.77	1628.57	34.64	-3.75	73.02	16.53	3514.56
Employer's perspective								
No SA	40.26	27.33	53.19	-8.58	-25.26	8.10	-4.69	-1052.66
No RSA	40.26	27.33	53.19	0.08	-0.08	0.24	530.00	1478.97
Time to RSA	40.26	27.33	53.19	34.64	-3.75	73.02	1.16	4046.70

From an employer's perspective, the total average cost was higher in the treatment arm compared to CAU, and the average number of days of sickness absence was also higher in the treatment arm, which indicated that the CAU was dominant (**Table 4.5**). The CE-plane demonstrated that most bootstrap cost-effectiveness sets fell into the north-west quadrant (**Figure 4.41**). The CEA curve demonstrated that the probability of the intervention being

cost-effective in reducing sickness absence days was 10% and 12% for willingness-to-pay (WTP) thresholds of £118 and £200, respectively. This clearly indicated that SHARP was less cost-effective with reference to control (**Figure 4.42**). The results from both the CE-plane and CEA curve confirmed the primary cost-effectiveness results that CAU was dominant.

The percentage point reduction in incidence of RSA was lower, but the treatment cost was greater in SHARP with reference to CAU, yielding an ICER of £530 per one-unit improvement in RSA and an INB of £1479. This means that an additional £530 is needed to achieve a one-unit improvement in the RSA (**Table 4.5**). The CE-plane pointed out that most of the bootstrap CE pairs fell into the north-east side of the quadrant, indicating that the intervention was effective but at higher cost (**Figure 4.43**). Similarly, the CEA curve demonstrated that the likelihood of SHARP being cost-effective compared to CAU was less than 5% cost-effective at a WTP of £0, 50% at a WTP of £5,000, 68% at a WTP of £10,000 and just over 80% at WTP threshold of £20,000 and £30,000, respectively (**Figure 4.44**). The primary cost-effectiveness result was supplemented by the results from the CE plane and CEA curve that SHARP was cost-effective to prevent occurrence of RSA.

There was a delay of 35 days in RSA with the SHARP intervention but with the higher costs, yielding an ICER of £1.16 per additional day of delay in RSA, and an INB of £4047 with a WTP of £118 for an additional day's delay (**Table 4.5**). The CE plane in Figure 18 shows that most of the CE pairs fell into the north-east quadrant, indicating that SHARP was less costly and more effective (**Figure 4.45**). The CEA curve demonstrated that the likelihood of SHARP being cost-effective was 62% and 80% at WTP of £118 and £200, respectively (**Figure 4.46**). Additionally, the results of non-parametric bootstrap at 95% confidence interval showed that the between-group difference in costs was statistically significant, but not for the effects.

Figure 4.3 CE-plane and CEA curve from a societal perspective

Fig. 4.31 CE plane for total days present

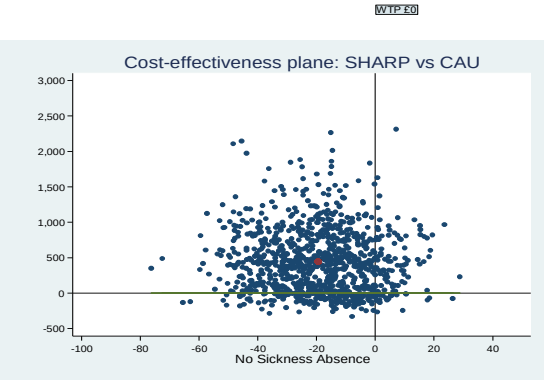


Fig 4.32 CEA curve for total days present

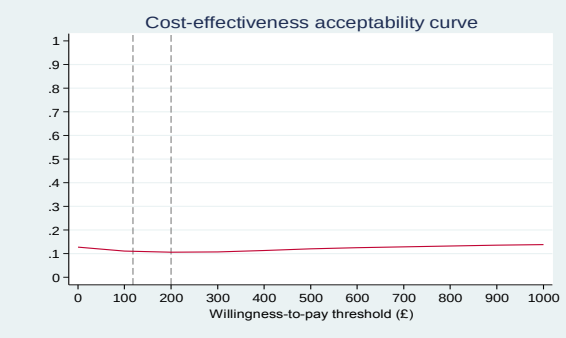


Fig. 4.33 CE plane for RSA

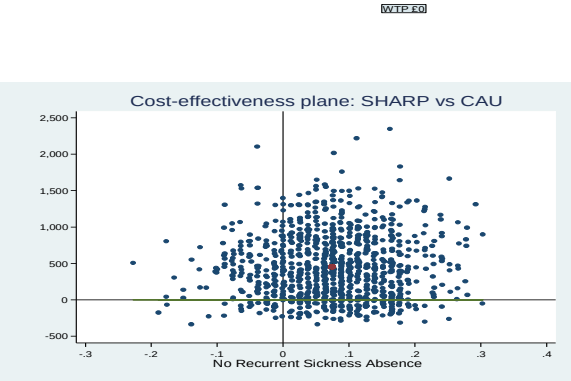


Fig. 4.34 CEA curve for RSA

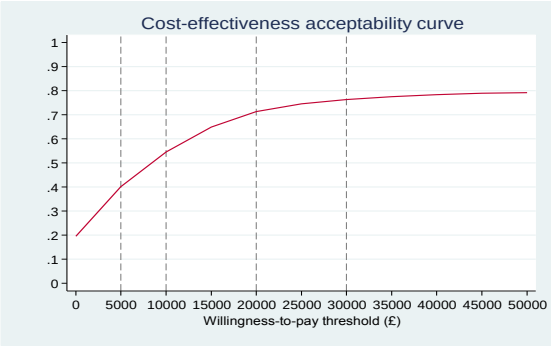


Fig. 4.35 CE plane for time-to-RSA

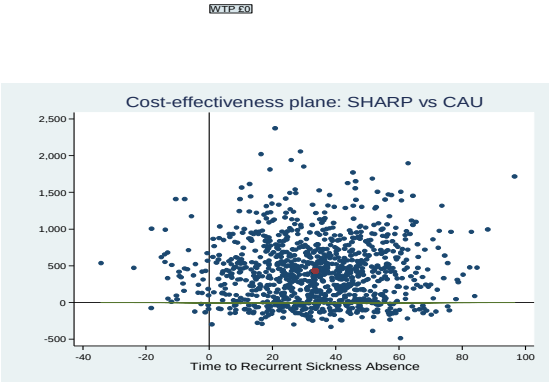


Fig. 4.36 CEA curve for time-to-RSA

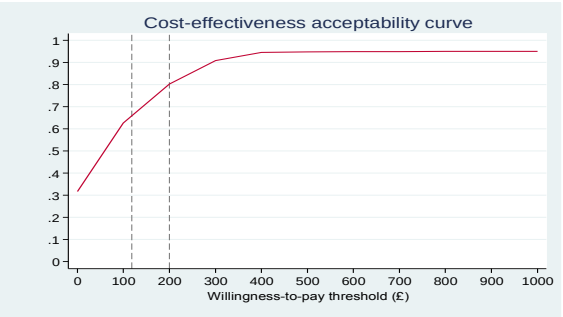


Figure 4.4 CE-plane and CEA curve from an employer perspective

Fig. 4.41 CE plane- total days present at work

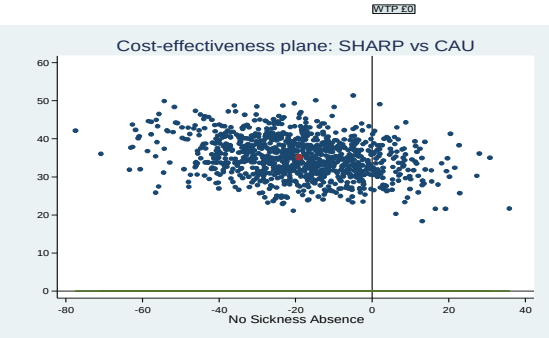


Fig. 4.42 CEA curve- total days present at work

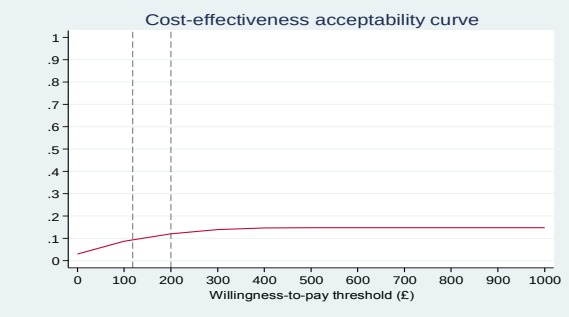


Fig. 4.43 CE plane for RSA

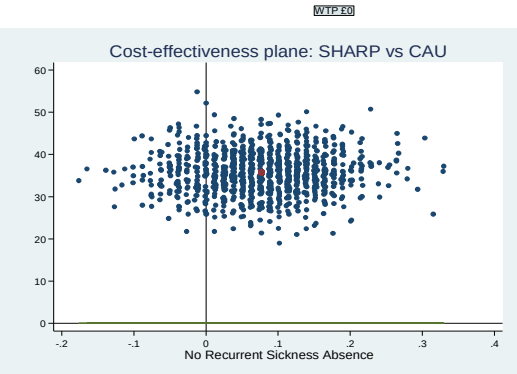


Fig. 4.44 CEA curve for RSA

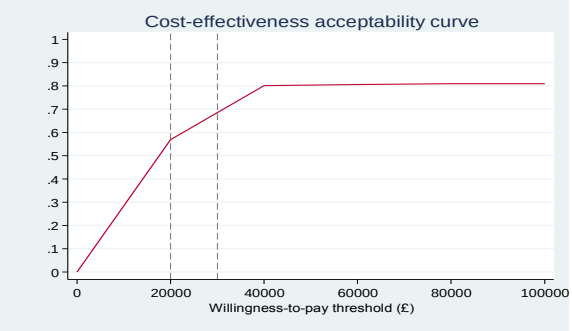


Fig. 4.45 CE plane for time-to-RSA

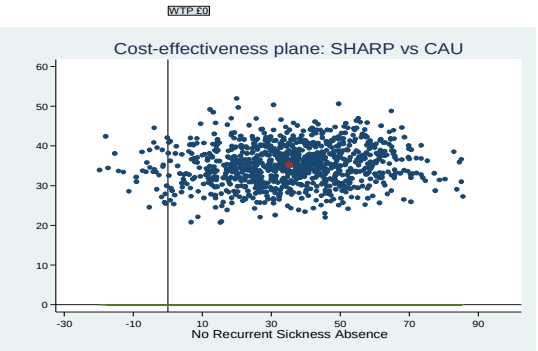
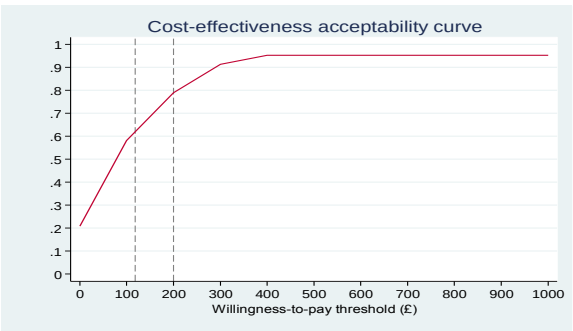


Fig. 4.46 CEA curve for time-to-RSA



4.3.7 Distribution of resource use costs for multiply-imputed data

The figures below show the kernel density estimates of the observed, imputed and completed costs density function of the individual resource use components. There is a visually distinctive wide density curve among observed, imputed and completed data for community mental health care and psychologist costs. Other resource use components also

have some differences among them, but the differences are thinner. Some resource components were unable to form a density plot because of data insufficiency.

Figure 4.5 Distribution of resource use costs for multiply-imputed data

Fig. 4.51 GP costs

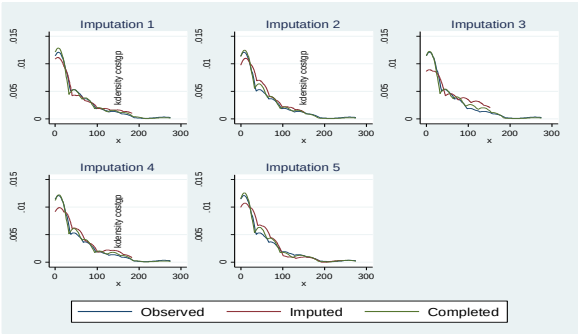


Fig. 4.52 Community mental health care costs

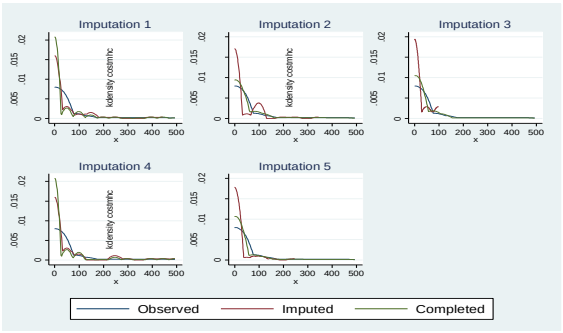


Fig. 4.53 Psychiatrist costs

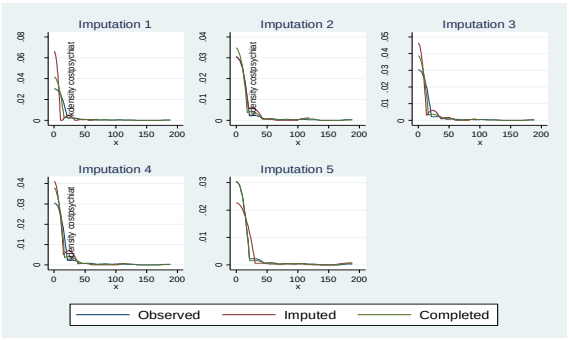


Fig. 4.54 Psychologist costs

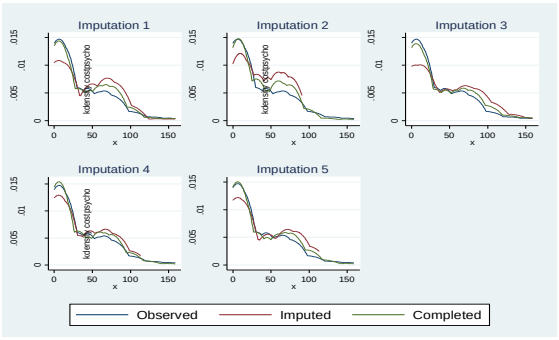


Fig. 4.55 Occupational physician costs

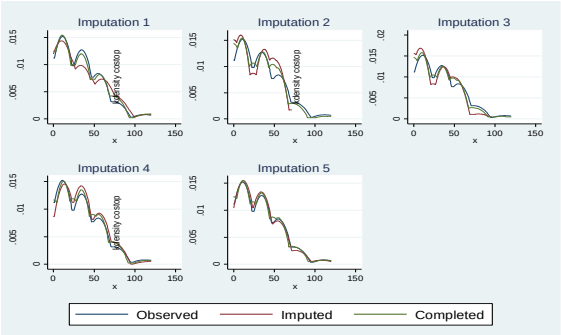


Fig. 4.56 Medical specialist costs

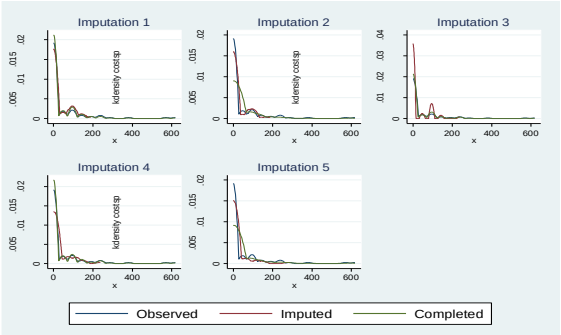


Fig. 4.57 Physiotherapist costs

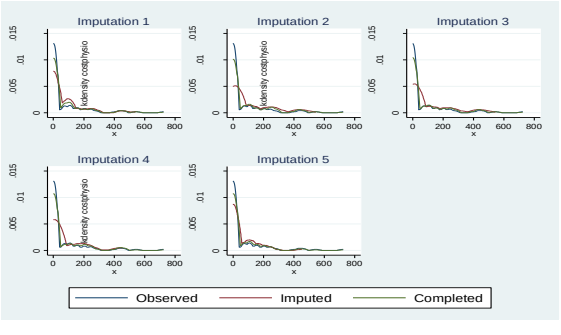


Fig. 4.58 Alternative medicine costs

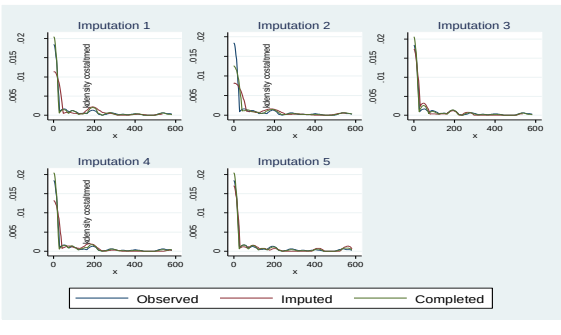


Fig. 4.59 Prescription medicine costs

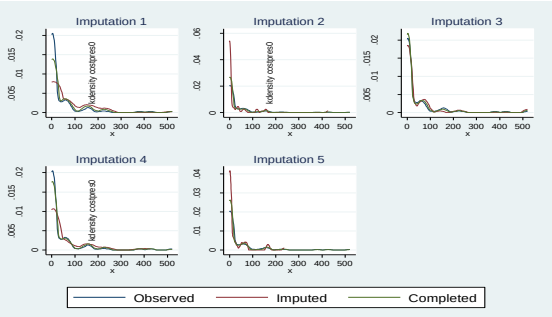


Fig. 4.510 Self-medication costs

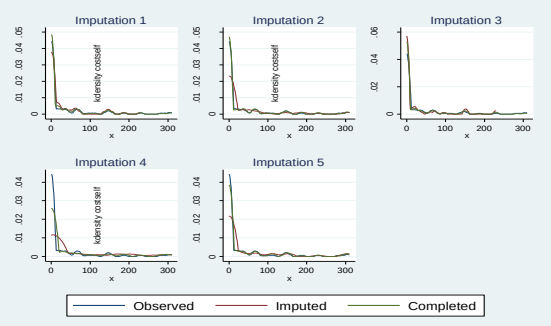
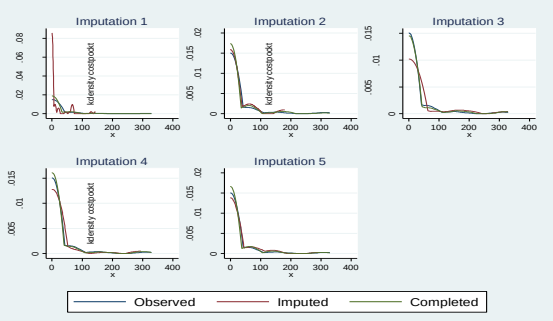


Fig. 4.511 Out-off-pocket costs



4.3.8 Cost-effectiveness results with multiple imputation

The few missing data of some baseline variables and outcome variables were replaced by expectation maximisation regression methods. In contrast, the percentage of missing costs data was high, and I therefore used multiple imputations to address such missing data. The three outcome measures (sickness absence days, the incidence of RSA and time-to-RSA) had no or very few missing data and, therefore, the mean values of these measures were similar in univariate analysis and analysis of multiply-imputed data.

Cost-effectiveness analyses with multiple imputations were carried out from societal and employer perspectives. The average costs of treatment in SHARP were found higher compared to CAU (Table 4.6). The mean number of sick leave days taken and the mean costs were higher in the SHARP group, signifying that SHARP was not cost-effective. The CEA curve showed that the probability of SHARP being cost-effective was below 15% for a WTP of £118 (Figure 4.61). The results from a CEA curve confirmed the primary analysis result that CAU was dominant.

The percentage point reduction in incidence of RSA was lower in the SHARP group, indicating that the intervention was effective, but with additional costs (ICER: £2848/unit reduction in RSA). The cost-effectiveness acceptability curve in Figure 4.62 showed that the probability of the SHARP intervention being cost-effective was below 30% for a WTP of £0, 70% for a WTP of £5000 and just over 80% for a WTP of £10,000, £20,000 and £30,000, respectively. Similarly, the intervention reduced early episodes of RSA in the intervention group by 35 days with slightly higher costs with reference to CAU, signifying that SHARP was cost-effective (Table 4.6). The findings of the CEA curve also confirmed the primary cost-effectiveness result (Figure 4.63).

Table 4.6 Mean differences between SHARP and CAU, and ICER and INB

Statistics	**Mean difference between intervention and control**						**ICER**	**INB**
	Costs	95% CI		Effects	95% CI			
Societal perspective								
No SA	216.36	-288.06	720.78	-8.58	-25.23	8.07	-25.22	-1228.76
No RSA	216.36	-288.06	720.78	0.08	-0.08	0.23	2848.28	1302.87
Time to RSA	216.36	-288.06	720.78	34.64	-2.14	71.41	6.25	3870.60
Employer's perspective								
No SA	36.68	19.87	53.50	-8.58	-25.23	8.07	-4.28	-1049.08
No RSA	36.68	19.87	53.50	0.08	-0.08	0.23	482.89	1482.55
Time to RSA	36.68	19.87	53.50	34.64	-2.14	71.41	1.06	4050.28

From an employer's perspective, the intervention cost was higher in the treatment arm. Days of work taken due to sickness was higher with extra costs in the SHARP group (Table 4.6), demonstrating that SHARP was less cost-effective with reference to control. The CEA curve in Figure 4.71 demonstrated the likelihood of the intervention being cost-effective was below 15% to decrease sickness absence days at a WTP of £118. This confirmed the primary cost-effectiveness results that the control was dominant.

The SHARP intervention decreased the percentage point incidence of RSA with some additional costs, with an ICER of £483 per one-unit reduction in incidence of RSA. The cost-effectiveness acceptability curve showed that the probability that SHARP was cost-effective was less than 5% for a WTP of £0 and just over 80% for a WTP of £5,000,

£10,000, £20,000 and £30,000, respectively, which concurred with the primary cost-effectiveness results (Figure 4.72). Similarly, the intervention also reduced the early episode of RSA in the SHARP group with additional costs (Table 4.6): the ICER was £2 per one-day delayed RSA. The result of the cost-effectiveness acceptability curve (97% probability of being cost-effective at a WTP of £118) also confirmed the primary analysis that the intervention was cost-effective in delaying RSA days (Figure 4.73).

Figure 4.6 CEA curve from a societal perspective

Fig. 4.61 CEAC for total days present at work Fig. 4.62 CEAC for incidence of RSA

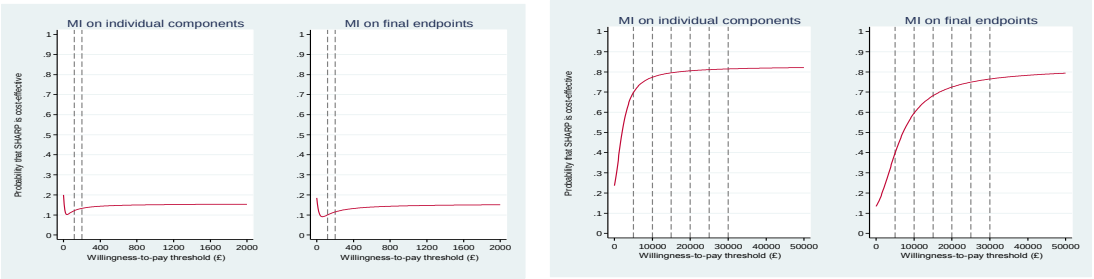


Fig. 4.63 CEAC for time to RSA

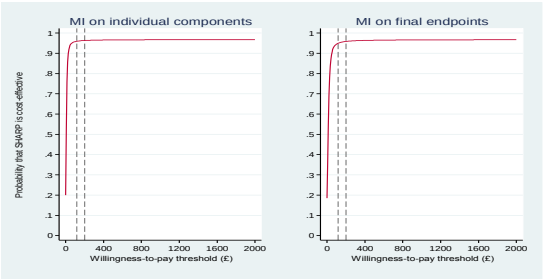


Figure 4.7 CEA curve from an employer's perspective

Fig. 4.71 CEAC for total days present at work Fig. 4.72CEAC for incidence of RSA

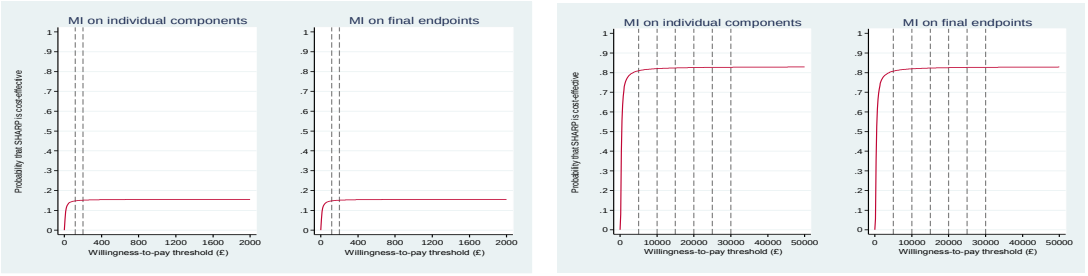
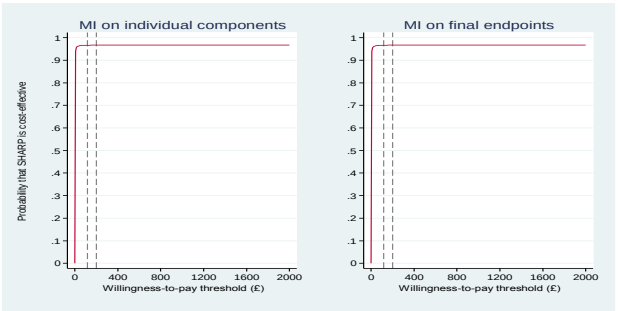


Fig. 4.73 CEAC for time-to-RSA

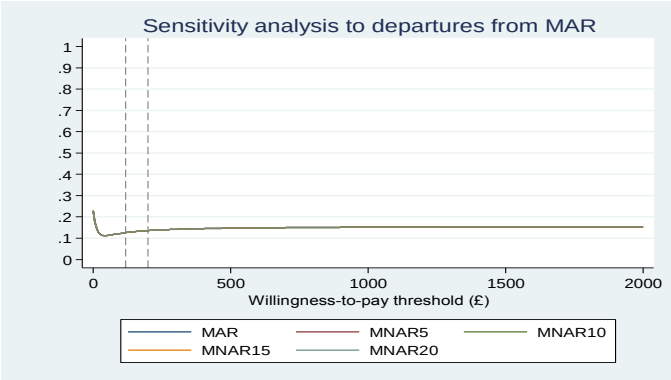


4.3.9 Sensitivity analyses

Sensitivity analysis of cost-effectiveness results departure from missing at random: To account for uncertainty in the incremental costs and effects, several sensitivity analyses were conducted, including non-parametric bootstrapping, sensitivity analyses to departure from missing at random (MAR) and sensitivity analyses excluding outliers.

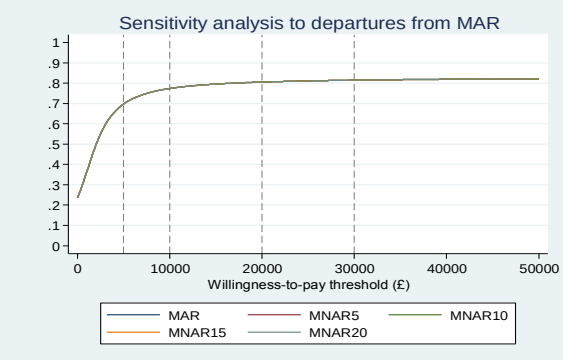
Different scenarios to departure from MAR were run, and these scenarios estimated the cost-effectiveness for days present at work, incidence of RSA and time to RSA, assuming the nature of data as missing not at random (MNAR). However, all these MNAR lines overlapped on the MAR line, suggesting that data were not missing at random. From the societal perspective, the sensitivity analysis result indicated that the likelihood of SHARP being cost-effective in reducing sickness absence was below 15% at WTP of £118 and the CEAC graph further suggested that additional costs did not improve the cost-effectiveness result (Figure 4.8).

Figure 4.8 Sensitivity analysis to departure from MAR for sickness absence days



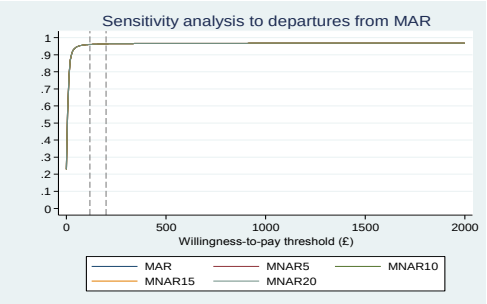
Sensitivity analysis of the cost-effectiveness result to departure from MAR for RSA showed that the likelihood of the intervention being cost-effective was 70%, 78% and 80% at a WTP of £5000, £10,000 and £20,000 respectively; further investment of additional costs did not change the cost-effectiveness result (Figure 4.9).

Figure 4.9 Sensitivity analysis to departure from MAR for incidence of RSA



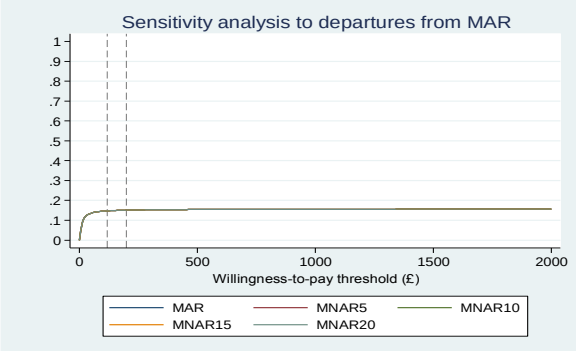
The sensitivity analysis of cost-effectiveness results to departure from MAR for delayed RSA days fell in the same MAR line and showed that the likelihood of SHARP being cost-effective was 95% at a WTP of £118, but a higher WTP did not change the cost-effectiveness result (Figure 4.10).

Figure 4.10 Sensitivity analysis to departure from MAR for time-to-RSA



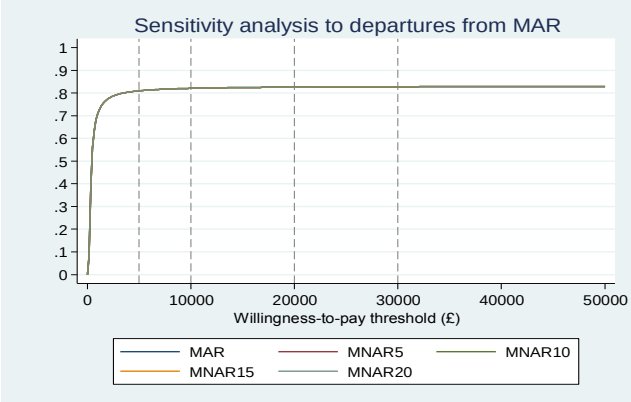
From the employer's perspective, the sensitivity analysis of the cost-effectiveness results to departure from MAR in reducing sickness absence, incidence of RSA and increasing time to RSA overlapped suggesting that the data for these outcome measures were not MNAR. Figure 4.11 showed that the likelihood of SHARP being cost-effective was below 20% at a WTP of £118 and this result did not change with additional costs. This result signposted that SHARP was not cost-effective with reference to CAU.

Figure 4.11 Sensitivity analysis to departure from MAR to reduce sickness absence



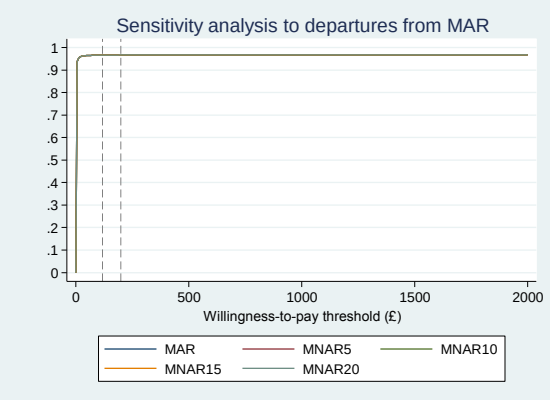
The sensitivity analysis of cost-effectiveness results for the percentage point reduction in incidence of RSA to departure from MNAR is presented in Figure 4.12. At a WTP threshold of £5000, the SHARP intervention had just over 80% probability of being cost-effective, but this result did not increase/change with higher WTP. This result signposted that SHARP was more cost-effective in terms of reducing RSA than CAU.

Figure 4.12 Sensitivity analysis to departure from MAR for incidence of RSA



The sensitivity analysis of cost-effectiveness results is presented in Figure 4.13. At a threshold of £118, the SHARP intervention had a 98% chance of being cost-effective, although, investment of extra costs would not change the cost-effectiveness results. This finding indicated that SHARP was more cost-effective than CAU in improving time to RSA.

Figure 4.13 Sensitivity analysis to departure from MAR for time-to-RSA



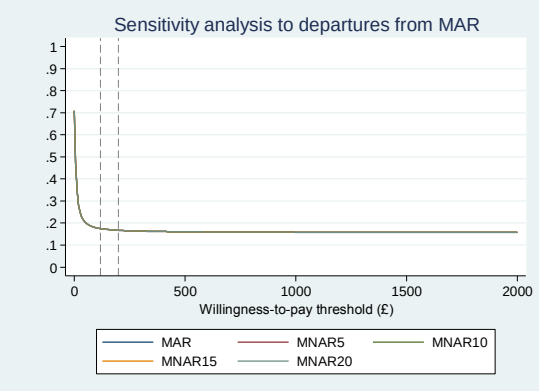
Sensitivity analysis of cost-effectiveness results excluding major outlier: Sensitivity analysis excluding outlier changes the direction of total cost from the higher to the lower in the intervention arm. Excluding outlier had a direct impact on the overall cost-effectiveness results. These two high cost values were components of average health care costs for a society, not for the employers. Therefore, sensitivity analysis of cost-effectiveness results was carried out from a societal perspective only.

The sensitivity analysis excluding outlier resulted in an ICER of £5.64 per day reduction in sickness absence at a lower cost (Table 4.7). The sensitivity analysis of the cost-effectiveness results for the reduction of sickness absence days to departure from MAR for different scenarios met in the same line, suggesting that the incremental costs and effectiveness data were not MNAR. The CEA curve showed that the likelihood of SHARP being cost-effective was below 20% at a threshold WTP value of £118, and the investment of extra costs would not change the cost-effectiveness results (Figure 4.14).

Table 4.7 Sensitivity analyses of cost-effectiveness results excluding major outlier

Statistics	**Mean**	**SE**	**95% CI**		**ICER**	**INB**
Costs	-48.38	88.21	-222.00	125.24		
No SA	-8.58	8.50	-25.23	8.07	5.64	-964.03
No RSA	0.08	0.80	-0.08	0.23	-638.85 (Dom)	1567.60
Time to RSA	34.64	18.77	-2.14	71.41	-1.40 (Dom)	4135.34

Figure 4.14 Sensitivity analysis excluding one outlier for sickness absence days



The sensitivity analysis of the cost-effectiveness results excluding outlier for the incidence of RSA is presented in Table 4.7. The sensitivity analysis of cost-effectiveness results showed that the intervention was dominant: the intervention was effective at a lower cost with an economic gain of £1568.

Sensitivity analysis of cost-effectiveness results departure from missing at random for different scenarios fell in the same line, indicating that the costs and effects data are not MNAR. The findings indicated that the likelihood of the intervention being cost-effective was just over 80% for a WTP of £5000 but there was no change in the cost-effectiveness results with a higher WTP (Figure 4.15).

Figure 4.15 Sensitivity analysis excluding one outlier for incidence of RSA

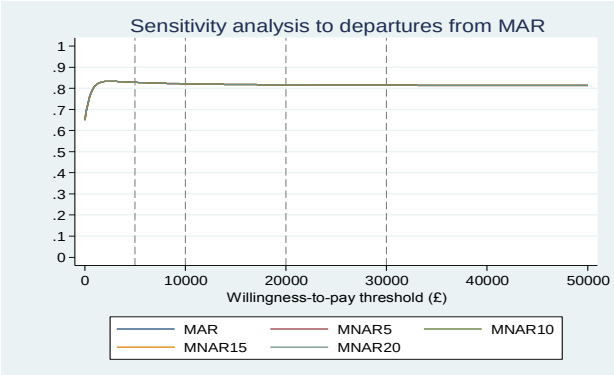


Table 4.7 shows the sensitivity analysis of the cost-effectiveness results excluding outlier. The findings show that the intervention was dominant, indicating that the intervention is

effective at lower costs with an economic gain of £4135. The sensitivity analysis of the cost-effectiveness results to departure from MAR fell in the same line, suggesting that the data are not MNAR. The cost-effectiveness plane indicated that the likelihood of the intervention being cost-effective was 98% at WTP of £118 (Figure 4.16).

Figure 4.16 Sensitivity analysis excluding one outlier for Time-to-RSA

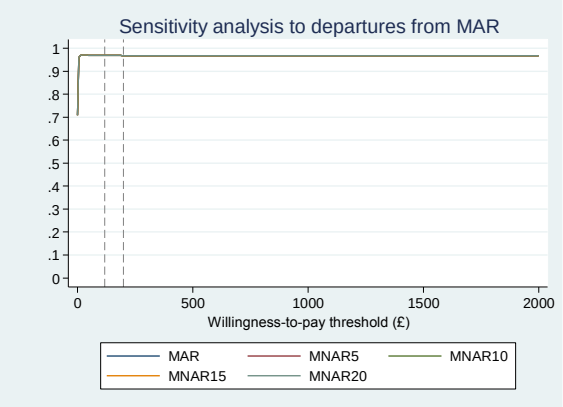


Table 4.8 shows the summary of cost-effectiveness results for the SHARP intervention. From the societal perspective, analysis of multiply-imputed data gave robust results for all three outcomes as compared to primary analysis. The sensitivity analysis excluding two major outliers changes the direction of the cost-effectiveness results. From the employer's perspective, the analysis of multiply-imputed data also gave robust cost-effectiveness results for all three outcomes as compared to the primary analysis. No extreme outlier existed in the employer's cost data.

Table 4.8 Summary cost-effectiveness results in terms of ICER and INB

Variables	**Primary Analysis**		**Multiple Imputation**		**Sensitivity Analysis**	
	ICER	INB	ICER	INB	ICER	INB
Societal Perspective (£)						
No SA	-66.72	-1584.80	-25.22	-1228.76	5.64	-964.03
No RSA	7535.37	946.83	2848.28	1302.87	-638.85	1567.60
Time to RSA	16.53	3514.56	6.25	3870.60	-1.40	4135.34
Employer's Perspective (£)						
No SA	-4.69	-1052.66	-4.28	-1049.08	NA	NA
No RSA	530.00	1478.97	482.89	1482.55	NA	NA
Time to RSA	1.16	4046.70	1.06	4050.28	NA	NA

4.4 Discussion

In this replication study, the provision of a problem-solving intervention (SHARP) for employees who were on sick leave with anxiety and/or depression was cost-effective when looking at the prevention of occurrence of RSA and time-to-RSA, but it was not cost-effective in reducing sick leave days over the 12-month follow-up period. Even though the health care delivery systems in the Netherlands differ from the UK, the cost-effectiveness results of the replication study are closely in line with the original study findings.

The cost-effectiveness of the intervention was analysed from both a societal and an employer's perspective. The difference in the health care costs from a societal perspective was not statistically significant between groups, but the difference in employer's costs was statistically significant ($p<0.001$). The lost productivity costs were not significantly different between two groups. Three different outcomes were considered for cost-effectiveness analysis from these two perspectives. From the societal perspective, the ICERs were -£67 per one sickness absence day reduction (CAU dominant); £7535 per one-unit reduction in incidence of RSA; and £17 per one delayed RSA day. From the employer's perspective, the ICERs were -£5 per one-day reduction in sickness absence (CAU dominant); £530 per one-unit reduction in incidence of RSA; and £1.16 per one delayed RSA day.

Surprisingly, the cost-effectiveness results of the multiple imputations changed the ICER results to a greater extent from a societal perspective, but there was less impact from multiple imputations on the cost-effectiveness results from an employer's perspective. The lesser impact could be due to the smaller number of resource use components included in the occupational health care services. After multiple imputations, from a societal perspective, the ICER for the different outcomes were -£25 per one sickness absence day reduction; £2848 per one-unit incidence of RSA reduction; and £6 per one delayed RSA day. From an employer's perspective, the ICER for the different outcomes were -£4 per one sickness absence day reduction; £483 per one-unit incidence of RSA reduction; and £1 per one delayed RSA day. The intervention did not yield economic benefits for the reduction of sickness absence days, but was successful in achieving economic benefit from the reduction of incidence of RSA and delayed RSA day.

Sensitivity analysis of the cost-effectiveness results was performed with multiply-imputed data in two ways: sensitivity analysis to explore the departure from MAR and excluding outlier. The analysis findings suggest that the nature of missing data was random as the cost-effectiveness results for different scenarios to departure from MAR fell in the same line. The CE-plane drawn for the three different outcomes to departure from MAR indicated that the likelihood of the intervention being cost-effective was just below 15% to reduce sickness absence days for a willingness to pay threshold of £118; 70% to reduce incidence of RSA with £5,000 cost-effectiveness threshold; and 98% for the delayed RSA day from the societal perspective with a WTP of £118. The likelihood of SHARP being cost-effective for three different outcomes from a societal and an employer's perspectives were not much different.

The sensitivity analysis excluding outlier changes the direction of the cost-effectiveness results for all three outcomes. The cost-effectiveness results excluding outlier yielded an ICER of £6 per sickness absence day reduction (low cost and lower effect); -£639 per one-unit incidence of RSA reduction (SHARP dominant); and -£1.4 per one delayed RSA day (SHARP dominant). The intervention yielded no economic advantage to reduce sickness absence days, but there was an economic benefit of the problem-solving intervention for the reduction of incidence of RSA and delay in RSA day.

This is, to my knowledge, the first study carried out to understand the transferability of economic evaluation results of workplace mental health intervention for employees from the Dutch to the English jurisdiction. In this study, outcome measures and health resource use data were directly transferred from the Dutch to the English context. However, valuation of health care resource use costs was done using UK unit cost information. As the health care delivery systems between the Dutch and English systems are different, there could be different outcomes and health care resource use patterns between these countries. But I assumed that the outcomes and resource use patterns in these countries would be similar.

The original study included incidence of RSA and time-to-RSA for the cost-effectiveness analysis, but my study added a third outcome, namely sickness absence days. The Dutch study (Arends et al., 2013) found that the problem-solving intervention was effective but at a higher cost compared to CAU for the reduction of incidence of RSA (ICER of £9468 per

one percent reduction of RSA) and increase in time to RSA (ICER of £25 per one prevented RSA day). These primary cost-effectiveness results from the original study are broadly similar to the replication study results reported here.

The SHARP intervention was unable to reduce sickness absence days and the CAU remained dominant. This could be partly due to higher sick leave absence in the SHARP group at baseline, and partly due to more health service utilisation by the SHARP group after going through the intervention delivered by the trained occupational physicians. Another possible reason could be the short follow-up period to capture the full impact on productivity measures.

Strengths and limitations: The strong points of the study are the replication of realistic design, inclusion of sickness absence information, the multiple imputations performed to minimise attrition bias and that the cost-effectiveness of the intervention was analysed from both societal and employer's perspectives. First, the pragmatic design allows the study to be conducted in real-world contexts and to include a wide variety of people. The study population in the original study was recruited from various areas of the Netherlands who were working for various industries/companies at different levels: this supports the external validity of the results. Second, this study included employees' sickness absence data from administrative records which generated data for internal validation. Even though average health care resource use data were available for 44% of the study sample, the use of multiple imputation techniques to handle missing data gives more reliable cost-effectiveness results. Finally, the study incorporates cost data for a wider societal perspective which can support the wider policy-driven implementation of the intervention, and also cost-effectiveness from an employer's perspective which can inform employers' decisions as to whether or not to invest in employees' mental health for improved productivity.

This replication study has several limitations which need to be considered. Firstly, this study solely relied on the Dutch healthcare service use and outcomes data, and added unit cost data from the English context; the country difference in the provision of health service may bias the cost-effectiveness results. This study assumed that the same treatment will have the same treatment outcome between countries, and utilises similar kinds of resources for the provision of services. This may not always be true as socio-demographic and

cultural factors may also influence health-seeking behaviour and provision of health care service. Moreover, the data in the original study were collected some years ago, which might not replicate the present-day care practices as some care and treatment arrangements will change over time.

Secondly, the original study collected retrospective data with self-administered questionnaires (in most cases) which may have biased the study results. Though the research team provided diaries for participants to keep records of health service utilisation, these diaries were not collected by the researcher to validate the self-administered resource use data. The researchers collected resource use data for the previous month for only four time points and linearly interpolated the data over a 12-month follow-up period. This may misrepresent the data if the data points do not reflect average values. Nevertheless, this possibly would not affect the path of cost-effectiveness results because the data for missing periods were incorporated identically for both SHARP and CAU groups.

Thirdly, missing data as a result of loss to follow-up is a limitation of this replication study as only 44% of the study participants have complete resource use data for complete case analysis. As I ran cost-effectiveness using only 44% of the data and did not perform a power calculation, there is the possibility of the study being underpowered for the primary cost-effectiveness analysis. I partly addressed this problem using multiple imputations to evaluate cost-effectiveness results, which gave more robust cost-effectiveness results than in the primary analysis. I also ran cost-effectiveness analyses to examine departure from missing at random (MAR) by assuming different scenarios to test whether the nature of missing data was other than MAR and found no evidence of it.

Conclusions: This study may support the view that transfer of economic data from one jurisdiction to another seems helpful when evaluating the cost-effectiveness of workplace interventions to prevent sickness absence. As this type of economic evaluation is time- and resource-saving, it seems to be an efficient way to explore the feasibility of whether to transfer a new intervention from one country to another. Based on the research findings, the study concludes that the problem-solving (SHARP-at work) intervention is cost-effective in reducing incidence of RSA and time to RSA with additional costs from both a societal and employer's perspectives. However, this intervention did not reduce sickness

absence days as compared to CAU, even with its higher costs during one-year follow-up period.

In general, practical implementation of the SHARP intervention is feasible in the English context and the study results support its implementation. But it is necessary to conduct a feasibility study to validate the study results before implementing any large-scale intervention. This study may serve as a reference document to identify the research potentials of the SHARP intervention to avoid sickness absence in the English context.

Chapter 5

5. Cost-effectiveness of Manager Training on Managing Mental Health to Reduce Sickness Absence with Common Mental Disorders

5.1 Introduction

Mental health problems are important causes of lost productivity in the workplace. The Adult Psychiatric Morbidity Survey 2014 in England showed that 18- 19% of people aged 16-64 years met at least one criterion for common mental disorders (CMDs) (McManus et al., 2016; Stansfled et al., 2016). An Office for National Statistics (ONS) report suggests that mental disorders accounted for 15.8 million days of work lost in 2016 in the UK (Office for National Statistics, 2017b). Another recent source – the UK Sickness Survey 2015 – pointed out that almost one-third of sickness absence was associated with mental disorders, and half of all employees who are experiencing health problems continue their work (EEF, 2015). It has also been estimated that CMDs are associated with about 40% of sickness absence resulting from lost workdays (Sainsbury Centre for Mental Health, 2007) and lost productivity due to reduced work performance while at work (Mitchell & Bates, 2011).

Moreover, mental health problems are also important causes of disability benefit claimants in the UK: these health problems are experienced by about 40% of incapacity benefit claimants and 23% of new disability living allowance claimants (Lelliott et al., 2008). Additionally, CMDs are major causes of job withdrawal and/or early retirement from work (David McDaid, Knapp, Medeiros, & Group, 2008).

A large proportion of people (63.5%) in the UK are aged between 16 and 64 years (ONS 2014) – what would in the past have been called ‘working age’ – (and 77.9% of them are economically active: 73.5% are in employment and only 5.5% are currently unemployed (Nomis, 2015).

There is a high cost associated with CMDs to employers. Deloitte MCS Limited (2017) estimated that mental disorders cost a total of £33- £42 billion for UK businesses: one-fourth is due to sickness absence, a half to reduced productivity, and one-fourth associated with the need to replace staff.

There are several benefits to employers of a healthy workforce: improved branding, improved retention, improved resilience, higher staff commitment, higher productivity, fewer accidents and reduced sickness absence (S. Bevan, 2010). Therefore, employers should be aware of their employees' health and well-being because of the direct benefits to their business. Studies show that training managers so that they are better at managing employee mental health and creating an employee-friendly workplace can help to reduce absenteeism and lost productivity (House of Parliament, 2012). It is also evident that supervisors' behaviour can influence the psychological wellbeing of employees and therefore there is a need not to neglect regular supervision (Gilbreath & Benson, 2004).

In the workplace, the topic of mental health and wellbeing has become a growing economic and social concern in recent years (Guarinoni et al., 2013; Henderson, Williams, Little, & Thornicroft, 2013). There has been considerable improvement in employers' awareness of psychological health and more efforts to change behaviour so as to support employees to improve their mental health and wellbeing (Henderson et al., 2013).

There is evidence from some studies of the effectiveness of supervisor and manager training targeted on employees' psychological well-being (Kawakami et al., 2005; Kawakami, Takao, Kobayashi, & Tsutsumi, 2006; Logan & Ganster, 2005; Takao et al., 2006; Theorell, Emdad, Arnetz, & Weingarten, 2001; Tsutsumi et al., 2005). Tsutsumi et al. (2005) studied the impact of mental health education to supervisors/managers to address employee psychological wellbeing and found that providing education to the supervisors has a beneficial effect on employees' psychological wellbeing. Theorell et al. (2001) examined the effect of an orientation programme for managers on psychosocial skills to address employees' distress in a Swedish insurance company. At one-year follow-up, the study found no significant difference in psychosocial demands, but there was significant reduction in cortisol and serum lipids in the intervention group. Takao et al. (2006) pointed out that there was a positive effect of manager training on job stress to prevent emotional distress and facilitate employees to improve productivity at work; a significant positive

outcome (p=0.012) from the intervention was seen in sub-group analysis for younger male white-collar employees. Kawakami et al. (2005) assessed the impact of online training for managers to reduce psychological distress in the workplace (an IT company in Japan) within a randomised controlled (RCT) design. The outcomes were assessed through the Brief Job Stress Questionnaire (BJSQ), which includes anxiety and depression sub-scales; the intervention was found not to reduce job stress in employees at 4-month post-intervention follow-up. A study carried out in sales and service industries also did not find beneficial effects of the intervention on job stressors for workers (Kawakami et al., 2006). Finally, Logan & Ganster (2004) concluded that management control training to managers did not enhance psychological wellbeing of employees. The study was carried out within an RCT, with participants recruited from a North American trucking company. Overall, available studies showed a mixed picture: some find that supervisor and manager training on mental health has an effect on the psychological well-being of employees, but many studies find no impact.

Previous studies related to manager and supervisor training on mental health only dealt with effects on clinical outcome measures (mental disorders in employees), but such interventions could potentially also have effects on quality of life, job satisfaction, productivity, staff retention, or costs to the employer. The study described in this chapter was designed to evaluate the cost-effectiveness of managing mental health (MMH) training for managers to reduce sickness absence among employees who are already experiencing or who are at risk of common mental disorders.

Economic evaluation is defined as “the comparative analysis of alternative courses of action in terms of both their costs and consequences” (Drummond et al., 2015). Cost-effectiveness, cost-utility and cost-benefit analyses are the most common forms of economic evaluation in health sector. I will study the economic impact of MMH training using cost-effectiveness and cost-benefit analyses from an employer’s perspective. In both of these analytic techniques, the costs of the alternatives are expressed in monetary units, while the consequences of the interventions are expressed in different units: natural units (e.g., one day reduction in sickness absence) in cost-effectiveness analysis and monetary units equivalent to outputs in cost-benefit analysis (Drummond et al., 2015).

Earlier in this chapter I highlighted the associations between common mental disorders and productivity at work. I also noted that productivity loss is associated with billions of pounds lost every year to UK businesses. Consequently, there is an urgent need to address common mental disorders in employees. Several initiatives are in place to address employee's mental health and wellbeing at work. One of the important initiatives can be to train managers to manage the mental health of those who are supervised by them. However, there is very limited evidence on effectiveness and no evidence on cost-effectiveness of managing mental health (MMH) intervention for the prevention of sickness absence.

The aim of the study was to assess the cost-effectiveness of managing mental health (MMH) training for managers to prevent sickness absence in the workplace. The plan was to collect data retrospectively from administrative records of a large UK company (called The Company from now on), covering trained managers and the employees supervised by them, and to do so for two periods: 6 months before and 6 months following the MMH training. Equivalent data will also be collected from a similar number of untrained managers and employees who are supervised by them for similar time periods, but now without training in the middle. The necessary cost data for this study will be collected with the help of the company's financial team. Then, the costs and effects data will be compared using multiple regression methods to compute an incremental cost-effectiveness ratio (ICER) for the intervention.

This study follows the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) guidelines for reporting economic evaluations of the interventions in health care developed by the International Society for Pharmacoeconomics and Outcomes Research (ISPOR) task force in 2013 (Antioch, Drummond, Niessen, & Vondeling, 2017; Husereau et al., 2013).

5.2 Study methods

5.2.1 Study population and subgroups

Some people-managers from various lines of business within The Company have participated in one-day MMH training. These managers and the employees who have been

supervised by them will be the main focus of the study. I also planned to compare employees supervised by managers who have received MMH training (and managers themselves) with employees supervised by managers who had not (at least at that time) received MMH training (again those untrained managers themselves). I worked closely with The Company to identify the 'untrained' comparison group, and to match the comparison group as far as is feasible on dates and manager characteristics to the intervention group. The participants will be full-time and part-time employees, aged between 18 and 64 years from two identified lines of business within The Company.

I wanted to aim for the maximum sample size possible to give greatest (statistical) power for the proposed analyses, making it easier to identify statistically significant differences and to make statistical adjustments for any differences between the comparison and intervention groups of supervised employees and managers, particularly if it proved hard to recruit managers into the study (i.e., to get their consent to participate), or if there were missing data for some individuals. I also wanted to avoid violating data anonymization principles agreed with The Company (where, for example, a people-manager would potentially be identifiable because of some combination of gender, team size or other factors). (I wanted to carry out retrospective statistical power calculations to check in case of non-significant results.)

5.2.2 Setting and location

I have planned to conduct this study in two lines of business in The Company. [In the version of this thesis submitted to the examiners, the company was identified and described. For reasons of confidentiality, the company is not identified in the final thesis.]

The Company has quite a long history of strong commitment to promote mental wellbeing and prevent mental disorders (including within-company treatment services) for its employees. It is well known nationally and internationally for its commitment to better employee mental health and wellbeing.

This is a pilot study initiated through the health, safety and wellbeing section of the human resource (HR) department of The Company, using internal communications and regular telephone conferences with key personnel.

5.2.3 Study design

The MMH intervention evaluation would be conducted based on before-and-after, quasi-experimental design in which individual-level data would be collected before (pre-test) and after (post-test) the intervention. The comparison group could be managers who have not been trained. This design is commonly used in evaluation research. The merits of this type of design are that it is cheaper, convenient, easy to carry out and much easier to get ethical approval as compared to an experimental design. However, this design is weaker than an RCT in its ability to establish causal relationship between the exposures and the problem.

Moreover, I have conducted a training evaluation survey with people managers who have been through MMH training and who were willing to participate in the survey. Written consent was taken from the participants before the survey. Descriptive analyses of survey data were carried out and these data would have also been linked with administrative data set for economic analysis.

The study design was amended following discussion with a representative from data security in The Company, and was formally approved by The Company. This revised analysis plan was also approved through the secured LSE research ethics process.

5.2.4 Study perspective

The analysis of costs would have been done from a company perspective, including the cost of offering the intervention, any treatment funded by The Company and the ongoing costs of mental health problems in employees (such as absenteeism). I would not have access to data on other health service use (e.g. NHS) for the participants, and so I would not be able to conduct an evaluation from a societal perspective.

5.2.5 Comparators

The evaluation would compare MMH training with the situation in the absence of MMH training. It would therefore need data linked to managers who have had this training as well as managers who have not had the training (and/or for those same managers prior to

receiving training). I would work closely with The Company (in selected lines of business) to identify the comparison group.

The managers in the intervention group received one-day managing mental health (MMH) training. The aim of this course is to deliver knowledge and skills to help managers to effectively manage someone potentially vulnerable to or diagnosed with a mental disorder. This training involves raising awareness of stress and mental health problems, and mental health law.

Trained managers work closely with their employees to identify employees' mental health problems, discuss possible solutions to reduce the impact of such problems and, if necessary, also discuss referral services, develop and implement action plans and monitor the progress of their implementation.

The study hypothesis is that managers who have received MMH training would be more supportive in resolving work and health-related issues experienced by the employees they supervise. This might lead to changes in behaviour, retention at work, reduction in sickness absence and greater productivity while at work, although the study would not have been able to evaluate all these potential impacts because it will not be able to access the necessary data. Employees also could receive treatment and care from their occupational physician, an NHS general practitioner or other NHS services.

The evaluation of MMH training would have been involved potentially four comparisons:

A. Managers who have received MMH training, comparing patterns of sickness absence in the 6-month period immediately before MMH training and the 6-month period immediately after;
B. Employees supervised by managers who have received MMH training, comparing patterns of sickness absence in the 6-month period immediately before MMH training and the 6-month period immediately after;
C. Managers who have and have not received MMH training, comparing patterns of sickness absence in the 6-month period immediately after MMH training for the intervention group with an equivalent period for the comparison group of untrained managers;

D. Employees supervised by managers who have and have not received MMH training, comparing patterns of sickness absence in the 6-month period immediately after their manager's MMH training for the intervention group with an equivalent period for the comparison group of employees supervised by 'untrained (in MMH)' managers.

In addition, I would have asked managers who have been through the MMH training for information, including their views on the training they received.

5.2.6 Time horizon/discount rate

Individuals in the study will be followed up for 6-months post-MMH training. There would be no discounting of costs and outcomes as the study duration is less than one year.

5.2.7 Choice of outcomes

Sickness absence would have been the primary outcome of the economic evaluation. The duration of sickness absence would be calculated as the number of hours or work days from the first day of absence until full return to work (Howard, Howard, & Smyth, 2012). This measure will be collected from The Company's HR records. I would also ask The Company for general information on each participant (age, gender, number of employees directly supervised, length of employment with The Company) to use as covariates for making adjustments to correct for any differences between groups being compared. The correlation between these manager characteristics and outcomes would have also been explored, and would be of interest in their own right. This manager information (age, gender, etc.) would have been collected using a 1-page questionnaire which would have been sent to managers at the time they are invited to consent to participate in the study.

I also wanted to collect a small amount of additional information from managers in this questionnaire, asking about how they rate their overall experiences of MMH training, how they rate the usefulness of the training in supporting employees with mental health issues, whether they have noticed any positive changes in the wellbeing of the people they supervise, or any changes in patterns of sick leave.

5.2.8 Measures of effectiveness

My initial analysis plan was revised following discussion with an employee (hereafter referred to as the Link Person) with The Company who worked as an Employee Assistance Consultant in the wellbeing, inclusion, safety and health department in The Company, and after approval by a senior person in The Company's security and information assurance section, linked in part to questions about potential data security issues. I completed the data audit process to the satisfaction of The Company regarding access to and analysis of individual employee-level data.

This evaluation research would have been involved the following data collection stages. First, all people-managers in the relevant lines of business within The Company who have received MMH training were invited to participate in the study. They had been sent: an invitation letter, information sheet, consent form and self-complete questionnaire by the company. They were asked to return the consent form and questionnaire to someone within The Company, and this had in turn been sent to me after removing any identifying information. Second, data on sickness absence for these managers and the employees they supervise would have been collected from HR records (for the 6-month periods immediately before and after MMH training). The anonymized HR records would have also been sent to me at LSE.

Third, a comparison group of untrained managers will be identified from the same lines of business within The Company. They will be sent information on the study (using a slightly different set of forms from those sent to the MMH-trained managers) and asked to consent to the extraction of sickness record data on themselves and the people they supervise from HR records, and the use of this data (in anonymised form) by the LSE team. Data on sickness absence would have been sought for dates that broadly match those of the managers going through MMH training. I would also try to match those in the comparison and intervention groups by reference to manager's age, gender, occupation type and employment status, but I would have been done so by using statistical matching techniques.

5.2.9 Estimating resource use and costs

I was not proposing to collect any new cost-related information, but I would need access to information held by The Company in order to calculate the total cost of the MMH intervention. I would also include the cost of the manager taking a day out from their normal duties, which I could estimate from their wage (individual-specific or averaged across all managers, by grade). Costs of running the training include management and administration costs as two hours per course (within The Company, estimated by the Link Person), refreshment costs, room hire (if relevant), and any travel and accommodation costs (for managers attending). The contract between The Company and the provider running the MMH training programme provides the main cost (covering the time of the consultant/assistant delivering the training). On average, there are ten line managers attending each course.

Indirect costs resulting from lost productive time would have been computed using the human capital approach, a period-specific salary of the employee group involved. Hourly labour cost of employees would have been collected from the company (averaged across grade or job type). The price year of the study would be 2015.

5.2.10 Analytic methods

The primary outcome measure in this study will be sickness absence and the cost-effectiveness analysis will be performed from an employer perspective. I received information on usefulness of MMH training through the questionnaire completed by trained managers. I would have been accessed individual-level data from HR records about demographic, sickness absence and economic data. The survey results were presented separately using descriptive statistics to provide a qualitative interpretation of the benefits of training.

My analyses would need to adjust for potential differences in the characteristics of managers and supervised employees when comparing outcomes and costs between the intervention and comparison groups. For example, I would anticipate adjusting for employee age, gender, occupation type, and employment type as each of these could have a bearing on the incidence of and response to mental health issues. These adjustments

would have been made using generalised linear models (GLMs) with the dependent variable being sickness absence over the study period (6 months), and the group allocation (MMH training or not) included among the independent variables. Both sickness absence and cost data are 'count' variables with only positive values, which results in right-handed skewness in the data distribution. In this case, the GLM regression methods with gamma family and log link function may be an appropriate option, although I will explore others too. Multiple imputations will be carried out to handle missing data, if necessary. The statistical analyses would have been carried out using STATA 14.

The cost-effectiveness of MMH training would have been calculated after computing the ICER. The ICER is conventionally defined as the difference in costs of intervention to control groups divided by the difference in outcome between these groups (Henderson et al., 2014; Petrou, 2012). In this case, the incremental cost difference will simply be the cost (per supervised employee or per manager) of the training itself, plus the cost of taking managers away from their normal employment duties to attend training. The incremental outcome is the difference in sickness absence days (for supervised employees and managers, either combined or analysed separately) between the pre-training and post-training periods, compared between the intervention (MMH training) and comparison (no MMH training) groups. I would have been used non-parametric bootstrapping method to estimate 95% confidence intervals (CIs) for mean costs and effects as these data are likely to have skewed distributions.

A cost-benefit analysis (CBA) would have also been conducted to estimate the economic gain of the intervention to the employer, with outcomes (reduced absences) being valued in monetary terms, based on wage rates. Uncertainty around costs, effects, and cost-effectiveness results would have been examined through sensitivity analyses, with adjustment for baseline characteristics. I would have performed univariate sensitivity analyses to address structural uncertainty. I would have also run subgroup analyses to address heterogeneity in data.

5.3 Results

5.3.1 Survey results of MMH training to managers

Data were collected from managers working in the two identified lines of business in The Company. Table 5.1 shows the descriptive findings of the MMH training evaluation survey among managers working in The Company.

A total of 65 trained managers agreed to participate in the survey, among them 69% were men. The average age of participants was 46 years. On average, one manager supervised 12 employees but there was wide individual variance (SE=2.798). The average years spent in The Company by participating managers were 22 years and there was huge individual variance in total years of experience in The Company. Participants on average were trained on MMH 10 months before the survey date.

Table 5.1 Descriptive analyses of user's satisfaction survey findings of MMH training to managers

Statistics	**Sample size**	**Proportion**	**Std. Err.**	**95% CI**	
Age (in Years) Mean	65	45.62	1.450	42.720	48.511
Gender	65				
Woman	20	0.31	0.058	0.206	0.433
Man	45	0.69	0.058	0.567	0.794
Supervisees	65	11.91	2.798	6.318	17.497
Total years worked at The Company	65	21.53	1.637	18.260	24.801
Last trained (in months)	56	10.29	0.852	8.579	11.992
Training experience rating					
Highly unsatisfactory	1	0.02	0.015	0.002	0.106
Neutral	9	0.14	0.043	0.072	0.249
Satisfactory	28	0.43	0.062	0.314	0.556
Moderately satisfactory	27	0.42	0.062	0.300	0.541
Usefulness of training					
Completely useless	1	0.02	0.015	0.002	0.106
Moderately useless	1	0.02	0.015	0.002	0.106
Neutral	16	0.25	0.054	0.155	0.368
Useful	22	0.34	0.059	0.232	0.464
Moderately useful	25	0.38	0.061	0.272	0.511
Support to employees after training	65				
Moderately negative	4	0.06	0.030	0.023	0.156
Somehow negative	3	0.05	0.026	0.015	0.137
Neutral	17	0.26	0.055	0.167	0.385

Statistics	Sample size	Proportion	Std. Err.	95% CI	
Somehow positive	22	0.34	0.059	0.232	0.464
Moderately positive	19	0.29	0.057	0.193	0.417
Positive change in mental health on employees					
No	31	0.48	0.062	0.356	0.601
Yes	34	0.52	0.062	0.399	0.644
Change in sick leave patterns					
No	50	0.77	0.053	0.648	0.858
Yes	15	0.23	0.053	0.142	0.352
Change in sick leave due to mental health problems					
Decreased	13	0.20	0.050	0.118	0.318
No change	48	0.74	0.055	0.615	0.833
Increased	4	0.06	0.030	0.023	0.156

The response of overall training experience, usefulness of training and support to employees with mental health problems after training was rated on 7-items Likert scales. Regarding overall training experience, 85% of the participants rated training as satisfactory. Fourteen percent of participants gave neutral response while the reminders rated it as highly unsatisfactory.

Seventy-two percent of respondents said that the training was useful in supporting employees who experience mental health issues, 25% gave neutral opinion, while 4% mentioned that the training was useless. Regarding support for employees with mental health issues, 73% of the respondents mentioned that support was positive, 26% gave neutral response, while the remainder said that training was not beneficial to support employees with mental health issues.

Fifty-two percent of the respondents said that they have observed positive changes in the wellbeing of the employees they supervised following the training. The majority of participants (77%) said that there was no change in the sick leave patterns of employees they supervised following MMH training. Regarding changes in sick leave pattern, 20% of respondents said that there was a decrease in sick leave associated with mental health issues within six months following MMH training while 6% of respondents said that days off work taken with mental health problems had increased.

In summary, the survey of managers on the effectiveness and usefulness of managing mental health training gave satisfactory results. A majority of participants expressed the

view that MMH training was satisfactory and the training was useful to support employees with mental health issues. They also mentioned that there was positive change in the wellbeing of employees and one in five respondents said that there was decrease in sick leave taken by employees following MMH training.

5.3.2 Cost-effectiveness results of MMH training to managers

I worked very hard with support from my supervisor to access data to evaluate cost-effectiveness of MMH intervention. Unfortunately, at the end I did not receive the sickness absence and economic data from The Company, and so it was impossible to evaluate the cost-effectiveness of the MMH intervention. This was mainly due to the resignation of the responsible person at The Company after many delays in setting up the processes described above.

5.4 Discussion

The main aim of this study was to evaluate the cost-effectiveness of managing mental health training to managers to reduce sickness absence associated with CMDs. I approached The Company with the help of my supervisor. The senior manager in The Company gave approval for me to conduct the cost-effectiveness study.

The Company has implemented several programmes to address mental health problems in employees. One of them is the training to managers on managing mental health to support employees with mental health issues. I developed a study proposal (analysis plan: this is attached as an appendix to this chapter) and submitted to The Company and the proposal was accepted. It took several months to get ethical clearance from The Company to collect sickness absence and economic data related to MMH intervention. After several conversations and paperwork with The Company's responsible person for the MMH study and human resource division, I finally got ethical clearance from them.

My conversations with my supervisor and responsible person within The Company concluded that it would be good to run a brief survey to understand the perception of managers about the usefulness of MMH training before collecting the main data for the

cost-effectiveness study. I developed the survey tools and carried out a survey. Survey results were presented in this chapter. After completing this survey, I drafted key findings of the managers' survey and my supervisor forwarded this to The Company via email.

My supervisor sent a number of email in order to access sickness absence and economic data along with the demographic and socioeconomic data required to evaluate the cost-effectiveness of MMH intervention. My supervisor received email reply after some weeks (July 2017) and noticed that the Link Person had resigned from The Company. It proved impossible to find a replacement link in time for the planned work for this thesis to go forward. Unfortunately, due to his absence, I could therefore not receive the intervention data related to MMH study and it was not possible to complete this planned study.

Chapter 6

6. Conclusions and Recommendations

My thesis explores a number of themes in relation to mental health problems and employment. It explores and identifies associations between common mental disorders (CMDs) – primarily anxiety and depression – and employment within different macroeconomic situations in England, explores the existing evidence base on workplace-initiated interventions and assesses the feasibility of further cost-effectiveness studies of such interventions which aim to reduce days off work associated with mental health problems. Here, I summarise the study results and offer some policy recommendations.

6.1 Contribution of my thesis

Chapter 1 provides an introduction to the topic, and emphasises why the association between common mental disorders and employment difficulties – especially absence from work – is so important for employees, employers and the whole economy. It is evident from this chapter that CMDs are a major source of sickness absence; sickness absence has enormous economic costs for UK businesses and for the UK economy. Chapter 2 reports the results of a systematic review of cost-effectiveness analyses and other economic evaluations of workplace-initiated interventions for common mental disorders. The review findings reveal that some previous studies have demonstrated that there is an economic case for workplace-initiated interventions, and that some interventions can avoid substantial economic costs by reducing sickness absence associated with common mental disorders. I also found from my review that there are relatively few published economic studies of workplace interventions for mental health problems internationally, and very few in the UK. The methodological quality of previous studies is mixed: some high-quality studies provide helpful recommendations for employers and governments, but there are also some low-quality studies that are too weak to generate robust recommendations. My review also found and commented on the protocols of ongoing economic evaluations in this field.

Chapter 3 uses data for three different years (2008, 2011 and 2014) drawn from the Health Survey for England to look at the association between CMDs and employment before, during and after the major economic recession that started in the UK and many other countries just under 10 years ago. My analyses demonstrate that there are a number of associations between anxiety and depressive disorders and aspects of employment in England. I used employment status as one key outcome of interest and anxiety or depression as a predictor variable, and survey years as contextual variables. I also included a number of other variables in the multivariable analyses to adjust for other influences. I analysed the data using three different regression models. In the first model, employment status (defined in two ways: either at work or not at work; and either employee or self-employed for those in employment) was taken as dependent variable and anxiety or depression as a predictor, adjusting for a wide range of other individual characteristics as covariates. The second model was an extension of the first model where analysis was done separately for men and women. My third model used anxiety or depression as the dependent variable, with employment status as the main predictor of interest, again adjusting for other individual-specific covariates. This allowed me to demonstrate the association between anxiety or depression and employment, and how economic recession and gender differences can impact the overall results. The regression models were adjusted to take account of demographic, socioeconomic and health-related measures. I carried out supplementary analyses to examine the consequences of missing data.

There is a double burden to business and the public sector associated with economic recession: first, the increase in the number of mental disorders needs more resources for management and the second, there could be a possibility of budget cuts due to economic recession. The study suggests that there is a case for workplace interventions to prevent and /or reduce such health problems.

With this in mind the original intention of Chapter 5 was to evaluate the cost-effectiveness of one such workplace intervention in a large UK company. However, as noted in Chapter 5 due to factors beyond my control it was not possible to complete the planned evaluation. I undertook a great deal of preparatory work for the cost-effectiveness evaluation of a programme that trained ‘people managers’ in how to be aware of and to manage mental health problems experienced by the people they supervised. Although some data were collected from managers who had undergone the training to find out about their

satisfaction with the course and their perceptions of its effects, it proved impossible to get the detailed economic and employees related data that I had expected.

Chapter 4 describes how I developed an English replication study using data originally collected for an intervention that was delivered and evaluated in the Netherlands. I had identified this intervention and study in my systematic review of the literature, and it looked to be suitable for re-analysis in this replication context. The Dutch researchers kindly made their data available to me for this part of my thesis. My modelling analysis looks at the cost-effectiveness of a problem-solving intervention (SHARP) to reduce recurrent sickness absence associated with CMDs.

To my knowledge, this is possibly the first study which replicates economic data to assess the cost-effectiveness of a workplace-initiated intervention to reduce sickness absence associated with CMDs. In this replication study, I used the outcome and resource use data from the original study and then substituted costs associated with resource use in the English context. The robustness of the cost-effectiveness results is also a contribution of this study. By estimating confidence intervals for the primary cost-effectiveness results using bootstrapped techniques, the uncertainty around the mean cost-effectiveness results is minimised. Furthermore, sensitivity analysis of the cost-effectiveness results was performed to address an outlier in study data. My economic evaluation looked at the effectiveness measures included in the original study, plus one additional measure, and employed statistical analyses that were in some respects different from those undertaken in the original study. This replication study reveals that the SHARP intervention is cost-effective in reducing the incidence of recurrent sickness absence (RSA) and time-to RSA, but it was not cost-effective in decreasing the total number of sickness absence days over the one-year follow-up period.

6.2 Policy inferences

There are several ways in which my findings would help employers and policy-makers to invest in workplace interventions to prevent or respond to common mental disorders, and so improve employee wellbeing and productivity in the workplace. My study presented results of the associations between anxiety or depression and employment status in different macroeconomic situations, and how the gender differences impact on these

associations. I then explored the economic case for workplace-initiated interventions for common mental disorders and studied the feasibility of cost-effective workplace interventions to prevent sickness absence associated with common mental disorders.

It is evident that the CMDs are major causes of absenteeism and lost productivity, and that they cost billions of pounds to UK business (Chapter 1). Given this situation, it is important to invest in workplace interventions to prevent common mental disorders. The systematic review in Chapter 2 indicates that workplace-initiated interventions can be cost-effective and in some case also cost-saving. The findings from this review offer employers and policy-makers more opportunities to invest on potential workplace-interventions to prevent common mental disorders and improve productivity at work.

The findings from chapter 3 findings indicate that there was a lower likelihood of people with anxiety or depression being employed and that the economic recession made employees' mental health even worse. Women with anxiety or depression problems were more likely to be at work as compared to men. The analysis also indicated that employment was supportive for better mental health and that those working as employees were less likely to experience anxiety or depression problems than the self-employed. Other factors such as age, gender, marital status, educational qualification, ethnic origin, degree of urbanisation, deprivation scores, quality of life, limiting longstanding illness and health-related problems also have an impact on employment status. Therefore, any policy decisions about improvement in the mental health of employees and organisational productivity also need to take account of the above-mentioned factors which are associated with employment while designing workplace interventions to address mental health problems among employees.

Chapter 2 explores the economic evidence relating to workplace-initiated interventions for the prevention of common mental disorders. The findings show that there is no adequate evidence of cost-effectiveness of the workplace interventions in relation to the reduction of common mental disorders and lost productivity. It was also found that there is wide variation in the interventions studied across different countries and also variation in the evaluation designs, with very few studies in UK. There is a need to do further research in this area in the UK context, and such work should look at both societal and employer perspectives as the benefits and costs can effect different players in different ways. As part

of this effort to evaluate workplace intervention to promote mental health and wellbeing there should be emphasis on examining the economic, as these interventions may have the potential to improve productivity and reduce sickness absence and staff turnover (Czabala, Charzynska, & Mroziak, 2011; Hassard, Cox, Murawski, De Meyer, & Muylaert, 2011).

Chapter 4 indicates that from a societal perspective, a problem-solving intervention was cost-effective in reducing incidence of recurrent sickness absence and delay in time-to recurrent sickness absence, but it was not cost-effective in decreasing total number of days off work with reference to control. Similar cost-effectiveness results were found from the employer perspective. This replication study is very important for both employers and policy makers looking to reduce the incidence of RSA and delay in time-to RSA.

It is also clear that undertaking research is not easy. As discussed in Chapter 5 a study to assess the cost effectiveness of manager' mental health training was fully designed and approved for ethical clearance, but it proved too difficult to obtain the data. It is important to improve links between academia and business to evaluate interventions.

6.3 Recommendations for future research

It would be exciting to further study the economic evaluation of the recession on employment of people with mental health problems. I had originally planned to study this question by using data from successive versions of the Adult Psychiatric Morbidity Survey (APMS) for England, conducted in 2000 and 2007 (pre-recession) and in 2014 (after recession). I completed a number of preliminary analyses with the pre-recession data, but unfortunately the APMS 2014 data have still not yet been released for public use. (This was a much linger delay than expected.) I also planned to use APMS data to analyse through modelling the generalised effects of workplace interventions. The alternative to APMS in the English context for me was data from different waves of the Health Survey for England, but pre-recession survey data did not include economic information that I needed for modelling intervention effects. So, I used HSE data to evaluate the impact of anxiety or depression in employment. APMS 2007 and 2014 are both rich in mental health outcomes, employment and economic data. One future possibility would be to extract data for the working age population who were in employment with common mental health problems during the survey period and create survey years as dummy variables and merge

data sets. Then, it would be possible to model the outcomes, resource use and costs for some workplace interventions using multivariate regression methods for both pre-recession and after recession periods to evaluate the economic consequences of recession.

The second potential research topic that would be interesting is the research idea from my incomplete study in Chapter 5. The main objective of this study was to assess the cost-effectiveness of managing mental health training for managers to reduce sickness absence associated with CMDs. An Australian study evaluated the effect of training managers in relation to workplace-based mental health problems to reduce sickness absence among employees was recently published by Milligan-Saville et al. (2017). This study (using an RCT design) was conducted among Australian fire and rescue workers with a six-month follow-up period. The primary outcome was the variation in sickness absence between those supervised by trained managers compared to those supervised by untrained managers. This study reveals that mental health training to managers substantially reduce sickness absence and there was a return on investment of £10 for every £1 spent. The feasibility of cost-effectiveness of such an intervention to reduce sickness absence is also possible in the English context.

A third research possibility is to conduct an economic evaluation of a problem-solving intervention within an RCT design in an English workplace setting. We could replicate the Dutch intervention or design our own intervention to train occupational physicians on problem-solving skills to address mental health problems among employees. It would be inspiring to conduct such a study in small- and medium-sized enterprises (SMEs) as those enterprises may not have sufficient resources to invest in other ways to address employees' mental health and wellbeing. In 2015, there were 5.382 million SMEs that employ 15.6 million workers in the UK (Department for Business Innovation and Skills, 2015). These enterprises make a great contribution to the UK's overall economic development. Employees in such enterprises are more vulnerable to mental health problems because of the nature of their work. So, appropriate interventions to target these enterprises and address the mental health problems of their employees would help to reduce mental health problems and reduce sickness absence and lost productivity associated with it. This will help not only to improve enterprises' profits but also help to improve a country's overall economic development. Therefore, the government and employers should collaborate to implement workplace interventions to reduce mental health problems in the workplace.

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Appendices

Appendix 2.1 Search strategy for systematic review of economic evaluation of workplace-initiated interventions for common mental disorders

Syntax for search in PubMed

1. employ*
2. work*
3. profession*
4. staff*
5. human resource/
6. occupation*
7. manpower/
8. labor OR labour/
9. informal sector/
10. OR/1-9
11. job-site OR job-site OR job-site/
12. worksite OR work-site OR work site/
13. work stations/
14. work place OR workplace OR work location/
15. OR/11-14
16. 10 OR 15
17. mental health services/
18. mental hygiene/
19. community mental health services/
20. employee assistance programme/
21. employee assistance programme/
22. employee health services/
23. psychological support/
24. social networks/
25. social supports/
26. control OR prevention/
27. psychotherapy/
28. disease management /

29. meditation/
30. yoga/
31. ehealth OR telehealth/
32. OR/17-31
33. Combat neuros*
34. Stress disorders/
35. Post-traumatic stress disorders OR PSTD/
36. Anxiety/
37. Depression/
38. Melancholia/
39. Paraphrenia/
40. Major depress*
41. Burnout/
42. Phobia/
43. Affective disorders/
44. Pain disorders/
45. Panic attacks/
46. Somatization disorders/
47. Agoraphobia/
48. Claustrophobia/
49. drug abuse OR substance abuse/
50. OR/33-49
51. Cost analysis/
52. Economic evaluation/
53. Cost-effectiveness/
54. Cost-utility/
55. OR/51-54
56. 16 AND 32 AND 50 AND 55

*Limit applied: ((Clinical Trial[ptyp] OR Controlled Clinical Trial[ptyp] OR Meta-Analysis[ptyp] OR Pragmatic Clinical Trial[ptyp] OR Randomized Controlled Trial[ptyp] OR systematic[sb]) AND ("2000/01/01"[PDAT]: "2013/12/31"[PDAT]) AND "humans"[MeSH Terms])

*Updated for January 2014 to June 2015

Syntax for PsycINFO search

1. DE "Personnel"
2. DE "Labor Market" OR DE "Labor Union Members" OR DE "Labor Unions"
3. DE "Occupations"
4. s1-s3/OR
5. DE "Mental Health Services" OR DE "Community Mental Health Services" OR DE "Online Therapy" OR DE "Community Psychiatry"
6. DE "Occupational Health" OR DE "Occupational Therapy"
7. DE "Community Mental Health" OR DE "Community Mental Health Services" OR DE "Community Mental Health Training" OR DE "Community Psychiatry" OR DE "Community Psychology" OR DE "Community Services" OR DE "Community Welfare Services"
8. DE "Prevention" OR DE "Primary Health Care" OR DE "Primary Mental Health Prevention"
9. DE "Health Promotion" OR DE "Health Screening"
10. DE "Employee Assistance Programs" OR DE "Employee Benefits" OR DE "Employee Efficiency" OR DE "Employee Engagement" OR DE "Employee Health Insurance" OR DE "Employee Interaction" OR DE "Employee Leave Benefits" OR DE "Employee Motivation" OR DE "Employee Pension Plans" OR DE "Employee Productivity" OR DE "Employee Retention" OR DE "Employee Turnover"
11. DE "Cognitive Therapy"
12. DE "Psychotherapeutic Counseling" OR DE "Psychotherapy" OR DE "Psychotherapy Training"
13. DE "Psychotherapy" OR DE "Psychotherapy Training" OR DE "Public Health Services"
14. DE "Stress Management"
15. DE "Meditation"
16. DE "Yoga"
17. DE "Exercise"
18. DE "Telemedicine" OR DE "Telemetry" OR DE "Telepathy"
19. DE "Online Therapy"
20. DE "Treatment"

21. s5-s19/OR
22. DE "Mental Disorders" OR DE "Mental Health"
23. DE "Stress"
24. DE "Anxiety" OR DE "Anxiety Disorders"
25. DE "Depression (Emotion)" OR DE "Deprivation"
26. DE "Major Depression"
27. s22-s26/OR
28. DE "Costs and Cost Analysis" OR DE "Budgets" OR DE "Health Care Economics" OR DE "Health Care Costs" OR DE "Pharmacoeconomics" OR DE "Cost Containment"
29. S4 AND s21 AND s27 AND s28

*Limiters 29 by (PDATE: 20000101-20131231; source type: Academic articles; Language: English

Syntax for search in EBSCO platform for PsycINFO, Business Source Complete, CINAHL Plus with Full Text, EconLit, ERIC, MEDLINE, PsycARTICLES

1. DE "EMPLOYEES"
2. (MH "Rural Health Personnel") OR (MH "Radiology Personnel") OR (MH "Health Personnel, Unlicensed") OR (MH "Employee, Disabled") OR (MH "Reserve Personnel")
3. DE "Personnel" OR DE "Service Personnel" OR DE "Disabled Personnel" OR DE "Blue Collar Workers" OR DE "Agricultural Extension Workers"
4. Employ*
5. DE "WORKING class"
6. (MH "Social Workers") OR (MH "Rural Health Personnel") OR (MH "White Collar Workers") OR (MH "Shift Workers") OR (MH "Blue Collar Workers") OR (MH "Community Health Workers") OR (MH "Farmworkers") OR (MH "Volunteer Workers") OR (MH "Health Personnel") OR (MH "Clerical Personnel")
7. (MH "Community Health Workers") OR (MH "Sex Workers") OR (MH "Volunteers") OR (MH "Health Personnel")
8. DE "Rescue Workers" OR DE "Foreign Workers" OR DE "Agricultural Extension Workers" OR DE "Unskilled Industrial Workers" OR DE "Skilled Industrial Workers" OR DE "White Collar Workers" OR DE "Social Workers" OR DE

"Psychiatric Social Workers" OR DE "Migrant Farm Workers" OR DE "Child Care Workers" OR DE "Blue Collar Workers" OR DE "Agricultural Workers" OR DE "Personnel" OR DE "Labor Market" OR DE "Allied Health Personnel"

9. Work*
10. Occupation*
11. Human resource/
12. Labor or labour/
13. Job site/
14. Workplace or work place/
15. Worksite or work-site/
16. S1-s15/OR
17. Mental health services/
18. (MH "Mental Health Services") OR (MH "Community Mental Health Services") OR (MH "Emergency Services, Psychiatric") OR (MH "Occupational Health Services")
19. DE "Mental Health Services" OR DE "Community Mental Health Services" OR DE "Online Therapy" OR DE "Community Psychiatry"
20. DE "EMPLOYEE assistance programs"
21. (MH "Employee Assistance Programs") OR (MH "Occupational Health Services") OR (MH "Employee Incentive Programs") OR (MH "Peer Assistance Programs") OR (MH "Employee Orientation")
22. DE "Employee Assistance Programs" OR DE "Health Care Utilization" OR DE "Educational Counseling" OR DE "Job Enrichment" OR DE "Supervisor Employee Interaction"
23. Employee health services/
24. Psychosocial support systems/
25. Social networks/
26. Therapy/
27. Prevent*/
28. Prophylaxis/
29. (MH "Psychotherapy") OR (MH "Cognitive Therapy")
30. Management/
31. Treatment/
32. Logotherapy/

33. (MH "Meditation") OR (MH "Yoga") OR (MH "Mindfulness")
34. (MH "Telemedicine") OR (MH "Teleradiology") OR (MH "Remote Consultation")
35. Ehealth or mobile health or telemetry/
36. s17-s35/OR
37. neurosis/
38. (MH "Stress Disorders, Post-Traumatic") OR (MH "Combat Disorders") OR (MH "Stress Disorders, Traumatic")
39. DE "Posttraumatic Stress Disorder" OR DE "Traumatic Neurosis" OR DE "Occupational Neurosis" OR DE "Occupational Stress" OR DE "Stress" OR DE "Psychological Stress" OR DE "Somatoform Disorders"
40. Burnout/
41. (MH "Depression") OR (MH "Bipolar Disorder") OR (MH "Seasonal Affective Disorder")
42. (MH "Depression") OR (MH "Depressive Disorder") OR (MH "Bipolar Disorder") OR (MH "Depressive Disorder, Major") OR (MH "Adjustment Disorders")
43. DE "Major Depression" OR DE "Depression (Emotion)" OR DE "Postpartum Depression" OR DE "Recurrent Depression" OR DE "Atypical Depression" OR DE "Bipolar Disorder" OR DE "Reactive Depression" OR DE "Endogenous Depression"
44. Phobia/
45. Drug abuse or substance abuse/
46. Alcohol related disorders/
47. s37-s46/OR
48. costs/
49. (MH "Costs and Cost Analysis") OR (MH "Cost Benefit Analysis") OR (MH "Health Care Costs") OR (MH "Health Facility Costs") OR (MH "Nursing Costs") OR (MH "Cost Savings")
50. (MH "Cost of Illness") OR (MH "Direct Service Costs") OR (MH "Hospital Costs") OR (MH "Employer Health Costs") OR (MH "Drug Costs") OR (MH "Cost Allocation")
51. Cost-effectiveness/
52. s48-s51/OR
53. s16 AND s36 AND s47 AND s52

*Limiters: [scholarly peer reviewed journals; PDATE: 20000101-20131231; source type: academic journals; language: English]

*updated for January 2014 to June 2015

Syntax for Web of Science

1. Employ*
2. Work*
3. Occupation*
4. Profession*
5. Human resource/
6. Manpower/
7. Labor or labour
8. Job/
9. #1-#8/OR
10. therapy/
11. psychotherapy/
12. community/
13. health services/
14. intervention*
15. treatment/
16. prevent*
17. care/
18. meditation/
19. yoga/
20. social welfare/
21. development/
22. s10-s21/OR
23. Mental illness/
24. Depress*
25. Stress/
26. Disorders/
27. S23-s26/OR
28. Costs/
29. cost analysis/
30. incentives/

31. economic*
32. economic evaluation/
33. cost-benefit/
34. expenditure/
35. s28-s34/OR
36. #9 AND #22 AND #27 AND #35

*** Refined by: LANGUAGE:** (ENGLISH) AND **DOCUMENT TYPES:** (ARTICLE)

*Indeses=CI-XPANDED, SCI, A&CI, PCI-S, PCI-SSH, BKCI-S, KCI_SSH, CR-EXPANDED, IC

Timespan=2000-2013

*updated for January 2014 to June 2015

ProQuest search syntax (British periodicals, IBSS, Periodicals archive online, Proquest dissertations and theses global)

1. SU.EXACT("Occupations") OR SU.EXACT("Workers")
2. SU.EXACT("Staff") OR SU.EXACT("Employees")
3. Artists/
4. Bankers/
5. Job site or job location/
6. Workplace/
7. Work environment/
8. S1-S7/OR
9. SU.EXACT("Psychotherapy")
10. SU.EXACT("Psychotherapy")
11. SU.EXACT("Community services")
12. SU.EXACT("Therapy")
13. SU.EXACT("Counselling")
14. SU.EXACT("Interventionism")
15. SU.EXACT("Health promotion")
16. SU.EXACT("Hospices") OR SU.EXACT("Residential care")
17. SU.EXACT("Prevention")
18. SU.EXACT("Occupational therapy")
19. SU.EXACT("Religious practice")
20. SU.EXACT("Meditation")

21. SU.EXACT("Yoga")
22. SU.EXACT("Community participation")
23. SU.EXACT("Community integration")
24. SU.EXACT("Community care")
25. S9-S24/OR
26. SU.EXACT("Mental illness") OR SU.EXACT("Psychopathology")
27. SU.EXACT("Depression")
28. SU.EXACT("Eating disorders")
29. SU.EXACT("Mental stress")
30. SU.EXACT("Madness")
31. SU.EXACT("Personality disorders")
32. SU.EXACT("Drug addiction") OR SU.EXACT("Addiction")
33. S26-S32/OR
34. SU.EXACT("Cost-effectiveness")
35. SU.EXACT("Cost-benefit analysis") OR SU.EXACT("Cost analysis")
36. SU.EXACT("Economic analysis") OR SU.EXACT("Economic impact analysis")
37. SU.EXACT("Commercial costs") OR SU.EXACT("Hospital costs") OR SU.EXACT("Comparative costs") OR SU.EXACT("Transaction costs") OR SU.EXACT("Social costs") OR SU.EXACT("Transport costs") OR SU.EXACT("Capital costs") OR SU.EXACT("Adjustment costs") OR SU.EXACT("Labour costs") OR SU.EXACT("Energy costs") OR SU.EXACT("Welfare costs") OR SU.EXACT("Replacement costs") OR SU.EXACT("Recurrent costs") OR SU.EXACT("Distribution costs") OR SU.EXACT("Costs")
38. SU.EXACT("Business economics") OR SU.EXACT("Distribution economics") OR SU.EXACT("Economic behaviour") OR SU.EXACT("Economic analysis") OR SU.EXACT("Budget economics") OR SU.EXACT("Economic activity") OR SU.EXACT("Economic calculations") OR SU.EXACT("Behavioural economics")
39. SU.EXACT("Pareto efficiency") OR SU.EXACT("Economic efficiency") OR SU.EXACT("Market efficiency")
40. SU.EXACT("Financial incentives") OR SU.EXACT("Wage incentives") OR SU.EXACT("Investment incentives") OR SU.EXACT("Work incentives") OR SU.EXACT("Economic incentives")
41. SU.EXACT("Health expenditure")

42. SU.EXACT("Financial loss")
43. S34-S42/OR
44. S8 AND S25 AND S33 AND S43

*Limiters applied: Peer reviewed; date from 01 January 2000 to 31 December 2013; source type scholarly journals; language English

*Updated for January 2014 to June 2015

Scopus syntax for search terms

1. TITLE-ABS-KEY **(employ*)**
2. TITLE-ABS-KEY **(work*)**
3. TITLE-ABS-KEY **(occupation*)**
4. TITLE-ABS-KEY **(manpower)**
5. TITLE-ABS-KEY **("human resource")**
6. TITLE-ABS-KEY **(labor)**
7. TITLE-ABS-KEY **(job)**
8. TITLE-ABS-KEY **(apprentice*)**
9. #1-#8/OR
10. TITLE-ABS-KEY **("mental health services")**
11. TITLE-ABS-KEY **("occupational health services")**
12. TITLE-ABS-KEY **("employee assistance program*")**
13. TITLE-ABS-KEY **(employee health services)**
14. TITLE-ABS-KEY **(psychosocial support systems)**
15. TITLE-ABS-KEY **(** "social networks")
16. TITLE-ABS-KEY **(prevent*)**
17. TITLE-ABS-KEY **(promotion*)**
18. TITLE-ABS-KEY **(therapy)**
19. TITLE-ABS-KEY **(psychotherapy)**
20. TITLE-ABS-KEY **(management)**
21. TITLE-ABS-KEY **(meditation)**
22. TITLE-ABS-KEY **(yoga)**
23. TITLE-ABS-KEY **(telemedicine)**
24. #10-#23/OR
25. TITLE-ABS-KEY **(disorders)**

26. TITLE-ABS-KEY (**"mental disorders"**)
27. TITLE-ABS-KEY (**"common mental disorders"**)
28. TITLE-ABS-KEY (**stress**)
29. TITLE-ABS-KEY (**burnout**)
30. TITLE-ABS-KEY (**pstd**)
31. TITLE-ABS-KEY (**anxiety**)
32. TITLE-ABS-KEY (**phobia**)
33. TITLE-ABS-KEY (**depress***)
34. #25-#33/OR
35. TITLE-ABS-KEY (**costs** AND **cost analysis**)
36. TITLE-ABS-KEY (**cost-benefit**)
37. TITLE-ABS-KEY (**cost-effectiveness**)
38. #35-37/OR
39. #9 AND #24 AND #34 AND #38

    *Limit 39 to (PUBYEAR, “2000 – 2013”; LANGUAGE , **"English"** ; SRCTYPE , **"j"**)

    *Updated for January 2014 to une 2015

Appendix 2.2 Methodological quality assessment of included studies

Quality Criteria	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Total %
Gorden	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	100%
Noben	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	95%
Arends	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	100%
Van Oostrom	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	100%
Rebergen	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	89%
Dewa	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	N	N	N	Y	Y	N	Y	Y	68%
Scheneider	Y	Y	Y	N	N	Y	Y	N	N	N	N	N	N	N	N	Y	N	N	Y	37%
McCraty	Y	Y	Y	N	Y	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	26%
Bittman	N	Y	N	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	Y	N	21%
Lerner	Y	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	Y	N	21%
Total %	90%	90%	90%	70%	70%	70%	70%	60%	50%	60%	60%	50%	50%	40%	60%	90%	40%	80%	60%	68%

19 CHEC lists: 1) Is the study population clearly described? 2) Are competing alternatives clearly described? 3) Is a well-defined research questions posed in an answerable form? 4) Is the economic study design appropriate to the stated objective? 5) Is the chosen time horizon appropriate in order to include relevant costs and consequences? 6) Is the actual perspective chosen appropriate? 7) Are all important and relevant costs for each alternative identified? 8) Are all costs measured appropriately in physical units? 9) Are costs valued appropriately? 10) Are all important and relevant outcomes for each alternative identified? 11) Are all outcomes measured appropriately? 12) Are all outcomes valued appropriately? 13) Is an incremental analysis of costs and outcomes of alternatives performed? 14) Are all future costs and outcomes discounted appropriately? 15) Are all important variables, whose values are uncertain, appropriately subjected to sensitivity analysis? 16) Do the conclusions follow from the data reported? 17) Does the study discuss the generalizability of the results to other settings and patient/client group? 18) Does the article indicate that there is no potential conflict of interest of study researcher(s) and funder(s)? 19) Are ethical and distributional issues discussed appropriately?

Appendix 3.1 Definition and coding of study variables

Variable	Description including code	Source
pserial	Serial number of an individual	Individual
hserial	Serial number of a household (SSU)	Household
psu	Sample point number, a primary sampling unit	Sample
wt_int	Weight for analysis of core interview sample	Other
strata	Stratification level	Individual
year	Year of survey **Code:** Year 2008-2011: 0=2008; 1=2011 Year 2011-2014: 0=2011; 1=2014 Year 2008-2014: 0=2008; 1=2014	Other
urban	Degree of urbanisation Code: 1= Urban 2= Town and fringe 3= Village, hamlet or isolated dwellings	Sample
hhsize	Household size Code: 1= household with one member 2=household with 2 family members ……. 5= household with 5 or more family members	Derived
year	Survey year for HSE study 2008, 2011 and 2014	Other
sex	Sex Code: 0= Female 1= Male	Individual
age	Age at last birthday (in years) -numeric (16-64 years)	Individual

marstatc	marital status including cohabitees Code: 1= Single 2= Married 3= Separated 4= Divorced 5= Widow 6= Cohabitees	Derived
topqual3	Highest educational qualification Code: 1= NVQ4/NVQ5/Degree or equivalent 2= Higher education below degree 3= NVQ3/GCE A Level equivalent 4= NVQ2/GCE O Level equivalent 5= NVQ1/CSE other grades equivalent 6= Foreign/other 7= No qualification	Derived
origin2	Grouped ethnic categories Code: 1= White 2= Black 3= Asian 4= Mixed 5= Any other ethnic group	Derived
Eqv5	Equivalised income quantiles (D) Code: 1= Lowest Quintile (<£10,671) 2= Second lowest Quintile (>=£10,67 - <£17,789) 3= Middle Quintile (>=£17,789 - < £27,317) 4= Second highest Quintile (>=£27,317 - <44,200) 5= Highest Quintile (>=£44,200)	Derived

totinc2	Total household income (D) - numeric	Derived
qimd	Quantile of Index of Multiple Deprivation (IMD) score Code: 1= 0.53->8.49 [least deprived] 2= 8.49->13.79 3= 13.79->21.35 4= 21.35->34.17 5= 34.17->87.80 [most deprived]	Derived
econact2	Employment status (2 groups) Code: 0= Not in work 1= In work	Derived
hrpemply	Whether an employee or self-employed Code: 0= Self-employed 1= Employee	Household
hrpftpt	Whether working full-time or part-time Code: 0= Part-time 1= Full-time	Household
hrpempst	Whether a manager or foreman Code: 1= Manager 2= Foreman/Supervisor 3= Other employees	Household
hrpnempl	Number of employed at work (including yourself) Code: numeric	Household
sector	Is sector private, public or non-profit Code: 1= Private sector 2= Public sector	Household

	3= Non-profit organisation	
paidwk	Currently in paid employment (2 groups) Code: 0= No 1= Yes	Individual
srcin01b	Earning from employment or self-employment Code: 0= Self-employment 1= Employment	Household
eqindex	EQ-5D utility index (social preference weight) Code: numeric (-0.10 – 1.00)	Derived
anxdep	Anxiety or depression Code: 0= No 1= Yes	Derived
genhelf	Self-assessed general health Code: 1= Very good 2= Good 3= Fair 4= Bad or 5= Very bad	Individual
hthstat	health today-best/worst imaginable health state Code: numeric (0- 100)	Individual
bmivg4	BMI valid group -4 Code: 1= Underweight [BMI: <18.5] 2= Normal [BMI: 18.5 - <25] 3= Overweight [BMI: 25 - <30] 4= Obese [BMI: >=30]	Derived
dnnow	Current drinking habit	Individual

	Code: 0= No 1= Yes	
limitill	Limiting longstanding illness (D) Code: 1= Limiting longstanding Illness 2= No limiting longstanding illness 3= No longstanding illness	Derived
mobility	Mobility (EQ-5D) Code: 1= No problems in walking about 2= Some problems in walking about 3= Confined to bed	Individual (Adult)
selfcare	Selfcare (EQ-5D) Code: 1= No problems with self-care 2= Some problems washing or dressing 3= Unable to wash or dress myself	Individual (Adult)
usualact	Usual Act Code: 1= No problems performing usual activities 2= Some problems performing usual activities 3= Unable to perform usual activities	Individual (Adult)
pain	Pain/discomfort Code: 1= No pain or discomfort 2= Moderate pain or discomfort 3= Extreme pain or discomfort	Individual (Adult)
anxiety	Anxiety /depression Code: 1= Not anxious or depressed	Individual (Adult)

	2= Moderately anxious or depressed 3= Extremely anxious or depressed	
condcnt	Number of grouped condition-Multiple (category) Code: 0= No 1= Yes	Derived
compm1	Neoplasms or benign growths Code: 0= No 1= Yes	Derived
compm4	Nervous systems disorder Code: 0= No 1= Yes	Derived
compm7	Heart and circulatory systems disorders Code: 0= No 1= Yes	Derived
compm12	Musculo-skeletal system disorders Code: 0= No 1= Yes	Derived

Appendix 5.1 Analysis plan for economic evaluation of managing mental health (MMH) intervention

Proposal for Economic Evaluation of Workplace Mental Health Interventions (FDR3465)
Rajendra Kadel, Martin Knapp and David McDaid
PSSRU, London School of Economics and Political Science
20 August 2016

Project duration: August to December 2016 (Status: Not completed)

Purpose and objectives

The purpose of this study is to evaluate the cost-effectiveness of Managing Mental Health (MMH) Training for The Company people-managers. The precise research question is:

What is the cost-effectiveness of MMH training for people-managers in The Company as a means to reduce workplace sickness absence among the employees they supervise, and also for those managers themselves?

This question addresses an issue that is relevant from a business perspective, but there would also be considerable interest in the findings more broadly. This note describes how the study will be conducted.

The LSE team comprises: Rajendra Kadel (postgraduate student), Martin Knapp (Professor of Social Policy and Director of PSSRU) and David McDaid (Associate Professorial Research Fellow). At The Company, [Name] is the lead for this work.

Analysis plan

Intervention

The intervention (MMH training) is a one-day course to deliver knowledge and skills to help managers to effectively manage someone at risk of, or diagnosed with a mental health

condition. This one-day training involves raising awareness of stress and mental health problems, and mental health law.

Trained managers work closely with their employees to identify employees' mental health problems, discuss possible solutions to reduce the impact of such problems and, if necessary, also discuss referral services, develop and implement action plans and monitor the progress of their implementation.

The study hypothesis is that managers who have received MMH training would be more supportive in resolving work and health-related issues experienced by the employees they supervise. This might lead to changes in behaviour, retention at work, reduction in sickness absence, and greater productivity while at work, although the study will not be able to evaluate all these potential impacts. Employees also could receive treatment and care from their occupational physician, NHS general practitioner, or other NHS services.

Samples

Some people-managers from various lines of business within the The Company have participated in one-day MMH training. These managers and the employees who have been supervised by them will be the main focus of the study. I will also compare employees supervised by managers who have received MMH training (and the managers themselves) with employees supervised by managers who had not (at least at that time) received MMH training (and again those 'untrained' managers themselves). I will work closely with The Company to identify the 'untrained' comparison group, and I will endeavour to match the comparison group as far as is feasible on dates and manager characteristics to the intervention ('trained') group.

Participants will be full-time and part-time employees from the [The Company] lines of business.

Sample size

I want to aim for the maximum sample size possible to give greatest (statistical) power of the proposed analyses, making it easier to identify statistically significant differences and to make statistical adjustments for any differences between the comparison and intervention groups of supervised employees and managers, particularly if it proves hard to recruit managers into the study (i.e., to get their consent to participate), or if there are missing data for some individuals. I also want to avoid violating data anonymization principles agreed with The Company (where, for example, a people-manager might potentially be identifiable because of some combination of gender, team size or other factors). (I will carry out retrospective statistical power calculations to check in case of non-significant results.)

Comparisons

The evaluation of MMH training will involve potentially four comparisons:
Managers who have received MMH training, comparing patterns of sickness absence in the 6-month period immediately before MMH training and the 6-month period immediately after;
Employees supervised by managers who have received MMH training, comparing patterns of sickness absence in the 6-month period immediately before MMH training and the 6-month period immediately after;

Managers who have and have not received MMH training, comparing patterns of sickness absence in the 6-month period immediately after MMH training for the intervention group with an equivalent period for the comparison group of untrained managers;

Employees supervised by managers who have and have not received MMH training, comparing patterns of sickness absence in the 6-month period immediately after their manager's MMH training for the intervention group with an equivalent period for the comparison group of employees supervised by 'untrained (in MMH)' managers.

In addition, I will ask managers who have been through the MMH training for information, including their views on the training they received (see below).

Outcome measures

Sickness absence will be the primary outcome of the economic evaluation. The duration of sickness absence will be calculated as the number of hours or work days from the first day of absence until full return to work. This measure will be collected from The Company's HR records. I will also require general information on each participant (such as age, gender, number of employees directly supervised, length of employment with The Company) to use as covariates for making adjustments to correct for any differences between groups being compared. The correlation between these manager characteristics and outcomes will also be explored, and could be of interest in their own right. This manager information (age, gender, etc.) will be collected using a 1-page questionnaire which will be sent to managers at the time they are invited to consent to participate in the study.

I also want to collect a small amount of additional information from managers in this questionnaire, asking about how they rate their overall experiences of MMH training, how they rate the usefulness of the training in supporting employees with mental health issues, whether they have noticed any positive changes in the wellbeing of the people they supervise, or any changes in patterns of sick leave.

Cost measures

I am not proposing to collect any new cost-related information, but I would need access to information held by The Company in order to calculate the cost of the training intervention. I would also include the cost of the manager taking a day out from their normal duties, which I could approximate from their wage (individual-specific or averaged across all managers, by grade). Costs of running the training include management and administration costs as 2 hours per course (within The Company, estimated by [Name]), refreshment costs, room hire (if relevant), any travel and accommodation costs (for managers attending). The contract between The Company and the provider running of the MMH training programme provides the main cost (covering the time of the consultant/assistant delivering the training). On average, there are ten line managers on each course.

Indirect costs resulting from lost productive time will be computed using the human capital approach, i.e. period-related income of the employee group concerned. Hourly labour cost

of employees will be collected from the company (averaged across grade or job type). The price year of the study will be 2015.

Data collection process

I have revised our analysis plan following discussion with [Name of person at The Company], Employee Assistance Consultant from the wellbeing, inclusion, safety and health department in The Company, and after approval by [Name] (The Company Security, Consulting & Information Assurance Services) following consultation with data security personnel at LSE. I have completed the data audit process to the satisfaction of The Company regarding access to and analysis of individual employee-level data.

This evaluation research will involve the following data collection stages. First, all people-managers in the relevant lines of business within The Company who have received MMH training will be invited to participate in the study. They will be sent: an invitation letter, information sheet, consent form and self-complete questionnaire by the company. (Precise details to be agreed with [Name of person at The Company].) They will be asked to return the consent form and questionnaire to someone within The Company. Second, data on sickness absence for these managers and the employees they supervise will be collected from HR records (for the 6-month periods immediately before and after MMH training). The anonymized HR records will be sent to LSE.

Third, a comparison group of untrained managers will be identified from the same lines of business within The Company. They will be sent information on the study (using a slightly different set of forms from those sent to the MMH-trained managers) and asked to consent to the extraction of sickness record data on themselves and the people they supervise from HR records, and their use (in anonymised form) by the LSE team. Data on sickness absence will be sought for dates that broadly match those of the managers going through MMH training. I will also try to match those in the comparison and intervention groups by reference to manager's age, gender, occupation type and employment status, but I will do so by using statistical matching techniques.

Statistical analyses

The primary outcome measure in this study will be sickness absence, which will be used in a cost-effectiveness analysis conducted from an employer's perspective. I will access individual-level data from HR records and through the questionnaire completed by trained managers. The survey results will be presented separately using descriptive statistics to provide a qualitative interpretation of the benefits of training.

Our analyses will need to adjust for potential differences in the characteristics of managers and supervised employees when comparing outcomes and costs between the intervention and comparison groups. For example, I would anticipate adjusting for employee age, gender, occupation type, and employment type as each of these could have a bearing on the incidence of and response to mental health issues. These adjustments would be made using Generalised Linear Models (GLMs) with the dependent variable being sickness absence over the study period (6 months), and the group allocation (MMH training or not) included among the independent variables. Both sickness absence and cost data are 'count' variables with only positive values, which results in right-handed skewness in the data distribution. In this case, the GLM regression methods with gamma family and log link function can be an appropriate option, although I will explore others too. Multiple imputations will be carried out to handle missing data, if necessary. The statistical analyses will be carried out using STATA 14.

The cost-effectiveness of MMH training will then be explored by calculating the incremental cost-effectiveness ratio (ICER). The ICER is conventionally defined as the difference in mean costs between intervention and comparison groups divided by the difference in mean outcome. In this case, the incremental cost difference will simply be the cost (per supervised employee or per manager) of the training itself, plus the cost of taking managers away from their normal employment duties to attend training. The incremental outcome will be the difference in sickness absence days (for supervised employees and managers, either combined or analysed separately) between the pre-training and post-training periods. I will use non-parametric bootstrapping method to estimate 95% confidence intervals (CIs) for mean costs and effects as these data are likely to have skewed distributions.

A cost-benefit analysis (CBA) would also be conducted to estimate the financial benefits of the intervention to the employer, with outcomes (reduced absences) being valued in monetary terms, based on wage rates.

Uncertainty around costs, effects, and cost-effectiveness results will be examined through sensitivity analyses of the cost-effectiveness results, with adjustment for baseline characteristics. I will perform univariate sensitivity analyses of the cost-effectiveness results to address structural uncertainty. I will also run subgroup analyses to address heterogeneity in data.

Ethical considerations

The study design has been amended following discussion with a representative from data security in The Company, and has been approved. This revised analysis plan will have LSE research ethics approval.

Appendix 5.2 Users' satisfaction survey questionnaire about MMH training for managers

Organisational Unit Code (OUC) Participants UIN :

Number of The Company employees directly supervised by you:

Personal information

Your age (Year) Gender: (M for Male, F for Female, O for other)

How long have you been working with The Company (in years)?

Questions about your Managing Mental Health (MMH) training

1. When did you have your training in Managing Mental Health? Please tell us the month and year?

2. How would you rate the overall experience of your MMH training? Please circle <u>one</u> response:

Highly unsatisfactory			Neutral			Highly satisfactory
1	2	3	4	5	6	7

3. How would you rate the usefulness of your MMH training in supporting employees who experience mental health issues? Please circle <u>one</u> response:

Completely useless			Neutral			Very useful
1	2	3	4	5	6	7

4. How has your support for employees who experience mental health issues changed as a result of your MMH training? Please circle <u>one</u> response:

Much more negative			No change			Much more positive
1	2	3	4	5	6	7

5. Have you noticed any positive changes in the wellbeing of the people you supervise following your MMH training? ☐ (Y for Yes and N for No)

6. Have you noticed any changes in patterns of sick leave of the people you supervise since your MMH traini ☐ (Y for Yes and N for No)

7. How has sick leave for mental health reasons changed in the 6 months since attending the course? Please circle <u>one</u> response:

Reduced	No change	Increased
1	2	3

!!! Thank you very much for completing this questionnaire!!!

Appendix 5.3 Consent form for participation in the Managing Mental Health (MMH) training evaluation

INTERNAL The Company RECORDS ONLY

Name of Researchers: Rajendra Kadel, Martin Knapp & David McDaid, London School of Economics and Political Science (LSE).
Title of study: Cost-effectiveness of Managing Mental Health (MMH) Training

Pease read and complete this form carefully. If you are willing to participate in this study, please write 'Y' for Yes and 'N' for No in the response boxes, and then sign and date the declaration at the end.

	Consent	Response
1	I have read the information sheet for the research project and I have been given the opportunity to ask questions about the project.	
2	I understand that the research will involve self-completed questions related to managing mental health (MMH) training	
3	I understand that the research will involve the use of non-sensitive anonymous information already held by The Company.	
4	I understand that the information about me and the people I manage will be kept confidential and neither I nor my colleagues will be identified in any way to the research team or in any reports.	
5	I know that I am free to decline to participate in this research study, and this will not affect my employment in any way.	
6	I understand that any information about me will be used solely for research purposes and the overall research findings will be publicly disseminated through the LSE, but without identifying any individual.	
7	I understand that I will be able to obtain a summary report following the completion of the study.	
8	I agree to take part in this study.	

I hereby sign the consent form and will return it to [email of The Company]

UIN Number :…… Signature: …….

Date: /_ _ /_ _ /2016.

(Note: If you have any queries regarding this form or study, please feel free to contact the research team at r.kadel@lse.ac.uk or m.knapp@lse.ac.uk).

Appendix 5.4 Information sheet for participants in the managing mental health (MMH) study

The study: This research study is an evaluation of training for The Company managers in Managing Mental Health. The focus is on the effect of the training in preventing or responding to mental health problems experienced by the people supervised by managers who have undergone the training. I am particularly interested in whether the training is cost-effective.

Being aware of mental health issues in the workplace, and responding appropriately to them, can significantly improve the wellbeing of employees, and improve productivity. But training managers requires resources. I am conducting this research to find out if there is an economic case for providing such training.

The research team: The research is being undertaken as part of a research degree at the London School of Economics (LSE) by Rajendra Kadel, supervised by Professor Martin Knapp and David McDaid.

The study design: I will compare rates of sickness absence for The Company employees and people-managers in the 6-month periods before and after managers have received training in managing mental health (MMH). I will combine these data with information about the costs of delivering the MMH training. I will also look at managers' views on whether they found the MMH training useful.

Data collection process: I will collect data in two ways. With your agreement, an administrator in The Company will extract data on sickness records for the people you supervise and yourself for two periods of time: the 6 months before you received MMH training and the 6 months after the training. Second, I would like you to complete a very short questionnaire to give us basic information on yourself (age, gender, number of employees directly supervised, length of employment with The Company) and your views on the MMH training you received. The questionnaire is attached here, and once you have completed it, please send it to [The Company email] although the questionnaire has a unique code on it, no information will be passed from The Company to the research team at the LSE which would make it possible to identify any individual.

The design for this study has been discussed with the personnel in the data security section in The Comapny, and has been approved by them. It has also been approved through the LSE research ethics process.

Information confidentiality

I will keep all research data secure and completely confidential. I will comply fully with the Data Security Act 1998. All data passed from The Company to the research team at LSE will be fully anonymized.

Information sharing

I will make our research findings available after completion of this study, and you will have an opportunity to view these findings through The Company. I may also publish the research findings in a biomedical journal.

Your decision to participate: Participation in this research is entirely voluntary. If you do not want to participate it will not in any way affect your employment in The Company

To find out more

Please contact either [Email address for NAME] in The Comapny, or a member of the research team at LSE: Rajendra Kadel at r.kadel@lse.ac.uk or Martin Knapp at m.knapp@lse.ac.uk if you would like to find out more.

Sending completed questionnaire to: [The Company email]