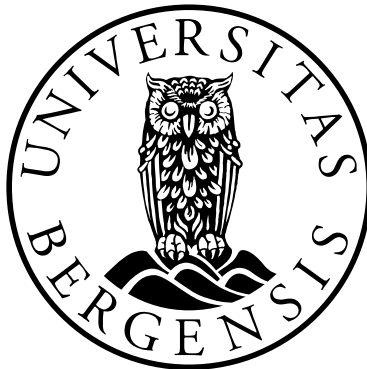


# **Long-term sickness absence and disability pension award as consequences of common mental disorders**

*Epidemiological studies using a population-based health survey  
and official ill health benefit registries*

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## **Scientific environment**

The present PhD project was financed through the Research Programme on Sickness Absence, Work and Health of the Research Council of Norway. The PhD project was part of the multidisciplinary research project "Health, work and society – multidisciplinary studies of determinants of sickness absence and disability", with researchers from Department of Economics, Department of Sociology, Department of Public Health and Primary Care and Department of Health Promotion and Development at the Faculty of Psychology, all at the University of Bergen.

The doctoral education was carried out at the Graduate School in Human Interaction and Growth (GHIG) and the general doctorate program at the Faculty of Psychology, University of Bergen. The scientific work conducted in the dissertation was primarily done at the Department of Health Promotion and Development (HEMIL) at the University of Bergen. Parts of the PhD project were also done at Institute of Psychiatry, King's College, London, UK and at the Department of Public Mental Health at the Norwegian Institute of Public Health.

The dissertation is presented through Department of Health Promotion and Development (HEMIL), University of Bergen, under additional supervision from Institute of Psychiatry, King's College, London and the Norwegian Institute of Public Health.

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## Abstract

The common mental disorders anxiety and depression are widespread in the population and will affect 1 in 4 adults at least once during their lifetime. Due to high prevalence of common mental disorders within official benefit statistics, the contribution from these conditions on sickness absence and ill health retirement in the population is increasingly recognised. Sickness absence and ill health retirement rates have increased dramatically across the western world since the 1980s, and these high rates place enormous burdens on public expenditures. Sickness absence and ill health retirement may also have dire consequences for the individuals affected. In order to prevent and reduce sickness absence and ill health retirement, knowledge about causes and mechanisms is essential. These causes and mechanisms can not be identified using mere official benefit statistics or cross-sectional studies. The role of common mental disorders as *risk factors* for sickness absence and ill health retirement has only been examined in a handful of studies, with relatively short follow-up. Further, few high quality longitudinal and population-based studies have examined whether common mental disorders are associated with specific sickness absence and ill health retirement patterns, such as frequent recurrence and long duration of sickness absence, or early ill health retirement.

Linking information from the epidemiological Hordaland Health Study (HUSK), conducted from 1997 to 1999, with data from official and comprehensive registries over sickness benefits and disability pension award (FD-Trygd) in the period 1997 to 2004, the aim of the present PhD project was to examine the long-term consequences and burden of common mental disorders on sickness absence and ill health retirement in the general population.

In Paper 1, the aim was to examine the prospective associations between common mental disorders and long-term sickness absence. Common mental disorders were found to be long-lasting risk factors for sickness absence, with detectable effects up to 4 years after baseline measurements. Common mental disorders were particular strong risk factors for very long duration and frequent recurrence of sickness absence. Comorbid anxiety and depression showed the strongest associations with the different

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outcomes, but anxiety without depression was also a significant and long-lasting risk factor for a range of sickness absence outcomes during follow-up. With one exception (frequent recurrent sickness absence), depression without co-occurring anxiety was not a predictor of future sickness absence.

The aim in Paper 2 was to examine if anxiety and depression were risk factors for disability pension award, and to investigate the contribution from sub case-level anxiety and depression symptom loads compared with case-level symptom loads on disability pension awards in the population. The results demonstrated that common mental disorders were relatively strong risk factors for subsequent disability pension award. Comorbid anxiety and depression gave a five-fold increased risk for disability pension award in general, and tripled the risk for disability pension award for non-mental medico-legal diagnoses. The risk of disability pension award was lower for sub case-level symptom loads, but due to much higher prevalence of these conditions, the proportion of disability pensions attributable to sub case-level symptom loads was comparable to the proportion of disability pension awards attributable to case-level anxiety and depression symptom loads.

Information from the official Norwegian disability pension registry was utilized in Paper 3. In this study, the aim was to quantify number of lost working years due to disability pension award for different medico-legal diagnostic groups. The findings revealed that although musculoskeletal disorders were the commonest stated reason for disability pension award, mental disorders caused more lost working years than any other diagnostic groups, due to a combination of young age at award and high prevalence. Among the mental disorders, common mental disorders were the greatest contributors to lost working years in the population.

The findings of the present dissertation indicate that common mental disorders are more important contributors to sickness absence and ill health retirement than acknowledged in official benefit statistics. Future studies should focus on gaining knowledge about how the characteristics of common mental disorders contribute to sickness absence and ill health retirement, and how we can intervene to reduce the individual and societal burdens from long-term sickness absence and ill health retirement due to common mental disorders.

## Abbreviations

APA – the American Psychiatric Association

BMI – body mass index

CBT – cognitive behavioural therapy

CI – confidence interval

CIDI - Composite International Diagnostic Interview

DIS – Diagnostic Interview Schedule

DSM – the Diagnostic and Statistical Manual

DWECS – Danish Work Environment Cohort Study

ECA – Epidemiological Catchment Area Study

FD-Trygd – Forløpsdatabasen Trygd

GBD – global burden of disease

GDP – gross domestic product

GHQ – General Health Questionnaire

GP – general practitioner

HADS – Hospital Anxiety Depression Scale

HPL – Human Population Laboratory

HSCL – Hopkins Symptom Checklist

HUBRO – Oslo Health Study

HUNT – Nord-Trøndelag Health Study

HUSK – the Hordaland Health Study

HR – Hazard Ratio

ICD – International Classification of Disease

ICPC – International Classification of Primary Care

IPS – Individual Placement and Support

IW – Inclusive Work-life

MCS – Maastricht Cohort Study

MHI-5 – Mental Health Inventory

mmol/L – millimoles/Liter

NAV – the Norwegian Labour and Welfare Administration



NEMESIS – Netherlands Mental Health Survey and Incidence Study

OR – odds ratio

OECD - Organisation for Economic Co-operation and Development

PAF – population attributable fraction

RCT – randomized controlled trials

REK – Regional Ethical Committee West

RRR – relative risk ratio

SHUS - National Health Screening Service

UK - United Kingdom

US – United States

WHO – World Health Organisation

WHR – waist-hip ratio

## List of papers

- Paper 1: Knudsen, A.K., Harvey, S.B., Mykletun, A. & Øverland, S. "Common mental disorders and long-term sickness absence in a general working population. The Hordaland Health Study (HUSK)". Submitted to *Acta Psychiatrica Scandinavica*
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- Paper 3: Knudsen, A.K., Øverland, S., Hotopf, M. & Mykletun, A.: "Lost working years due to mental disorders: an analysis of the Norwegian disability pension registry." Submitted to *PLoS One*

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# 1. Background

The aim of the present PhD project was to examine the contribution of common mental disorders on sickness absence and ill health retirement in the general population. Utilizing epidemiological information from a large population-based health survey and data from the official Norwegian registries over sickness benefit and disability pension recipients, the present PhD project spans two research fields: psychiatric epidemiology and sickness absence research.

In the following section, I will introduce the research fields of psychiatric epidemiology and sickness absence research, with brief summaries of their historical background, areas of research interest, and derived knowledge. Further, the data utilised in the present PhD project is collected from a specific geographical area at a particular point in time, namely in Norway from the mid-1990s to the mid-2000s. Knowledge about the context of the data is essential to the reflection around relevance, validity and generalizability of the results from the present PhD project, and I will therefore describe of the historical and current organisation of the Norwegian Social Insurance Scheme.

Additional issues that are relevant for the context of the present PhD project will also be presented in the following section. This includes a short summary of the most important terminology used in the dissertation, and a discussion around categorical versus continuous approaches to the measurement of mental disorders. As the categorical approach to mental disorders is largely utilised in the present dissertation, it is important to recognise the limitations associated with this approach.

I will end the introductory section with a literature review of previous epidemiological studies on the relationship between common mental disorders and sickness absence and ill health retirement in the general population. Gaps in the knowledge base and how the aims of the present PhD project may contribute in filling these gaps will then be emphasized.

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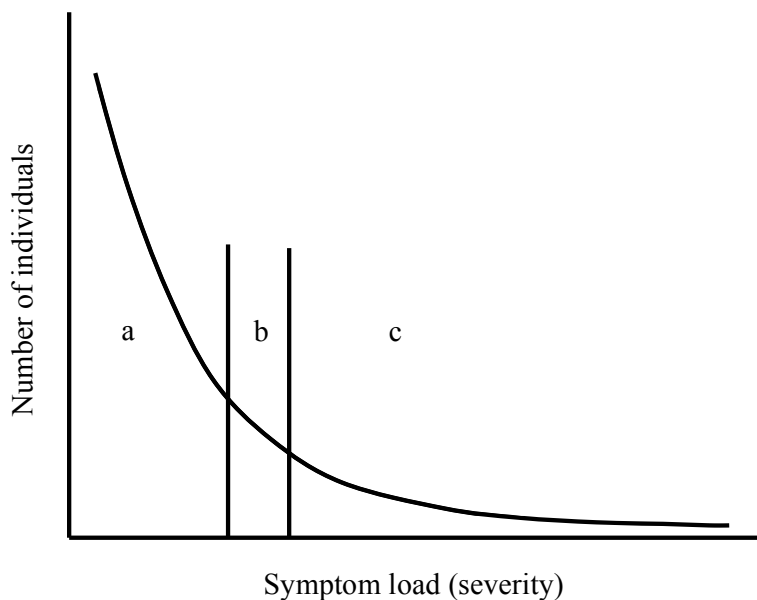
## *Terminology*

The use of terminology in psychiatric epidemiology and sickness absence research literature varies. In an attempt to avoid confusion in the present dissertation, the most important terms, with their definition and commonly used synonyms are detailed in Table A in Appendix A. "Mental health problems" will be used as a general term, describing both sub case-level and case-level mental health symptom loads in the population. "Severe mental disorders" will in the present context refer to mental disorders that are long-lasting and often have comprehensive functional impact, such as psychotic disorders, schizophrenia and severe cases of bipolar disorder. "Common mental disorders" will be used as a common term for both anxiety and depression, while the terms "anxiety" and "depression" refer to anxiety and depressive symptom loads crossing a predefined case-threshold, but not necessarily equivalent to the diagnostic categories of anxiety and depressive disorders as defined in diagnostic manuals. Further, "sub case-level symptom load" will in the current context be used for anxiety and depression symptom loads in the close area below a predefined case-threshold. "Medico-legal diagnoses" are the primary diagnoses for which sickness absence or disability benefits are awarded, stated on sick-leave notes or disability benefit applications handled by the social insurance bureaucracy. "Sickness absence" and "ill health retirement" refers to time-limited and permanent/chronic absence from work-life due to ill health before scheduled age retirement, respectively. "Ill health benefits" is a common term for the payment of official benefits that shall compensate income loss due to sickness absence or ill health retirement, while "disability pension" is an official benefit type in Norway, which shall compensate for permanent work-life exit before scheduled age-retirement due to work-impairments caused by ill health. As other western countries may have a less permanent arrangement, the term "disability benefits" will be used as a general term for benefits that shall compensate for long-lasting (more than 1 year) absence from work-life due to ill health.

## 1.1 Categorical versus continuous approaches to the measurement of mental health problems

In contrast to somatic health problems, mental health problems are primarily characterised by their impact on cognitive, emotional and interpersonal functioning. Mental health problems in the population may be described and measured both through continuous and categorical approaches. Several studies indicate that the distribution of mental health symptoms follows a continuum from none to high symptom load in the population (Figure 1) [1-4].

Figure 1. Distribution of mental health symptoms in the population



a=non-case symptom loads, b=sub case-level symptom loads, c=case-level symptom loads

Despite the continuous distribution of mental symptoms in the population, mental health problems are often defined as distinct categories. The most influential categorical approach to mental health problems is perhaps the classification of mental symptoms as specific mental disorders, which are given diagnostic labels such as major depression, panic disorder, generalized anxiety disorder or simple phobia. The categorisation of mental disorders in terms of diagnostic criteria is based on the



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presence and clustering of certain specific symptoms, and their duration [5, 6]. Some would also add that the symptom clusters should be followed by a behaviour that is distressing and dysfunctional for the individual, and is judged to be culturally deviant (in this context “behaviour” is understood in broadest sense, including emotions and cognitions) [6, 7].

Mental disorders can be measured with diagnostic interviews, such as the Diagnostic Interview Schedule (DIS) [8] and the Composite International Diagnostic Interview (CIDI) [9], and with short questionnaires and screening tools, like the General Health Questionnaire (GHQ) [10], the Hopkins Symptom Checklist (HSCL) [11] and the Hospital Anxiety and Depression Scale (HADS) [12]. Diagnostic criteria may be broadly or narrowly defined, and more or less operationalized, and differences in operationalization and inclusion of diagnostic criteria in different measure instruments may cause wide variation in prevalence estimates [13]. When broad criteria are used, both diffuse and less severe forms of the disorder may be defined among the cases. Narrow criteria, on the other hand, often exclude all but the most severe and clear cut cases [13]. Diagnostic interviews are usually more extensive and detailed than questionnaires, and are used to assess cases that satisfy diagnostic criteria in the population. In general, diagnostic interviews define mental disorders more narrowly than short questionnaires, which are largely used to screen for possible mental disorder cases in the population by measuring for instance anxiety and depression symptom loads.

Whilst continuous approaches may give insights into how consequences of mental disorders are distributed among individuals with low or high symptom loads, the categorical approach is useful because it makes it possible to count how many individuals in the population who fulfils the criteria for a mental disorder [13]. These *prevalence estimates* help identify the need for treatment and may guide where health service resources should be aimed. Categorisations also help introduce order in discussions of characteristics, causes and treatment of mental disorders [7].

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The categorical approach is however also associated with some important limitations. The categorisation of mental health symptoms into specific mental disorders is heavily affected by current knowledge status, the development of new treatments and political decisions on health care and resource management [14]. The classification of mental disorders into different diagnostic categories is largely defined in accordance with two influential diagnostic manuals: the Diagnostic and Statistical Manual (DSM), edited by the American Psychiatric Association (APA) [6], and the World Health Organisation's (WHO) International Classification of Diseases (ICD) [5]. Although great care and effort are being invested to ensure a well-defined diagnostic threshold of clinical and functional relevance, expert panels decide on the classification of mental disorders. Mental disorders are thus social constructs, with categorisation developed in the ongoing discourse.

The categorical approach to mental disorders also leads to different sets of symptoms being treated as different disorders. Individuals who display a range of different symptoms are thus defined as having comorbid disorders, rather than co-variation between groups of symptoms [3]. This may lead to an inaccurate understanding of the expression of symptoms [15].

Information about symptom loads not reaching predefined cut-offs may be missed when the categorical approach is used. The prevalence of mental health symptoms lying just below the threshold for a mental disorder case is higher than the prevalence of case-level symptoms (Figure 1). Many studies have demonstrated dose-response associations between mental disorders and functional impairment, rather than a sudden appearance of impairment when symptoms reach a certain threshold, although the dose-response association may not necessarily follow a linear pattern [2, 16, 17]. Compared with non-cases, individuals with sub case-level symptom loads may also have an increased risk for functional impairments [18, 19]. Due to the higher prevalence, sub case-level symptom loads may have equivalent or even higher impact on the public health compared with severe, but less prevalent symptom loads [20, 21].

## 1.2 Psychiatric epidemiology

Epidemiology is the study of distribution and determinants of health related states or events, including disease and ill health [22]. It is the key method in public health research, and helps guide policy decisions regarding interventions to improve the health of the population [23, 24]. Psychiatric epidemiology has developed from general epidemiology, and has shared areas of interest and methodology with general epidemiology. Research activity within psychiatric epidemiology focuses on the distribution, determinants and consequences of mental health problems in the population.

Sickness absence and ill health retirement are relevant phenomenon within psychiatric epidemiology because these are considered among the most severe and common consequences of mental disorders [25]. Further, mental disorders often develop in relatively young age compared with other common health problems, and occupational outcomes are thus of particular relevance for individuals with mental health problems. In the following I will briefly present the historical background of the development of psychiatric epidemiology as a research field, before the distribution of mental disorders in the population and some of the important consequences of these disorders are described.

### 1.2.1 Historical background

Epidemiology as a research field emerged in the Victorian age in England, with the development of systematic and quantitative attempts to describe patterns of disease in the population, and their relationship with environmental factors [24]. During the 20<sup>th</sup> century, social changes and public health interventions led to a rapid decrease in epidemics of infectious diseases. With this decrease, chronic diseases, including mental disorders, emerged as the leading causes of disability and mortality in the population. In contrast to infectious and communicable diseases, chronic diseases often have their exposures occurring years or even decades before the onset of the disease [24]. The impact of social status, lifestyle and health behaviours have in the last 50 years been increasingly recognised as factors heightening the risk of chronic

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diseases. These new public health challenges required a change in methodology employed in epidemiological research, and led to the development of methods such as case-control studies and historical and prospective cohort studies [24].

Psychiatric epidemiology originated and developed in concordance with this shift in public health challenges and epidemiological methods. The focus within psychiatric epidemiology has also gradually shifted from mere descriptive to analytical designs, contributing in the understanding of risk factors, characteristics and consequences of mental health problems in the population.

### **1.2.2 Distribution of common mental disorders in the population**

Mental disorders are among the most common health problems in the population. Studies examining the distribution of mental disorders have estimated that around half of the adult population will satisfy diagnostic criteria for at least one mental disorder during their life-time [26-29], while one in four will suffer from a mental disorder within a year [27-30]. Milder versions of mental disorders are shown to be much more prevalent than severe versions [30, 31]. The most common mental disorders are anxiety disorders (including specific phobias, agoraphobia, panic disorder and generalized anxiety disorder) and depressive disorders (including major depression and dysthymia), which will affect 20% to 25% of the population once or more during lifetime [26-28, 32]. The prevalence rates of common mental disorders are more than ten times higher than the prevalence rates for severe mental disorders like bipolar disorders or psychotic disorders, of which prevalence estimates are ranging from 0.4% to 3.4% [28, 33-36]. Anxiety and depressive disorders affects twice as many women compared to men [26, 28, 32, 37].

The prevalence of common mental disorders in the general workforce is lower than in the general population. Between 5% and 10% of active workers are estimated to be suffering from anxiety or depression [38-41]. The lower prevalence of common mental disorders in the workforce may be a result of the healthy worker survivor effect [42], or the harmful effects of worklessness on mental health [43-46].

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Compared with other prominent public health problems, mental disorders are as common as pain conditions [47, 48], and more prevalent than coronary-heart disease [49], diabetes [50] and cancer [51]. The latter are health problems that usually develop quite late in the life-span (age 55+) [50]. Mental disorders, in comparison, usually have their onset in relatively young age, and many individuals with a mental disorder will have had symptoms or illness episodes as early as in their childhood [52]. This early onset makes mental disorders particularly relevant for the working age population.

Many individuals with a mental disorder will experience comorbidity with other mental disorders [30, 53, 54], with pain conditions [55, 56] or with somatic disorders [57-59]. Comorbidity with depression or anxiety has been found to greatly increase the severity and functional outcomes of the other disorders [30, 39, 60]. For instance, comorbidity between chronic somatic diseases and depression has been found to greatly worsen health outcomes compared with a somatic disorder alone or comorbid somatic disorders without depression [56, 58]. Comorbidity is particularly common between anxiety and depression [3, 30, 53, 54, 61], and the joint effect of the conditions increases the risk of negative outcomes [30, 62, 63]. There are indications that anxiety and depression have shared etiology and genetic influence [54, 64, 65], and it has been argued that they are better understood as a common pattern of co-variation of symptoms, different expressions of a common internalising syndrome or as a general factor of mental distress rather than as separate disorders [61, 66-68].

### **1.2.3 Consequences of common mental disorders**

Common mental disorders are associated with a range of adverse consequences [69], and are estimated to cause higher burden on the health status of the population than severe mental disorders due to the combination of high prevalence, high negative impact on functioning, and early age of onset [58, 70-72]. In WHO's Global Burden of Disease (GBD) studies of the early 1990s, disability burden in terms of lost years with full health due to illness was calculated and compared for a range of disorders and diseases. Depression was then ranked fourth among the leading causes of disability

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burden worldwide [73], and has been estimated to be the second leading cause of disability burden worldwide by 2020 [74-76]. Anxiety was not included in the WHO estimates, but has similar prevalence rates as depression [26-28, 32] and is also associated with severe consequences [62, 77, 78] and significant impairment in perceived quality of life [79-81]. Both anxiety and depression are associated with considerable economic cost, both in terms of health care cost, non-medical cost and indirect cost (i.e. productivity loss for employer or lost tax income for the state due to nonparticipation in work-life), and anxiety more so than depression [72].

In addition to general functional impairment, lowered quality of life and high general economic cost, common mental disorders are also associated with a range of negative occupational outcomes, including sickness absence and ill health retirement. The association between common mental disorders and sickness absence and ill health retirement will be more thoroughly described in the literature review later in this section.

Employment rates among individuals with mental disorders are in general lower than for many other illnesses [82, 83], particularly among individuals with severe mental disorders like schizophrenia [84]. But also common mental disorders are associated with reduced work-life participation. On group level, individuals with a common mental disorder are 2-3 times more likely to be unemployed [85-88], and they have more unstable work histories, with frequent job turnover [87, 89] than symptom-free peers. Most individuals with a mental disorder want to work [83], and the high unemployment rate is probably not only a reflection of work-impairment caused by the mental disorder, but also discrimination in employment processes due to stigma [90, 91].

Absence from the work-life is not the only occupational challenge associated with common mental disorders. Discrimination against individuals with mental disorders in work contexts may be exhibited through omissions for promotion, micro-managing, over-attribution of mistakes to the disorder, gossip and subtle forms of social exclusion [90, 91]. Common mental disorders are further associated with lower productivity and

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work quality when at work (presenteeism) also among individuals with milder versions of these disorders [38, 39, 85, 87-89, 92, 93]. Common mental disorders may affect the ability to perform mental and interpersonal tasks, and the efficiency of time-management [87]. The costs of productivity loss due to common mental disorders have been found to exceed the costs associated with absenteeism and medical costs, counting for up to 70% of the total workplace expenditures associated with common mental disorders [92].

## 1.3 The Sickness Absence Research Field

### 1.3.1 Background

The sickness absence research field focus on causes and consequences of sickness absence, sickness presence and sickness certification practices [94]. Embedded in the sickness absence research field is also research on more permanent forms of sickness absence, such as ill health retirement. The sickness absence research field is relatively new, and developed as the result of a societal need; prescription of sickness absence is a common practice in health care across the western world, yet little is known about the consequences of this practice for the individual and the wider society and economy [95]. A dramatic increase in sickness absence rates since the second half of the 1980s has caused a major burden on official expenditures, which may have consequences for the design of the welfare state in the long run [94]. A large review of the current status of the sickness absence research field in 2004 concluded “*the field of research is underdeveloped in terms of theory, methodology, as well as concepts*” [95 p. 10]. Among the particular challenges that were identified were lack of standardisation of both terminology and outcome measures, lack of longitudinal studies, and failure to distinguish between causes of illness and causes of sickness absence. The latter is a problem because illness in itself does not necessarily cause sickness absence. Sickness absence is first eligible when the illness has caused *work-impairment*. Presence of work-impairment is often more difficult to determine than presence of illness [96-98].

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The high rates of sickness absence and ill health retirement are in sharp contrast to the fact that the health status of the population is better than ever. The discrepancy between objective measures of the public health and subjective reports of more symptoms, more feelings of general distress and increased disability has been viewed as a paradoxical consequence of medical progress since the late 1980s [99]. For the present issue, it is likely that causes of sickness absence and ill health retirement may be found also in factors beyond ill health.

### **1.3.2 Factors and models studied within sickness absence research**

There is increasing realisation that sickness absence is a complex phenomenon, in which different factors may be important in predicting onset of sickness absence, determine duration and recurrence of sickness absence, and operate as barriers of return to work. As an answer to the multi-causal nature of sickness absence and ill health retirement, sickness absence research is conducted within several disciplines, including medicine, sociology, psychology and economy. In some ways this is positive, as the variety in methods, theories and assumptions from different disciplines contributes to illuminate the complex phenomenon of sickness absence from several relevant angles. The challenge is that there is no unified theory underlying sickness absence research, and the choice of methods and research questions usually depends on the background discipline of the researcher [100]. This lack of a synthesis of knowledge may provide the risk that the researchers within the different disciplines get too submerged within their own approach, without considering alternative explanations. The sickness absence research field, with its focus on a societal challenge, would perhaps benefit from a more *transdisciplinary* approach [101], in which community actors and researchers from several relevant disciplines collaborated to develop a shared conceptual framework that integrates and extends discipline-based concepts, models and methods to address sickness absence.

Despite the heterogeneity within the sickness absence research field, some explanatory models have been suggested, such as models explaining sickness absence with job satisfaction [102], the absence culture at the work-place [103], moral hazard [100] or



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job strain [104]. Medical explanations of sickness absence and ill health retirement have also been extensively studied, with a focus on illness or disability as causes for sickness absence and ill health retirement.

On the other hand, sickness absence research conducted within economic disciplines have tended to be inspired by rational choice theory [105], where work-life exit is understood as a more or less conscious choice where the individual consider costs and benefits in search to maximize welfare and wellbeing [100]. Health in these models are often only included as covariates, and are considered as much less relevant than in the medical explanations [106, 107]. Rather, the focus often tends to be on the ratio between work salary and benefit compensation level, or opportunities or strains in the work-situation against more spare-time. Economic explanations are often seen in discourses where reduced benefit compensations are suggested as interventions to reduce sickness absence and ill health retirement rates.

Occasionally, ill health is the indisputable main cause of sickness absence, for instance in cases with infectious diseases, severe injuries or advanced stages of cancer. The most common medico-legal diagnoses within both long-term sickness absence and disability pensioning are however symptom-based disorders, such as musculoskeletal disorders and common mental disorders [108-116]. Work-impairment is often difficult to estimate in these disorders [96, 97], and factors beyond mere medical aspects may influence the decision on sickness absence or disability pension award, such as the psychosocial environment at the workplace [117-119], educational qualifications [120], type of occupation [121, 122] and the individuals general opportunities in the labour market [123, 124].

Many of these factors may influence on each other, and together increase or decrease the risk of sickness absence or ill health retirement. Individuals with health problems may face greater challenges in finding a new job in an already difficult job market, and lower levels of education or occupational skills often give less flexibility in job opportunities. Unemployment increase both physical and mental morbidity [43-45, 125-129], and may further increase the risk of ill health retirement. Lower socio-

economic status is associated with more stressors in general, such as financial problems, a poor housing situation, and relationship problems, which again may have negative influence on health. This may prolong the duration of sickness absence and increase the risk of recurrence [130]. On the other hand, the economic compensation in ill health benefits may approach the work income for persons with lower socio-economic status compared to persons with higher status, and increase the likelihood of short or long-term sickness absence. Individuals with lower socio-economic status may also be more likely to have jobs that are experienced as less satisfying or less important for the identity [131], which may further reduce the motivation to stay in work during periods with ill health [132-134].

It is not a one-to-one relationship between poor health and sickness absence and ill health retirement, and many individuals with even quite severe somatic or mental health problems manage to stay in work despite their symptoms [135]. It is thus likely that a range of factors have an impact on each decision of sickness absence or ill health retirement.

## 1.4 The Norwegian Social Insurance Scheme

The data utilized in the present PhD project are gathered in Norway in the period 1997 to 2004. Some background information about this context is important to understand the relevance, validity and generalizability of the results from the PhD project.

Sickness and disability benefits are important components of the Norwegian Social Insurance Scheme, which again is essential for Norway as a welfare state. In the following section I will present the historical background of the Norwegian Social Insurance Scheme, the organisation of the ill health benefit systems and changes and reforms in the Social Insurance Scheme before, during and after the period 1997 to 2004.

### 1.4.1 The background of the Norwegian Social Insurance Scheme

The Norwegian Social Insurance Scheme has its origin in the transition from an agricultural to an industrialised society during the 1800s, with changes in family

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structure, increased urbanisation and increased dependency on employment income rather than natural household [136]. Even in the 1800s there was great support in the population for introduction of social insurance schemes. In 1894 the first statute on accident insurance for factory workers was established. Several statutes followed in the coming years, and these were merged into one act in 1966: the National Insurance Act. The most important new aspect with this act was that the economic compensation should be of such a magnitude that the adapted living standard could be maintained [136]. The act of 1966 was replaced by an updated act in 1997 [137]. The National Insurance Act comprises the entire Norwegian population, and regulates benefits in almost every situation where economic compensation from the state is needed [136]. As a general rule, all persons who are either resident or working as employees in Norway are compulsorily insured and entitled to benefits [138]. Insured persons must contribute to the financing of the scheme, usually by income taxes.

#### **1.4.2 Benefits to compensate for lost income due to ill health**

Within the current Social Insurance Scheme, three types of benefits shall compensate for lost work income due to ill health; sickness benefits, work assessment allowance and disability benefits. Data regarding sickness benefits and disability pension are used in the analyses of the present dissertation as proxies for sickness absence (sickness benefits) and ill health retirement (disability pension). These two benefit types will be further described below. Work assessment allowance is a benefit paid to individuals who have had long-term sickness absence, and where the working capacity is assessed and return to work is tried, before a decision on disability pension award is made [139].

##### *Sickness benefits*

The most important amendments of the Norwegian sickness benefits regulations took place in 1977 [140], and the regulations have remained more or less unchanged since then [138]. To be entitled to sickness benefits the person must have been in occupational activity the four weeks prior to the sickness absence. This includes activities directed towards obtaining new work when unemployed. The worker may

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self-report being sick for a three day period, but needs a sick-leave note from his or her physician for sickness absence exceeding three days. The employer is responsible for the payment of sickness benefits in the first 16 days of the sickness absence period. Absence beyond the employer-period is compensated by the Social Insurance Scheme and limited to a total of 250 working days (52 weeks). Compared with similar countries, Norway is relatively unusual with 100% income compensation from day one of the sickness absence period [94, 141].

### *Disability benefits*

In contrast to sickness benefits, which are paid on a day-to-day basis, disability benefits are a more permanent compensation for lost work income. The purpose of disability benefits is to ensure income for individuals who have had their earning ability permanently reduced by  $\geq 50\%$  due to an illness, disease, injury, or disability accepted as a medical condition, and where there is little or no chance of improvement of the working capacity in the future. Disability benefits in Norway are comprised of basic benefit, attendance benefit, temporary disability benefit and disability pension. A basic benefit is granted if the disability involves significant extra expenses, and attendance benefit is granted if the disabled person needs special attention or nursing [138]. A disability benefit can be granted to individuals aged 18 to 66 (age 16 until January 1<sup>st</sup> 1998). Disability benefits may be awarded to individuals who have never been in paid work and to individuals who have had their earning ability reduced before the age of 18, for instance due to severe learning disabilities, autism spectrum disorders or injuries experienced during childhood. Disability benefits are, however, not to be given for social problems like unemployment. It is further a prerequisite that the individual has received trials of treatment and rehabilitation to improve the working capacity before a disability benefit is granted.

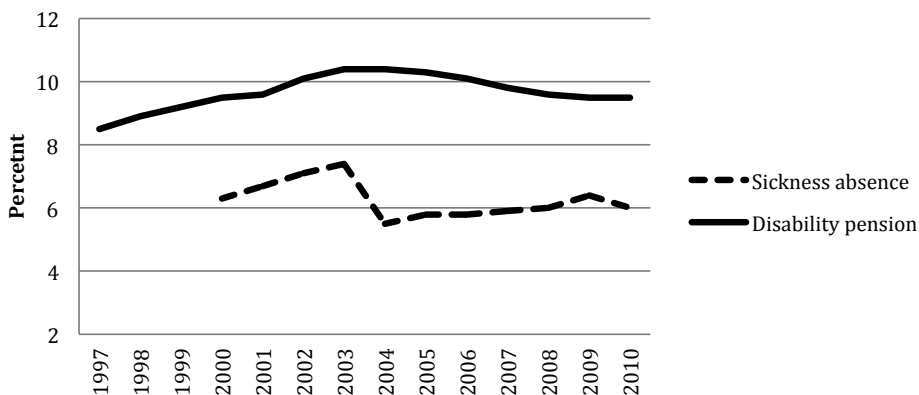
Disability pension consists of basic pension and a supplementary pension [142]. The size of the disability pension is dependent on previous income, supporting responsibilities (i.e. children or spouse who cannot support themselves), and years of active work participation. Disability pension may be granted for full or partial reduced working capacity. In case of partial disability the pension is reduced proportionally

[138]. Disability pension is paid until age 67, when the recipient is transferred to age-retirement pension.

### 1.4.3 Reforms and changes in the Social Insurance Scheme 1997 - 2012

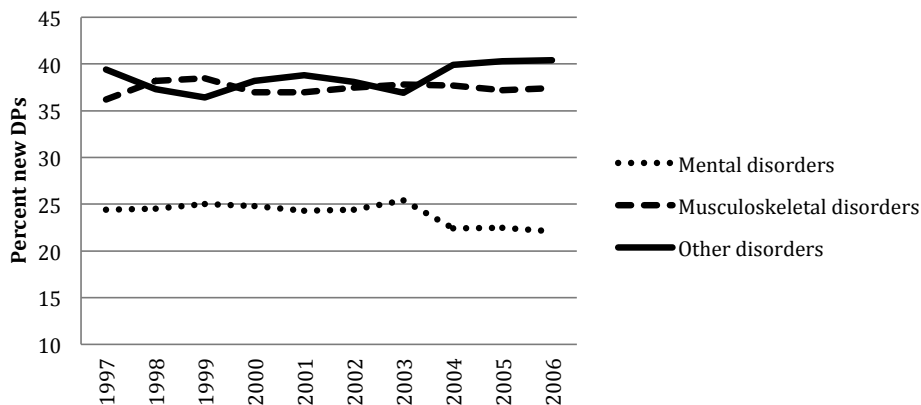
Both during and after the period (1997 to 2004) the present PhD project utilizes data from, there have been reforms and changes in the Social Insurance Scheme that have affected the inflow into sickness and disability benefits. The potential effect of these reforms and changes on the generalizability of the results from the present PhD project will be considered in the discussion section of the dissertation. The levels of sickness absence and ill health retirement compensation and the requirements to be entitled to sickness or disability benefits have remained unchanged from 1997 to today. Rates of sickness absence in the period 2000 to 2010 and rates of disability pension in the Norwegian working-age population in the period 1997 to 2010 are presented in Figure 2, while the distribution of new disability pensions by medico-legal diagnoses in the period 1997 to 2006 is presented in Figure 3.

Figure 2. Sickness absence<sup>1</sup> and disability pension rates in the Norwegian working-age population (age 16 to 67), 1997 to 2010<sup>2</sup>.



<sup>1</sup>Physician prescribed sickness absence. <sup>2</sup>Sources: Statistics Norway [143], NAV [144] and the Norwegian Institute of Public Health [145]

Figure 3. Distribution of new disability pension (DP) awards by medico-legal diagnosis. 1997 to 2006<sup>1</sup>.



<sup>1</sup>Source: The disability pension registry in FD-Trygd

### *Reforms and changes during the period 1997 – 2003*

The years 1997 to 2003 were characterised by a good economic and labour market situation in Norway, with low unemployment rates [146]. Rates of long-term sickness absence and disability benefits were however high compared with similar countries in the Organisation for Economic Co-operation and Development (OECD) area [146]. Few reforms were implemented in the Social Insurance Scheme in the period 1997 to 2004. In October 2001, the Norwegian Government and the major labour market partners signed the agreement on Inclusive Work-life (IW). The objectives of the agreement were to reduce sick leave, secure employment for persons with impaired working capacity and increase the average retirement age [147]. Enterprises that signed the IW agreement were entitled “IW enterprises”, and committed themselves to aim for the fulfilment of the agreement within the enterprise [147]. The IW agreement was renegotiated in January 2006 and March 2010.

### *Reforms and changes after 2004*

Since the turn of the year 2004 the Norwegian Government has introduced several major policy reforms to prevent and reduce long-term sickness absence and permanent work-life exit.

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Time-limited disability benefits were introduced in 2004 as an attempt to reduce the increasing ill health retirement rates. The target group was persons for whom there was great uncertainty regarding future working capacity and where return to work was regarded as a likely outcome, in particular persons with milder mental disorders and musculoskeletal disorders. The introduction of time-limited disability benefits affected the inflow of new disability pensions in the following years; resulting in a decrease in both total number of all-cause disability pension awards (Figure 2) and in number of awards for mental and musculoskeletal disorders (Figure 3). Despite this decrease, the introduction of the scheme was followed with a total increase in number of new disability benefit recipients [148]. Return to work was in many cases difficult to accomplish, and it was found that two-thirds of those who had been granted time-limited benefits were later transferred to permanent disability pension [148]. In 2010, medical rehabilitation allowance, occupational rehabilitation allowance and time-limited disability benefits were merged into a common scheme; work assessment allowance [139].

In July 2004, new procedures within sickness absence practice were introduced, with increased focus on activity and contact with the workplace during periods with sickness absence, in addition to increased and faster access to treatment and medical rehabilitation. Among these new procedures was a shift from full sickness absence to graded sickness absence as the primary rule [149, 150]. In 2006, the State Public Employment Service was merged with the National Insurance Administration into a new institution, the Norwegian Labour and Welfare Administration (NAV). The intention behind the creation of NAV was to provide coordinated services, with particular attention to activation strategies among individuals with long-term sickness absence.

### *The current situation*

Compared to other OECD countries, Norway is still ranked low on general unemployment, even in times of the global recession and economic crisis [151]. Work participation among women and older workers (55+) is relatively high, but not higher than in the other Nordic countries [152, 153]. The employment rate of disabled

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individuals in Norway is however estimated to be only 45%, a number in sharp contrast to the resources Norway has invested in vocational training and rehabilitation of disabled people [146]. Norway has on several occasions been criticized by OECD of the under-utilisation of the work-force with disabilities [86, 151].

Despite great effort to reduce the high sickness absence and disability pension rates, there has been little change in these from 2000 to 2010. In the last quarter of 2010, the sickness absence rate in the Norwegian working population was 6.0%, compared with 6.3% in 2000 (Figure 2). Rates of disability pension were 9.5% both last annual quarter in 2000 and in 2010 (Figure 2). These high sickness absence and disability pension rates results in enormous public expenditures due to benefit compensations. OECD countries spent on average 1.2% of their gross domestic product (GDP) on disability benefits in 2007 [82], but in Norway, these expenditures were more than twice as high [82]. In the National Budget, it was estimated that Norway would spend 37,5 billion NOK on sickness benefits and 58,7 billion NOK on disability benefits in 2012 [154].

## 1.5 Literature review

Sickness absence and ill health retirement rates have increased across the western world since the 1980s, and in line with these rates, more and more studies have investigating factors contributing to sickness absence and ill health retirement in the population. The majority of published studies within sickness absence research are originating from the northern part of the western world, in particular Sweden, Finland Norway, United Kingdom (UK), the Netherlands and the United States (US).

In concordance with the recognition of the adverse consequences of common mental disorders, increasing research activity has focused on the impact of common mental disorders on sickness absence and ill health retirement. Two main data sources have been employed in studies using epidemiological study designs. Medico-legal diagnostic information from sick-leave notes or disability benefit applications, recorded in large registries or databases, have been utilized in *record-based studies*,



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while large *health surveys* have gathered self-reported information from the general population or sub-groups of the population. Population-based health surveys give a “snapshot” of the health status of the population of interest at a given point in time, and this information can be linked with data on sickness absence or ill health retirement, assessed either simultaneously (*cross-sectional studies*) or in the future (*longitudinal studies*).

In the following sections I will summarise the current findings from the epidemiological literature of the impact of common mental disorders on sickness absence and ill health retirement, gained from record-based, cross-sectional and longitudinal studies. The summary will primarily focus on record-based and longitudinal studies examining these associations in the general population, but has been supplemented with studies based on specific occupational cohorts of a certain size, like the Whitehall studies from UK [17, 108] and studies on employees in the Dutch Post and Telecom [155, 156] or in the French national gas and electric company (the GAZEL study) [157]. These occupational cohorts have been included because the sample sizes, gender and age distributions, and range in socio-economic positions among the employees may resemble the general population. More details on the studies included in the following summary are given in Table B to Table G in Appendix A.

### **1.5.1 Record based studies**

Information about medico-legal diagnoses stated on sick-leave notes or disability benefit applications are in many western countries recorded in large official databases, or in company registries on health service or health insurance use among the employees. These records and registries are the main sources of official benefit statistics, and may also be used in epidemiological research.

The advantages of record-based studies are that they often covers whole populations or groups of populations, and that they are relatively cheap, as the data are already collected. The records are however scarce in information beyond mere receipt of a benefit, and potential confounders are rarely included in record-based studies [158].

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There are also important constraints on the validity of the medico-legal diagnostic information. Multiple diagnoses are usually contributing in a sickness absence or ill health retirement case, but the construction of the sick-leave notes or disability benefit applications forces the physician to choose one of the diagnoses as the primary diagnosis. Usually, only the primary diagnosis is recorded in sickness absence or disability benefit registries. Several factors may influence the decision on primary medico-legal diagnosis, and there are important indications of common mental disorders being underutilised as primary diagnoses in sickness absence and disability benefit contexts. For instance are common mental disorders often not detected by the physician [159-161], particularly when they co-occur with somatic symptoms or disorders [56, 159, 162]. The physician may also be reluctant to use a mental disorder as primary diagnosis due to stigma, perhaps in particular when the patient strongly disagree with the condition being a mental disorder [159, 162].

The results from record-based studies will thus illustrate only one aspect of the relationships between common mental disorders and sickness absence and ill health retirement, namely how this looks among individuals who seek medical help and are recognized sufferers of common mental disorders. These limitations are important to bear in mind when the findings from record-based studies examining the contribution from mental disorders on sickness absence and ill health retirement are described below.

Due to large differences in benefit practices, it is difficult to compare incidence and prevalence rates of sickness absence and ill health retirement across countries. A general trend, found both in Norway, the Netherlands, Sweden and UK, is that increasing rates of sickness absence and ill health retirement are ascribed to a mental disorder diagnosis [109, 114, 163-168]. Mental disorders, in particular anxiety and depression, are now among the most commonly used medico-legal diagnoses both on sick-leave notes and in disability benefit applications [108-116]. Mental disorders account for around 35% of all disability benefits across the OECD area, [169]. The increase in the use of mental disorder diagnoses seems to coincide with a decrease in the use of musculoskeletal diagnoses, and in some countries, such as UK, mental

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disorders have overtaken for musculoskeletal disorders as the most prevalent diagnosis for disability benefit claims [166, 170]. In Norway, however, musculoskeletal disorders is still the largest diagnostic group, accounting for 36.2% of the sickness absence cases in second annual quarter in 2011 [171] and 30.1% of the disability pensions awarded in 2009 [172]. Mental disorders is the second largest group, stated as diagnosis in 15.3% of the sickness absence cases [171] and in 22.7% of new disability pension awards [172].

The cross-national trend of increased rates of mental disorders with a corresponding decrease rates of musculoskeletal disorders within benefit statistics is probably more a reflection of changes in diagnostic practice than a general increase in the prevalence of mental disorder in the population [68, 165, 170, 173]. Changes in working conditions, with greater intensification of work and increased cognitive and social demands in many occupations [86], improved management of musculoskeletal disorders [166, 170], and changes in health beliefs and expectations [166, 170], in addition to lowered threshold for granting of sickness absence and ill health retirement on mental health grounds [165] are also suggested as explanations for the increased use of medico-legal mental disorder diagnoses.

Compared to sickness absence ascribed to other diagnoses, sickness absences due to common mental disorders are in general found to have longer duration [108, 110, 112, 115, 174]. In Norway, the median duration of sickness absence due a mental disorder was found to be 79 days [115]. Many sickness absence episodes due to mental disorders becomes chronic [115], and 1 of 4 workers with sickness absence due to depressive symptoms have not returned to work within 12 months [112, 174]. Long duration and frequent recurrence of sickness absence are predictors of subsequent work life exit [175, 176], and a large group with sickness absence due to a common mental disorder leaves the work life through ill health retirement [115, 116, 157, 177-180]. High recurrence of sickness absence has also been linked with mental disorders, both among workers in the Dutch Post and Telecom [155, 156] and among employees in the financial/insurance sector in Canada [112].

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Gender and age differences have also been examined in record-based studies, with mixed findings. For instance are higher incidence, recurrence and duration of sickness absence ascribed to mental disorders found among women in some studies [113, 115, 116, 156, 179, 181], while other studies showed longer duration of the absence [113, 181] and higher risk of ending up with ill health retirement among men [116, 157, 175, 178-180, 182].

Mental disorders are the most common diagnoses stated on disability benefit applications in the youngest age-group (below age 30) [82, 168], and disability benefits with a diagnosis of a mental disorder are generally awarded at a younger age than disability benefits for other diagnoses [82]. It is however unclear whether early ill health retirement applies only to specific mental disorders, for instance disorders with onset in very young age such as mental retardation or developmental disorders, or to very severe mental disorders, like schizophrenia; or if disability benefits for common mental disorders are also awarded at a younger age compared with other diagnoses.

### **1.5.2 Cross-sectional studies**

Population-based health surveys can complement and expand the knowledge gained from record-based studies, as the independent measures of exposures and outcomes reduces the biases that affects the validity of medico-legal diagnostic information in clinical contexts. Epidemiological studies employing a cross-sectional design are useful to investigate whether or not there exist an association between common mental disorders and sickness absence and ill health retirement, independent on whether the presence of the disorder is recognised by a physician. A major limitation with cross-sectional studies is, however, that the defined exposure is measured at the same time as the defined outcome. It is thus not possible to determine the temporal sequence between the variables. This is an important challenge in the current context, as it is likely that long-term sickness absence and ill health retirement can cause heightened levels of anxiety and depressive symptoms.

Despite this important limitation, numerous cross-sectional studies have examined the relationship between common mental disorders and sickness absence [39, 80, 183-

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195]. Cross-sectional studies examining the relationship between common mental disorders and ill health retirement are, in comparison, scarce.

Up to three times more sickness absence days has been found among individuals with common mental disorders compared to individuals without these disorders [39, 80, 183-192]. Higher prevalence of common mental disorders is further found among sickness absentees compared to the general population [193-195]. Common mental disorders have been found to account for more sickness absence days than many, relatively severe, somatic diseases [80, 188, 190]. For instance have data from the United States shown that anxiety and depressive disorders were associated with more absence days than ulcers, autoimmune disease and arthrititis [188].

Some cross-sectional studies have indicated that the relationship between common mental disorders and sickness absence follow a dose-response pattern, where higher mental symptom load is correlated with more sickness absence [183, 184]. However, milder mental health problems, such as worries, are also found to be related to increased sickness absence [189]. As for other functional and medical outcomes, comorbidity with other mental or somatic disorders, or with pain conditions seemingly strengthens the association between common mental disorders and sickness absence [39, 80, 185, 189, 190, 194].

### **1.5.3 Longitudinal studies**

In order to prevent and reduce sickness absence and ill health retirement, knowledge about predicting factors are essential. Findings from cross-sectional studies have indicated that there is an important relationship between common mental disorders and sickness absence. These findings needs to be supplemented with knowledge from longitudinal studies, examining whether common mental disorders are risk factors in predicting later sickness absence and ill health retirement. To date, only a few studies based on the general population have investigated the temporal relationship between common mental disorders and sickness absence, and even fewer have examined common mental disorders as risk factors for ill health retirement. These studies are of

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particular relevance for the present PhD project, and I will therefore give a relatively detailed summary of these studies below.

One of the earliest studies to examine longitudinal associations between common mental disorders and sickness absence is from the Epidemiological Catchment Area (ECA) Study in North Carolina, US in the 1980s. Individuals with depressive disorders, assessed with DIS, self-reported presence of all-cause sickness absence (meaning sickness absence due to all medico-legal diagnoses) one year after initial assessments. Individuals with major depression were found to be more than three times more likely to report sickness absence during follow-up, however, the adjusted result was not statistically significant (odds ratio (OR) with 95% confidence interval (CI): 3.15 (0.77-12.82)). Neither dysthymia nor minor depression were found to predict sickness absence in this study [20]. Ten years later, the first waves of the Netherlands Mental Health Survey and Incidence Study (NEMESIS) also assessed common mental disorders using a diagnostic interview (CIDI), with one year follow-up of self-reported all-cause sickness absence. In this study, significant associations between common mental disorders and sickness absence were only found among men, with all depressive disorders being significant predictors of future sickness absence (OR: 1.72 (95% CI: 1.20-2.48)). Of the anxiety disorders, only simple phobia was significantly associated with future sickness absence (OR (95% CI): 2.01 (1.22-3.32)) [40].

The remaining longitudinal studies have employed screening questionnaires to assess common mental disorders. In Maastricht Cohort Study (MCS), also from the Netherlands, depressive symptoms was measured with HADS [193], whilst general mental distress was measured with GHQ [196]. Mental health information was later linked with information on all-cause sickness absence from official records. Mental distress increased the risk of sickness absence during 18 months follow-up both for men (relative risk: 1.33, 95% CI: 1.21-1.46) and women (relative risk: 1.45 (95% CI 1.23-1.72)) [196]. Controlling for fatigue reduced the associations, particularly for women [196]. In Danish Work Environment Cohort Study (DWECS) depressive symptoms were measured with Mental Health Inventory (MHI-5) and linked with

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official registries on all-cause sickness absence lasting 8 weeks or more up to 78 weeks after baseline. Fully adjusted, severe depressive symptoms were risk factors for sickness absence both among men (hazard ratios (HR): 2.69 (95% CI: 1.18-6.12)) and women (HR: 2.27, 95% CI: 1.25-4.11) [16]. Mental distress was in Oslo Health Study (HUBRO) measured with HSCL and linked with official records on presence of sickness absence (> 8 weeks) with a medico-legal diagnosis of mental disorder up to 5 years later [197]. Even after adjusting for covariates, mental distress more than doubled the risk for sickness absence both among men (HR: 2.7, 95% CI: 1.7-4.3) and women (HR: 2.2, 95% CI: 1.7-3.0) [197]. In the longitudinal Whitehall II Study in UK, common mental disorders among civil servants were measured in two phases using GHQ, and later linked with civil service records of sickness absence, including medico-legal diagnosis, giving 8 years follow-up. After adjusting for covariates, the authors found that case-level common mental disorders predicted sickness absence diagnosed with a mental disorder among men (rate ratios: 1.67 (95% CI: 1.13-2.46), but not sickness absence diagnosed with a non-mental disorder (rate ratios: 1.07, 95% CI: 0.92-1.25) [17]. The fully adjusted risk for all-cause sickness absence was borderline significant, with rate ratios: 1.19 (1.03-1.37)). Having a recent common mental disorder, or having common mental disorder on both phase 1 and phase 2 increased the risk of sickness absence during follow-up [17].

Most of the longitudinal studies described above have controlled for a quite extensive list of potential confounders. All studies have included information on age and some measure of general health or somatic illness [16, 17, 20, 40, 193, 196, 197]. Most studies have in addition controlled for socio-demographic factors, for instance marital/cohabitation status and children living at home, race and living area [16, 17, 20, 193, 196] and socio-economic factors (i.e. education, employment grade, material problems) [17, 20, 193, 196, 197]. Four studies included health related behaviours, like physical activity, alcohol consumption and smoking [16, 17, 20, 197], while mental health issues, such as stressful life events and comorbid mental disorder, was included in one study [20]. Three studies also included information about work characteristics (shift work, job control, job security, social support) [17, 193, 197].

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Dose-response associations between symptoms of common mental disorders and sickness absence are seemingly also operating prospectively [16, 17, 193]. In the Whitehall II Study, case-level, but not sub case-level common mental disorder was associated with subsequent sickness absence, while risk of sickness absence in DWECS was primarily evident among individuals within the highest quartile of depressive symptom severity [16]. In the MCS study, increasing levels of depressive complaints reduced the time to onset and increased the duration of first sickness absence episode after baseline [193]. Higher levels of depressive complaints were also associated with more sickness absence days [193].

Gender stratified analyses of the association between common mental disorders and sickness absence have been employed in several studies [16, 17, 40, 193, 196, 197]. In the Whitehall II Study and NEMESIS studies, significant associations between common mental disorders and sickness absence was found only among men [17, 40], while depressive symptoms increased the risk for sickness absence more among men than among women in DWECS [16]. In contrast, MCS found stronger effects between mental distress and depressive complaints and sickness absence for women compared with men [193, 196]. No gender differences were found in HUBRO [197].

In summary, in general do longitudinal studies find that common mental disorders are risk factors for all-cause sickness absence [16, 17, 20, 40, 193, 196, 197], although one study only observed a statistically non-significant tendency of such a relationship [20]. Two studies further demonstrated significant associations only for sickness absence diagnosed with a mental disorder [17, 197]. There are some indications of a dose-response association where increasing symptom severity corresponds with increased risk for sickness absence [16, 17, 193]. The effects of common mental disorders may also be somewhat different for men compared with women [16, 17, 40, 193, 196, 197]. Other aspects of the sickness absence phenomenon, such as duration, recurrence and total number of sickness absence days during follow-up have only been examined in one study, indicating shorter time to first sickness absence episode, longer duration of this and more sickness absence days among those with higher depressive symptom-loads [193].



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Only four studies had examined the longitudinal relationship between common mental disorders and ill health retirement in the general population [62, 198-200] prior to the present PhD project, one of them including middle-aged men only [199].

Information from ECA has been used to also examine the relationship between mental disorders and transfer to disability benefits one year later. Among the common mental disorders assessed in ECA, only panic disorder was significantly associated with self-reported ill health retirement (OR: 5.2, 95% CI: 2.10-12.77) [198]. In a Finnish cohort of middle-aged men depression symptom load was measured with Human Population Laboratory (HPL) and linked with official disability pension records. In this study, men in the highest third of depression symptom loads had increased risk for disability pensions awarded both for mental disorders (adjusted relative risk: 2.74, 95% CI: 1.68-4.46), chronic somatic diseases (adjusted relative risk: 1.68, 95% CI: 1.05-2.71) and cardiovascular diseases (adjusted relative risk: 1.61, 95% CI: 1.12-2.32) [199]. In the second wave of the Nord Trøndelag Health Study (HUNT-2) in Norway, information on common mental disorders, measured with HADS, was linked with official registries on disability pension award, including medico-legal diagnosis, 6 to 30 months after participation. Adjusted for potential confounders, common mental disorders were identified risk factors for disability pension award (anxiety only: OR: 1.52 (95% CI 1.25-1.84), depression only: OR: 1.60 (95% CI 1.25-2.05), comorbid anxiety and depression: OR: 2.41 (95% CI 1.99-2.93)) [62]. Common mental disorders were also found to be risk factors also for disability pensions awarded for non-mental diagnoses [62]. Finally, longitudinal associations between severe depressive symptoms and all-cause disability pension award during 10 year follow-up was demonstrated in DWECES (adjusted HR: 2.38, 95% CI: 1.22-4.66) [200]. Most of the covariates included in the previously mentioned longitudinal sickness absence studies were also included in the longitudinal ill health retirement studies.

Gender differences have not been specifically examined in regard to mental disorders and disability pension, but there seems to be some age effects. One study found that middle aged men with high depressive symptom loads received disability pension award on average 1.5 years earlier than non-depressed men [199]. Stronger

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associations between common mental disorders and disability pension among younger (20-44) compared to older individuals (45-66) was also showed in one study [62].

#### **1.5.4 Gaps in the knowledge of the impact of common mental disorders on sickness absence and ill health retirement**

To prevent ill health retirement and promote successful return to work for persons who have been outside work-life for shorter or longer periods due to ill health, knowledge about causes and mechanisms underlying sickness absence and ill health retirement is essential. The association between common mental disorders, sickness absence and ill health retirement have been examined in numerous record-based and cross-sectional studies. The list of longitudinal studies investigating these relationships is however short, and there are many important gaps in the knowledge base.

First, the majority of previous studies are either based on i) diagnostic information from sickness absence or disability benefits registries, where the validity of diagnoses is uncertain; or ii) on data from cross-sectional studies, in which inferences about temporality of exposure and outcome cannot be drawn. Among the few longitudinal studies examining the role of common mental disorders as risk factors for sickness absence, only six were conducted on the general population [16, 20, 40, 193, 196, 197], with only one of these employing a follow-up period exceeding 18 months [197]. Prior to the present PhD project, only three longitudinal studies had investigated the role of common mental disorders as risk factors for ill health retirement among both genders in the general population [62, 198, 200]. Thus, knowledge on whether common mental disorders are risk factors for all cause sickness absence and ill health retirement in the general population is still scarce. Due to the short follow-up employed in most of the studies, it is also uncertain how prolonged the effect common mental disorders on sickness absence and ill health retirement is.

Second, findings from record-based and cross-sectional studies have indicated that common mental disorders are associated with longer duration and frequent recurrence of sickness absence [108, 110, 112, 115, 155, 156, 174]. Duration of first sickness absence episode is relevant as longer episodes are found to be more strongly

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associated with chronic ill health, in particularly musculoskeletal and mental disorders [201], than shorter episodes, which seems to be more affected by work satisfaction or infectious diseases [185, 201, 202]. Further, longer duration and frequent recurrence of sickness absence also increase the risk of permanent work-life exit through ill health retirement [176, 180, 203]. To avoid the biases inherent in record-based studies (i.e. differences in sick-leave practice when the physician recognise a common mental disorder) and cross-sectional studies (i.e. increased level of mental symptom loads due to the strain associated with lasting and recurrent absence from work), longitudinal evidence of the potential associations between common mental disorders and lasting and recurrent sickness absence is needed.

Third, sub case-level anxiety and depression symptom loads may also contribute to reduced working capacity. Due to higher prevalence, sub case-level symptom loads may have similar or even higher impact on the public health compared with case-level symptom loads [20]. Longitudinal studies have examined the association between different symptom loads of common mental disorders and sickness absence, demonstrating dose-response associations [16, 17, 193], but the contribution from sub case-level common mental disorders on ill health retirement is not known.

Fourth, knowledge on which types of mental disorders that are associated with early ill health retirement is important for several reasons. Number of lost working years in the diagnostic groups is dependent both on age at disability benefit award and prevalence of the diagnostic group within the disability benefit statistics. It is likely that a disability benefit is awarded at a younger age for severe mental disorders, such as mental retardation, developmental disorders or psychotic disorders, than for common mental disorders. On the other hand, many more individuals are awarded disability benefits for a common mental disorder than for a severe mental disorder or developmental disorder. Knowledge about age differences among disability benefit recipients for mental disorders is also important because it is likely that the prognosis for prevention of ill health retirement in young age is better for common mental disorders than for severe mental disorders. Age at disability benefit award may thus expand the understanding of the impact of a specific disorder on ill health retirement

in the population, and be a valuable correction of mere prevalence estimates from official benefit statistics. It is not known whether it is the severe or the common mental disorders that cause the highest number of lost working years in the population.

Finally, compared to depression, little attention has been given to anxiety as a risk factor for sickness absence or ill health retirement. The prevalence rates of anxiety and depression are comparable [26-28, 32], and anxiety shares many of the adverse consequences associated with depression [62, 77, 78]. Anxiety and depression frequently co-occur, and the joint effect of these two have been shown to have more adverse consequences than when they appear alone [30, 62, 63]. Previous studies only focusing on depression may have underestimated the effect of common mental disorders on sickness absence and ill health retirement. A specific examination the prospective effects of depression, anxiety and a combination of the two on sickness absence and ill health retirement may increase our understanding of the relationship between these outcomes and common mental disorders.

## 1.6 Aims of the PhD project

Based on the gaps described above, the overall aim of the present PhD project was to focus on prospective relationships and lost working years in the examination of the associations between common mental disorders and sickness absence and ill health retirement in the general population. The specific aims for each paper in the project were the following:

In Paper 1, the aim was to examine the prospective associations between both anxiety and depression and long-term sickness absence. Specifically, we wanted to examine whether anxiety and depression were risk factors for very long duration and frequent recurrence of sickness absence. We also aimed to examine whether or not a prospective effect of anxiety and depression was evident on sickness absence occurring several years after study participation.

In Paper 2, the aim was to examine the prospective associations between anxiety and depression and both all-cause disability pension award and disability pension award

for non-mental medico-legal diagnoses. Finally, we aimed to examine and compare the relative contribution of sub case-level and case-level anxiety and depression symptom loads on disability pension awards in the population.

In Paper 3, we aimed to quantify and compare lost working years due to disability pension award for different medico-legal diagnostic groups. We further wanted to investigate which classes within mental disorders that were causing the highest number of lost working years.

## 2. MATERIALS AND METHODS

In the following section, the materials and methods employed in the three papers of the PhD project will be presented, with an overview given in Table H in Appendix A.

### 2.1 Study designs

Epidemiological study designs may be observational or experimental [158], and the observational study design is employed in the present PhD project. Observational studies can further be descriptive, giving figures for incidence or prevalence of health-related states or exposures, or analytic in which associations between exposures and outcomes are investigated [158]. As described in the literature review above, epidemiological studies may use routinely collected data, such as databases on official payments of ill health benefits, which are often used in record based studies. In the present PhD project, both individual data from a population-based health survey and routinely collected data have been utilized to examine both descriptive and analytical aims. In the following, I will give a presentation of the study design being employed in Paper 1 and Paper 2; the cohort design, in addition to a presentation of descriptive studies based on routinely collected data, as used in Paper 3.

#### *The Cohort Study Design*

The two essential features of the cohort study are i) participants are defined by their exposure status, and ii) it has a longitudinal design, often with substantial length of follow-up [158]. In the *population cohort study*, the selection of participants are based on convenience or circumstance [158, 204], in the present context all inhabitants within a certain age span living in one county of western Norway. Population cohort studies are expensive and extensive studies, and it is customary to collect data from several areas of interest. Among the advantages of the population cohort study are that the results may be broadly generalizable [158], and that the longitudinal design can establish the temporal sequence between exposure and outcome, usually with minimal information bias [204]. They also provide the possibility of direct estimation of outcome incidence rates among the exposed individuals [204], and some of the

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potential confounders in the associations of interest may be controlled for at baseline due to the extensive data-collection. The disadvantages of cohort studies are that they are time-consuming and expensive. They are also vulnerable to factors affecting the associations during follow-up [204]. Further, selection bias due to nonparticipation or loss to follow-up (attrition) is a particular important challenge in cohort studies.

### *Routinely collected data*

Routinely collected data, such as medico-legal diagnostic information from disability pension applications, may be used in descriptive epidemiological studies. Routinely collected data from official ill health benefit registries were employed in all three papers of the present dissertation. Such registries are primarily established to ensure control over public expenditures, and are reliable in terms of who are receiving a specific benefit at a given point in time. The registries are however scarce in information beyond mere receipt of a benefit, which gives important constraints with regard to the inclusion of potential confounders [158].

## **2.2 The Hordaland Health Study (HUSK)**

The Hordaland Health Study (HUSK) was an epidemiological population-based health study conducted from 1997 to 1999 in Hordaland County in western Norway. The study was a collaboration between the National Health Screening Service (SHUS), the University of Bergen and local health services.

The study population of HUSK included all persons born between 1953 and 1957, aged 40 to 46 years at the time of the health study, who were living in Hordaland County (N=29,400). The study also included 2,291 men and 2,558 women born in 1950-51, and 1,868 men and 2,470 women born in 1925-27, who had participated in an earlier study in 1992-93. In Paper 1 and Paper 2 of the present dissertation, only the individuals born in 1953-57 were included. A total of 8,598 men (57.0%) and 9,983 (70.0%) women from this population participated in HUSK, giving an overall participation rate of 63.1% (n=18,565). Nonparticipants were more likely to receive

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disability pension, both at baseline and after HUSK, in particular for mental disorders [205].

A personal invitation to attend clinical examinations was sent to all potential participants by mail. The examination premises were established in close proximity of the potential participant's homes. One reminder was sent to persons who did not visit the examination premises within three weeks after the invitation was sent, and to those who did not return the questionnaires they received at the physical examination. The data were collected both via physical examination at the HUSK premises and by a battery of self-administered questionnaires. The questionnaires were organised in two main questionnaires, where questionnaire 1 was sent to the individuals together with the personal invitation for participation, and questionnaire 2 was given to the participants when they met at the examination premises. When questionnaire 2 was completed, the participant was responsible of sending the questionnaire to the HUSK project centre for registration. Among the 18,565 participants, 87.1% responded on questionnaire 2. The physical examination consisted of physiological measures and blood sample collections, including height, weight, waist and hip circumference, blood pressure, heart rate and non-fasting cholesterol. The questionnaires assessed health-related variables such as health behaviours, mental health and psychosocial factors, working conditions, medication use, pain and musculoskeletal symptoms, somatic symptoms and somatic conditions. All the participants received written feedback on the results of their health examination. If some of the results revealed physical values of concern, i.e. previously unknown high blood pressure, the participant was recommended to contact the primary health services. SHUS could also facilitate this contact, if so desired by the participant.

Data from HUSK was utilized in Paper 1 and Paper 2 in the present dissertation, in linkage with information from the Norwegian official registries on sickness and disability benefits. The linkage was applicable through the participants' personal identification number, issued to all Norwegians at birth or when Norwegian state citizenship is granted for immigrants. The linkage was done by Statistics Norway.



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## 2.3 Measurements of common mental disorders – the Hospital Anxiety and Depression Scale (HADS)

Common mental disorders (anxiety and depression) were in Paper 1 and Paper 2 measured using the Hospital Anxiety and Depression Scale (HADS), which was included in the second HUSK questionnaire. HADS is a screening instrument developed to identify cases of anxiety and depression in non-psychiatric hospital settings [12]. Somatic symptoms, such as musculoskeletal and abdominal pain, dizziness and headaches, sleep problems, fatigue and lack of energy are common both among patients with anxiety and depression and among patients with physical illnesses, and when the scale was developed, care was taken to avoid identification of false-negative cases of anxiety and depression in the presence of a physical illness [12]. Thus, HADS measures only emotional and cognitive symptoms of anxiety and depression.

HADS was developed to consist of two subscales, assessing symptoms of anxiety (HADS-A) and symptoms of depression (HADS-D), with seven items on each scale (the HADS items are presented in Table I in Appendix A). The brevity of the HADS scale makes it a convenient, fast and easy-to-use screening tool for anxiety and depression in several settings. The items are rated on a 4 point scale from 0 to 3, which gives scores in the range from 0 to 21 on each subscale. The originally recommended cut-off for a possible case of anxiety or depression was a score of 8 on each subscale [12]. A literature review from 2002 examining the validity of the HADS, summarised that most studies demonstrated a two-factor solution that had good concordance with the original suggested HADS-A and HADS-D subscales [206]. HADS has shown good case-finding properties, and using score 8 as a cut-off on the subscales has been found to give sensitivity and specificity in the range 0.70 to 0.90 [206]. The ability of HADS to separate between anxiety and depression as different constructs has been confirmed in hospital settings [12], in the general population [207] and in the general working population [41]. HADS scores may however also be employed as continuous measures, and factor structures other than the conventional two-factor structure have been employed in studies examining the latent structure of the HADS [206, 208].

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In Paper 1 and Paper 2 of the present dissertation the score on each of the HADS subscales was used to identify four mutually exclusive groups: i) reference group (score <8 on both HADS-A and HADS-D), ii) anxiety only (score  $\geq 8$  on HADS-A, score <8 on HADS-D), iii) depression only (score  $\geq 8$  on HADS-D, score <8 on HADS-A) and iv) comorbid anxiety and depression (score  $\geq 8$  on both HADS-A and HADS-D). The latter group was included due to the high co-occurrence of anxiety and depression [3, 30, 53, 54, 61], and because the combined effect of the two on sickness absence and disability pension award may differ from the effect of either condition alone [30, 62, 63].

The HADS-A and HADS-D subscales scores were also used as ordinal variables to examine dose-response associations between increasing symptom loads and ill health retirement in Paper 2. Categories indicating symptom severity based on the subscale scores were computed (range of subscale scores in parentheses): reference (0-4), sub case-level (5-7), mild case-level (8-10), moderate case-level (11-14) and severe case-level (15-21). The cut-offs 8 and 11 were characterised in the Zigmond and Snaith original HADS paper as indicators of “possible case” and “probable case” respectively [12]. The additional cut-offs are not validated, but were defined to reflect increasing severity indicated by increasing HADS scores. This operationalization of HADS scores has also been used in a previous publication [209].

## 2.3 The Norwegian Social Insurance Administration Registries (FD-Trygd)

Payment of sickness absence exceeding 16 days and of disability benefits is a governmental responsibility in Norway, and all payments of ill health benefits are accurately recorded in the Norwegian Social Insurance Database, Forløpsdatabasen Trygd (FD-Trygd). The registry is complete for the Norwegian population and is continuously updated. FD-Trygd was established in 2000, but contains information about official payment of benefits from 1992 and onwards. The data in the registries includes type of benefit, degree of compensation, start and end date of benefit reciprocity and medico-legal diagnosis. The data sources for FD-Trygd are

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administrative registries from Statistics Norway, NAV and the former State Public Employment Service (Rikstrygdeverket and Arbeidsmarkedetsetaten). The registries are administered by Statistics Norway.

### **2.3.1 Information from the sickness benefit registry**

In Paper 1, information from the sickness benefit registry in FD-Trygd was used as a proxy measure for information about sickness absence episodes up to 6.2 years after HUSK participation (baseline). The choice of sickness absence outcomes measured in Paper 1 was partly in accordance with previously suggested sickness absence measures, with adaptations to the specific characteristics of the Norwegian sickness benefit registry. Hensing and colleagues have suggested the use of five basic measures to assess different aspects of sickness absence; frequency, length, incidence rate, cumulative incidence and duration [201]. Of these, three measures; cumulative incidence, duration and frequency, were employed in Paper 1. *Cumulative incidence* in the present context measures the risk of experiencing sickness absence during a specific time-period in a specific population, and was defined in the HUSK sample as risk until first sickness absence episode after baseline. *Duration* of first sickness absence episode was categorised into three mutually exclusive groups: 17 to 56 days, 57 to 90 days and >90 days. The duration spans were chosen to align with both policy requirements and previously used cut offs: Within the Norwegian system, a more detailed medical examination is required after 56 days (8 weeks) to assess whether the person is still in need of sickness absence, while >90 days of sickness absence has previously been used as a measure of very long sickness absence episodes [179, 181]. Individuals with no end-date on their sickness absence episode (n=721) were excluded from the duration analysis. *Frequency* was measured as number of sickness absence episodes during follow-up, counted and grouped as 0, 1, 2, 3 and 4 sickness absence episodes, with >4 episodes truncated into the last group. A final sickness absence measure not previously suggested was also included in Paper 1: To examine whether the effect of common mental disorders on sickness absence remained over prolonged time after baseline, associations with presence of a sickness absence episode 0.05 to

2.00 years, 2.01 to 4.00 years and 4.01 to 6.2 years after baseline assessment were examined.

### **2.3.2 Information from the disability pension registry**

Information from the disability pension registry was used in Paper 2 and Paper 3 in the present dissertation. In Paper 2, registry-based information about disability pension was linked with individual information from HUSK.

#### *Date variables*

The disability pension registry contains several variables that state the dates of different disability pension events. Two commonly used date variables gives information related to the award of disability pension; one variable gives the *date of first disability*, usually the first day of the sickness absence period that resulted in disability pension award, and a second variable gives the date of *when disability pension was awarded*. As the validity of the date of first disability is uncertain, the date of when disability pension was awarded was chosen as the disability pension date in both Paper 2 and Paper 3. This variable states the month and year of disability pension award.

#### *Diagnostic information*

In Norway, as in several other western countries, the general practitioner (GP) is the patients' main contact in the health service system, and is often the primarily responsible for the preparation of disability pension applications. A medico-legal diagnostic label indicating the health problem(s) causing the work disability must be stated on the disability pension application for a decision on suitability of disability pension award to be taken. This diagnostic information was utilised in both Paper 2 and Paper 3.

Information about the primary medico-legal diagnosis stated on the disability pension application is included in the FD-Trygd disability pension registry, and is coded according to WHO's diagnostic manual ICD version 9 and 10 [210, 211]. Since December 1998, diagnostic information was to be given in accordance with ICD-10,

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but some of the HUSK participants awarded disability pension during follow-up had their diagnostic code given in accordance to ICD-9 codes. Codes given in ICD-9 were therefore in Paper 2 translated into corresponding chapters in ICD-10 [212]. The medico-legal diagnoses in FD-Trygd are updated each year, and will for some individuals change during the expiration process. As these changes probably are due to corrections of misclassifications, the last stated diagnosis was used in Paper 2 and Paper 3.

An overview of the categorisation of medico-legal diagnostic information in the present dissertation is given in Table J in Appendix A. In Paper 2, it was examined whether or not common mental disorders were associated with disability pension award for non-mental disorders. Medico-legal diagnostic information was in this paper categorised as *mental diagnoses* versus *non-mental diagnoses* according to the ICD-10 chapter of the medico-legal diagnostic code. In the latter analysis, all disability pensions awarded for a mental disorder (ICD-10 codes F00-F99, n=112) were excluded from the analysis.

In Paper 3, we aimed to examine disability pension awarded for more specific diagnostic categories, and the diagnostic information was in this paper categorised on three levels. The two largest diagnostic groups among disability pension recipients are mental disorders and musculoskeletal disorders, and thus the broadest level of diagnostic categorisation was termed *main diagnostic groups*, and consisted of mental disorders (ICD-10 codes F00-F99), musculoskeletal disorders (M00-M99) and a final group including all other diagnoses. In increasing details, the seven most used ICD-10 *diagnostic chapters* for which disability pension is awarded was then examined. These chapters constituted a total of 87.1% of the disability pensions awarded in the period 2001 to 2003. The remaining 10.0% of the awards were included in an “other” category. Diagnostic information was missing for 2.9% awards. Finally, age at disability pension award was compared between the different *classes within mental disorders*, also defined in accordance with their ICD-10 codes. All classes of mental disorders were included in Paper 3.

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### 2.3.3 Time periods and follow-up

The HUSK participants included in Paper 1 were followed from their participation date until December 31<sup>st</sup> 2003, allowing for a maximum follow-up of 6.2 years. In Paper 2, the included HUSK participants were followed from their participation date until their date of disability pension award, or until December 31<sup>st</sup> 2004 if they were not awarded disability pension. This gave a maximum follow-up of 7.2 years. In Paper 3, disability pensions awarded in the time-period 2001 to 2003 were included. As described previously, 2001 to 2003 was a period without any major reforms in the disability pension scheme in Norway.

## 2.4 Covariates

Both sickness absence and ill health retirement are associated with a range of exposures. Numerous factors are also found to increase the risk of developing a common mental disorder. In an attempt to reduce the impact of alternative explanations, several variables with previously demonstrated associations between both the exposure (common mental disorders) and the outcomes (sickness absence or disability pension) were controlled for in the analyses in Paper 1 and Paper 2.

Covariates included gender [26, 28, 82, 163, 181], socio-demographic factors [120, 122-124, 133, 213, 214], health related behaviour [215-221], physical measures [188, 221-225], somatic conditions [58, 188] and pain conditions [56, 226, 227].

HUSK provided self-reported information on *gender*. *Socio-demographic* variables included self-reported *marital status* (unmarried, married, separated, divorced, widow/widower), self-reported *level of education* (ranging from less than seven years of schooling to more than four years studying at a college or university). Information about *income after tax* was retrieved from the income registry in FD-Trygd. Included in Paper 2 was also information about *current work situation* (paid employment, full time domestic work, studying or military service, unemployed or laid off).

Measures of health related behaviour included self-reported information on *smoking habits* (smoker versus non-smoker), *physical activity* (mean hours per week with

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activities involving sweating and shortness of breath, operationalized as 0-1 hour light activity, more than 1 hour light activity, less than 2 hours hard activity, more than 2 hours hard activity) and *alcohol consumption* (number of units per two weeks). The measure of alcohol consumption was employed somewhat different in Paper 1 and Paper 2. In Paper 2, the reported alcohol consumption per 2 weeks was operationalized into three categories (0 units, 1-15 units, more than 16 units). However, alcohol consumption differs between the genders, and in Paper 1 (which was designed after Paper 2 was published), alcohol consumption was operationalized using gender specific percentiles of consumption per 2 weeks (abstainer, consumption 0-33% percentile, consumption 33%-66% percentile and consumption 66%-100% percentile).

Information on physical measures was collected from the physical examination at the HUSK premises. *Body mass index* (BMI) and *waist-hip ratio* (WHR) were calculated. WHR differs between the genders, and measures of WHR were stratified in gender specific z-scores in Paper 1, but not in Paper 2. Information on *cholesterol level*, measured in mmol/L, was gathered from blood samples, and *pulse* and *systolic blood pressure* were measured three times at rest. To avoid erroneous data due to arousal, data from the final measurement was used in the analyses. All the physical measures were used as continuous measures.

Self-reported presence of *somatic conditions* were assessed for six conditions in HUSK, with the following prevalence estimates among the participants: myocardial infarction: 0.4%, stroke: 0.5%, diabetes: 1.1%, angina pectoris: 0.5%, asthma: 6.1% and multiple sclerosis: 0.5%. Due to these low prevalence estimates, we chose to operationalize all the somatic conditions into a common continuous variable, rather than controlling for each condition separately in the analyses. In Paper 2, self-reported information on current use of any medication was included. Where prescribed medication was presented, a team of physicians appointed appropriate diagnoses based on the International Classification of Primary Care (ICPC) system for any likely underlying physical condition. This information was used as a continuous variable reflecting the *number of physical conditions under pharmacological treatment*.

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Finally, self-reported presence of *pain conditions* was assessed by positive response on questions on presence of *back pain* (upper and/or lower) or *fibromyalgia*.

## 2.5 Statistical procedures

### *Exclusion procedures*

The target population in Paper 1 was individuals at risk for sickness absence in the general working population. Among the HUSK participants, those who had not responded to the questionnaires (n=2,603) were excluded, together with individuals not in employment (n=1,875) at baseline. Individuals who had less than 1 year between any sickness absence episode during follow-up and disability pension award (n=164) were excluded, as these individuals were likely to have started their process of disability pension award and not return to active work participation. To ensure a prospective design, individuals who were sickness absent at baseline (n=484) were also excluded. Finally, the distribution of number of sickness absence episodes among the HUSK participants ranged from 0 to 112, but was greatly skewed, with 89% of the participants having 4 or less sickness absence episodes during follow-up, and 99% having less than 10 episodes. Three individuals with more than 50 sickness absence episodes during follow-up were excluded, as the frequency of the episodes might indicate a loose connection to the work-life or erroneous registration in the sickness benefit registry. The final study sample in Paper 1 consisted of 13,436 individuals, 75.0% of the 18,565 who participated in HUSK. The exclusion procedure of Paper 1 is visualized in Figure A in Appendix A.

In Paper 2, the target population was individuals from the general population not receiving disability pension. In this paper, n=2,654 HUSK participants were excluded due to nonresponse on the questionnaires. Individuals who were already receiving disability pension at baseline (n=553), and individuals awarded disability pension during the first year after HUSK participation (n=70) were also excluded. The latter group was excluded to avoid elevated symptom levels due to the disability pensioning process in itself [228]. The final study population consisted of 15,288 individuals,



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82.3% of those participating in HUSK. The exclusion procedures in Paper 2 are presented in Figure B in Appendix A.

### *Handling of missing data*

Missing data in the current context refers to the situation where an individual participated in HUSK, but had missing responses for some of the variables of interest. Missing responses may affect the validity of the results. In Paper 1 and Paper 2, data were missing in the variables *income after tax, education, physical activity, alcohol consumption, BMI, WHR, cholesterol level, systolic blood pressure, pulse* and *number of somatic conditions*. When data is missing, the default method for most statistical software packages is to exclude all cases with missing data from the analyses. This is referred to as *listwise deletion* [229]. Listwise deletion may introduce systematic bias in the derived estimates and decrease the power of the sample. One approach to handling missing data is through missing imputation procedures, where the missing data is substituted [229]. Two different imputation procedures were used to substitute missing data in Paper 1 and Paper 2. In Paper 1, missing data was imputed by the user written Multiple Missing Imputation program in Stata 11.0 [230], using the multivariate normal approach with 5 imputation procedures. In Paper 2, missing data was imputed manually. Missing data on health related variables (physical activity, smoking and alcohol consumption) were substituted with predictions based on multivariate linear regression models built on valid responses to the other variables included in the analyses. Missing data on physical measures (BMI, WHR, cholesterol, blood pressure, pulse) were substituted with the mean value of the present variable. Finally, data missing on presence of any somatic condition and any conditions under pharmacological treatment were substituted with the value 0, as most individuals in this age group do not suffer from any somatic conditions and are consuming few medications.

All analyses in Paper 1 and Paper 2 were repeated without the missing imputation procedures (list-wise deletion). This did not produce estimates that fell outside the CIs of the missing imputed data. Hence, missing responses in the included covariates probably had little impact on the estimates from the analyses.

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## Analyses

Basic statistics to describe the characteristics of the samples were employed in all three papers. In Paper 1, the distribution of the exposure groups (reference, anxiety only, depression only, comorbid anxiety and depression), and different sickness absence outcomes among the exposure groups was described in crude numbers and percentages. The distribution of population characteristics in Paper 2 was given in crude numbers and percentages, with mean/median and standard deviations given where appropriate. Lost working years in Paper 3 was calculated by subtracting age when disability pension was awarded from age 67, which is the scheduled retirement age in Norway. Basic statistics were employed to describe total incidence, gender distribution, age at disability pension award, total lost working years (in numbers and percentages) and average number of lost working years within the three diagnostic levels. The results were presented both in descriptive tables and as line and bar graphs. As the results in Paper 3 were based on complete registries of disability pension awards in the Norwegian population, they have no confidence intervals.

Prospective associations between common mental disorders and the sickness absence outcomes first sickness absence episode, duration of first sickness absence episode and sickness absence in three time-spans after baseline in Paper 1, and disability pension award in Paper 2 were examined using regression models. In both papers, Cox proportional hazard regression models were employed to take into account the observation time for each HUSK participant until the outcome [231]. The Cox regression method models instantaneous hazard, which is the risk of experiencing the outcome for an individual with particular characteristics at a particular point of time during the follow-up period [232]. The results are presented as Hazard Ratios (HR) with 95% confidence intervals (CI).

The order of adjustment in the analyses in Paper 1 and Paper 2 was determined *a priori*, based on assumed chronological appearance. Crude and gender adjusted associations between common mental disorders and sickness absence outcomes or disability pension award were first examined, before adjusting for the remaining covariates in the following five blocks: i) socio-demographic factors (education,

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income, marital status), ii) health related behaviour (physical exercise, smoking and alcohol consumption), iii) physical measures (BMI, WHR, cholesterol, blood pressure and pulse), iv) somatic conditions (and current use of any medication in Paper 2) and finally v) pain conditions (back pain and fibromyalgia). In an additional Cox regression analysis examining the relationship between common mental disorders and disability pension award in Paper 2, z-scored HADS-A and HADS-D scores were used as independent continuous variables, adjusted for gender only and then fully adjusted for all covariates.

In Paper 1, the association between common mental disorders and number of sickness absence episodes were examined using multi-nominal logistic regression, with results presented as relative risk ratios (RRR) using 0 sickness absence episodes as the common reference group. When interpreting the results from this analysis, it is important to remember that the RRRs only shows the strength of the association between the reference group (in this context 0 sickness absence episodes) and the chosen variable category (i.e. 3 sickness absence episodes), and not differences in the association between i.e. 2 and 3 sickness absence episodes [233, 234].

Gender stratified analyses were further performed in Paper 1 to examine whether there were any gender differences in the effect of common mental disorders on first sickness absence episode. Stratification in an analysis according to the value of a variable (i.e. gender) is based on an underlying assumption that there is an interaction between the effect of the exposure (i.e. common mental disorders) and the variable of interest (i.e. gender) on the outcome (i.e. sickness absence). In Paper 1, an assumption of an interaction between common mental disorders and gender on sickness absence was based on previous literature showing gender differences in the prospective association between common mental disorders and sickness absence [16, 17, 40, 193]. All unadjusted associations between common mental disorders and the different sickness absence outcomes were in Paper 1 tested for gender interaction using the Likelihood Ratio test.

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The hypothesised dose-response association between symptom load of anxiety and depression and subsequent disability pension award were in Paper 2 examined by calculating gender adjusted HRs with 95% CI for the four groups with scores above the reference group (sub case-level, mild case-level, moderate case-level and severe case-level). The dose-response associations were then plotted into an error bar graph with 95% CI. To examine and compare the relative contribution of sub case-level and case-level anxiety and depression symptom loads on disability pension awards in the population, population attributable fractions (PAF) were calculated. The PAF value takes both the prevalence of the exposure and the effect sizes into account [235], and the values are meant to indicate how much of the disease burden (in this case disability pension awards) that could be eliminated if the causal factor (in this case common mental disorders) was eliminated from the population [236]. The calculation of PAFs in Paper 2 is suitable because common mental disorders are likely to be causally related to disability pension award, and because common mental disorders are likely to be amenable to intervention [236]. The limitations of the PAF index will be handled in the discussion section later in the dissertation.

Stata 11.0 and 12.0 was used for all analyses in Paper 1 and Paper 3 [237], whilst the analyses in Paper 2 were conducted in SPSS ver.15.

## 2.6 Ethics

The data in HUSK was collected in accordance with ethical standards required by the Regional Ethical Committee West (REK) of Norway. The permission to collect and store the data from HUSK was given by the Norwegian Data Inspectorate. All participation in HUSK was voluntary, and all potential participants received written information about the project before they met at the examination premises. The participants gave their written statements of informed consent, including the specific consents to use information from HUSK in health research and to link this information with data from Social Insurance Database registries. The participants also gave their written statement that they were informed that no specific time-limit was set for the

storage of the data. Copies of the consent statement and the permits from REK and the Data Inspectorate are included in Appendix B.

As the information in FD-Trygd consist of routinely collected data which are anonymized and not possible to trace back to individual persons, ethical approval from REK are not needed for the use of these data. The access to use and store information from FD-Trygd falls under the duty of confidentiality. This includes requirement of secure storage of the data to prevent access for unauthorized persons. I gave a written declaration of confidentiality at the time when I received the FD-Trygd data.

### 3. RESULTS

The following section will give a summary of the most important results in the present dissertation. Further details can be found in the respective papers.

#### 3.1 Paper 1

Among the HUSK participants included in Paper 1, 6,117 persons (45.5%) experienced at least one sickness absence episode during the 6.2 years follow-up. Common mental disorders were risk factors for all sickness absence outcomes measured during follow-up, and showed particular strong associations with sickness absence episodes of very long duration (>90 days) compared to episodes with shorter duration (17 to 56 days, or 57 to 90 days), and with higher number of recurrent sickness absence episodes. Finally, although the associations between common mental disorders and sickness absence weakened over time, common mental disorders showed borderline significant associations with sickness absence up to six years after HUSK participation.

Some general findings across the different analyses in the study are worth emphasising. Firstly, the effect of common mental disorders differed between the three exposure groups. In all analyses, the strongest associations with sickness absence was found for the category comorbid anxiety and depression, which had statistically significant effect on all but one of the sickness absence outcomes (sickness absence 4.01 to 6.2 years after HUSK participation) in the fully adjusted models. Anxiety only was generally more weakly associated with the sickness absence outcomes than the comorbid category, but was a stronger risk factor than depression only, which was a statistically significant predictor for the outcome “4 or more recurrent sickness absence episodes during follow-up” only. Secondly, among the included covariates, pain was the only covariate that had some explanatory power, reducing much the associations between common mental disorders and the sickness absence outcomes. Finally, no evidence for an interaction between common mental disorders and gender on sickness absence was found.

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## 3.2 Paper 2

Disability pension was awarded to 522 HUSK participants (3.4%) during the 7.2 years follow-up period in Paper 2. Common mental disorders were relatively strong risk factors for disability pension award, with comorbid anxiety and depression giving an almost five-fold increased risk for disability pension award during follow-up. The effect of common mental disorders on disability pension award was evident several years after baseline. Anxiety and depression were also predictors of general disability pension award when examined as continuous variables.

Common mental disorders were also risk factors for disability pension awarded for non-mental diagnoses, with a more than three-fold increased risk in the comorbid anxiety and depression category. A dose-response association between increasing anxiety and depression symptom-loads and risk of disability pension award was found. The prevalence of sub case-level anxiety and depression were however much higher than the prevalence of the three case-level groups (mild, moderate and severe) combined. The proportion of disability pensions attributable to sub case-level anxiety and depression symptom-loads were therefore comparable to the proportions of disability pensions attributable to case-level symptom loads, and considerably higher than the proportions of disability pensions attributable to the severe case-level symptom loads. As in Paper 1, controlling for covariates beyond pain conditions had little impact on the associations between common mental disorders and disability pension award.

## 3.3 Paper 3

In the period 2001 to 2003, the annual incidence of disability pension awards in the working age population in Norway was 0.9%. Musculoskeletal disorder was the most common medico-legal diagnostic group among the disability pension awards, accounting for 36.3% of all incident disability pension awards, followed by mental disorders (24.0%). When age at disability pension award was taken into account, mental disorders caused the highest number of lost working years among all medico-

legal diagnostic groups, both in terms of total lost working years for mental disorders as a group, and average number of lost working years for each disability pension awarded. Developmental disorders and mental retardation had the highest average numbers of lost working years among the specific mental disorders, with around 40 lost working years per individual. Individuals suffering from these conditions were often awarded disability pension as soon as they turned 18. The incidence of disability pension award due to these conditions was however much lower than disability pensions awarded for anxiety and depressive disorders. When both incidence and age at disability pension award was taken into account, anxiety and depressive disorders were the disorders causing the highest number of lost working years among the mental disorders.



## **4. DISCUSSION**

### **4.1 Novel findings of the present dissertation**

The present dissertation has contributed with six new findings regarding the impact of common mental disorders on sickness absence and ill health retirement. First, common mental disorders seem to have a more long-lasting effect on sickness absence and ill health retirement than previously shown. Second, common mental disorders were shown to be risk factors for long duration and frequent recurrence of sickness absence. Third, the proportions of disability pensions attributable to sub case-level anxiety and depression were found to be comparable to the proportions of disability pensions attributable to case-level anxiety and depression. Fourth, due to younger age at disability pension award, more lost working years were demonstrated for mental disorders than for any other diagnostic group. Fifth, anxiety seems to have a similar effect as does depression on ill health retirement, but showed stronger association than does depression with sickness absence. Finally, anxiety disorders was found to be the diagnostic group causing the highest number of lost working years among the mental disorders.

### **4.2 Strengths and limitations of the studies**

Below I will discuss the most important strengths and limitations of the studies in the present PhD project. The focus will primarily be on strengths and limitations that are applicable to at least two of the three papers in the dissertation, with a more in-depth discussion than permitted within the word-limit of journal articles. Strengths and limitations regarding individual papers in the dissertation, such as the use of HADS severity cut-offs in Paper 2, reverse causality in Paper 2 and issues regarding the underlying premise of calculation of lost working years in Paper 3, are discussed within the relevant paper, and will not be repeated here.

### **4.2.1 Methodological strengths**

The main strengths of Paper 1 and Paper 2 were the access to a range of health related information in a large sample from the general population and the long follow-up. The use of data from complete, official registries on sickness and disability benefit recipients is a strength of all three papers.

Although the employed population in a defined geographical area is suggested as the best measure of a population at risk in sickness absence studies [201], information from clinical samples or populations already on sick-leave or receiving ill health benefits have been used in the majority of previous studies. An inherent risk in such samples is that participants give strategic answers to exposure questions, for instance answers that are in accordance with their benefit status or application for such. This may be particularly problematic in the sickness absence research context, as benefit recipients may feel a need to avoid disclosing information that may imperil their benefits. This risk is reduced in the population-based approach, as the participants should have fewer incentives to produce particular responses. Further, many of the aims examined in population-based health studies are often generated after the data-collection, and cannot influence the participants' responses. The population-based approach in the present dissertation also allowed for comparison with a symptom free reference group, and the large sample size provided power to study sub-groups of interest according to exposure status (anxiety only, depression only and comorbid anxiety and depression). The population-based approach also includes participants from several occupations, organisations and socio-economic positions.

A particular strength of the HUSK study is the extensive data collection, with several health related measures included. This enables the control of a range of potential confounders, and reduces the risk of alternative explanations in the association between common mental disorders and sickness absence and ill health retirement. The use of an extensively tested exposure measure, the HADS screening questionnaire, with the conventional cut-off is also a strength of Paper 1 and Paper 2.

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Finally, the registry-based outcomes in all three papers provide several strengths, in addition to the long follow-up in Paper 1 and Paper 2. Recall bias is a challenge in retrospective epidemiological studies, and in particular has limited ability to recall detailed past events among survey participants been demonstrated [238]. It is thus difficult to gain detailed information on i.e. first date of sickness absence or ill health retirement, number of sickness absence days or number of sickness absence episodes over several years through self-reported information from survey participants. Recall bias is avoided in the present PhD project by employing highly accurate registry information on benefit status, date of entry or exit into the benefit, and for the disability pension registry; the primary medico-legal diagnosis stated on the disability pension application [239-241]. The completeness of the registries further minimizes the risk for attrition in the two cohort studies.

#### **4.2.2 Methodological limitations**

The most important limitations of the present dissertation concern nonparticipation in HUSK, residual confounding and the validity of the medico-legal diagnostic information in the FD-Trygd disability pension register. Other issues are operationalization of the HADS screening questionnaire, the inability to separate between confounders and mediators among the included covariates in Paper 1 and Paper 2, and issues regarding generalization. These limitations will be discussed in the following paragraphs.

##### ***Operationalization of the HADS screening questionnaire in Paper 1 and Paper 2***

The operationalization of the HADS scores as indicators of anxiety and depression in Paper 1 and Paper 2 may raise some concerns. Firstly, although HADS have demonstrated good case-finding properties both in the general population [207] and in the general working population [41], it must be emphasized that HADS is not a diagnostic instrument, and the identification of case-level anxiety and depression is not equivalent to clinical diagnoses of an anxiety or depressive disorder. Rather, HADS is screening tool for identification of possible cases of anxiety or depression. Screening instruments are in general higher on sensitivity than on specificity, and this gives the

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inherent risk of identification of false positives when such instruments are used. On the other hand, the exclusion of somatic symptoms from the HADS may contribute to that individuals with predominantly somatic symptoms of anxiety and depression are not recognised as possible cases. Finally, as anxiety and depression are remitting and relapsing conditions, it may be somewhat random whether or not a single measure at a single point in time capture the individuals at risk. Such random misclassification increase the risk of regression dilution bias, which will give a bias towards the null hypothesis [242].

In the present context, misclassification is likely to be a greater problem for the groups surrounding the case-level cut-off (HADS subscale score of 8) than for the groups with higher scores. Using a more conservative cut-off for case identification, for instance HADS subscale score of 11, could reduce the risk of misclassification. This would probably result in stronger effect sizes, but as the groups with sub-scale score  $\geq 11$  are much smaller than the groups with sub-scale score of 8 to 11, a more conservative HADS cut-off will also give smaller PAF values in Paper 2.

Secondly, despite the fact that a two-factor structure of HADS has been demonstrated in several studies, these factors are not completely consistent with the originally suggested HADS-Anxiety and HADS-Depression subscales [12, 206, 208]. The use of a two-factor HADS-A and HADS-D structure will base the interpretation of the results on a presumed existence of two discrete disorders (anxiety and depression) rather than on variation of general symptoms of mental distress [3]. A recent literature review of studies investigating the latent structure of HADS concluded that although a two-factor structure was found in half of the included studies, the heterogeneity of the results suggested that the latent structure of HADS is still unclear and depends on the statistical methods employed [208]. Due to the inability to consistently differentiate between constructs of anxiety and depression, the authors of this review rather suggested the use of HADS as a measure of general mental distress [208].

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*Inability to differentiate between confounders, mediators and proxy measures, and risk of residual confounding in Paper 1 and Paper 2*

A *confounder* is a variable that is not intermediate on the pathway between the exposure and the outcome, but is associated with both the exposure and the outcome of interest [243]. Confounding factors may provide alternative explanations for the association between the exposure and the outcome [244]. The adjustment of covariates in Paper 1 and Paper 2 is an attempt to eliminate such alternative explanations for the associations between common mental disorders and sickness absence and ill health retirement. A *mediator* is a factor that lies on the causal pathway from exposure to outcome. The mediator is caused to vary by the exposure variable and will in itself cause variation in the outcome [243]. Adjusting for mediators in the analyses will lead to over-adjustment, with resulting underestimation of the effect of the exposure on the outcome. All health variables in HUSK were collected cross-sectionally, and this precludes empirical investigation of whether or not the covariates in Paper 1 and Paper 2 operate as confounders or mediators in the associations between exposures and outcomes. Gender is the only covariate where the assumption of confounding may be truly justified, with presence established before both exposure and outcome.

The issue of over-adjustment is perhaps particularly relevant for pain conditions, which had a substantial impact on the associations between common mental disorder and both sickness absence and disability pension award. Several studies have demonstrated high comorbidity between pain conditions and common mental disorders [55, 56]. Common mental disorders and pain conditions probably have a bidirectional relationship, perhaps with shared neurological pathways [56] or shared psychological vulnerabilities [55]. Pain may thus operate both as a confounder and as a mediator in the examined associations in Paper 1 and Paper 2. Pain may also be part of the clinical expression of a common mental disorder, for instance in somatisation disorders (which is categorised under the anxiety disorders). The use of HADS, with its focus on the emotional and cognitive characteristics of common mental disorders, may increase the risk for pain being a proxy measure for common mental disorders among individuals with primarily somatic symptoms expression of their common mental disorder. If that is the case in the present dissertation, the pain-adjusted effect sizes will be an under-

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estimation of the true impact of common mental disorders on sickness absence and ill health retirement [243].

The included covariates in Paper 1 and Paper 2 do not constitute an exhaustive list over possible confounders in the associations between common mental disorders and sickness absence and ill health retirement. The list of somatic conditions included in the HUSK questionnaire consisted of only six self-reported disorders, and somatic symptoms were not included in the analyses. There are also other factors that are associated with both the exposure and the outcomes, like work-related factors [197, 245-249], personality traits [250-252], earlier episodes of sickness absence [253-255], and sleep problems [256-259]. Residual confounding may therefore be present, resulting in an overestimation of the effect of common mental disorders on sickness absence and disability pension. However, some factors do point in the direction of residual confounding not being a major problem in Paper 1 and Paper 2. The list of somatic conditions included some of the most prevalent conditions among individuals in their forties [260]. Further, over 90% of the HUSK participants reported not having any of the mentioned somatic conditions. In regard to work-related factors, earlier episodes of sickness absence and sleep problems, these may well be on the causal pathway between the exposures and outcomes, and hence operate as mediators that should not be controlled for.

### *Nonparticipation and attrition in Paper 1 and Paper 2*

Cohort studies are vulnerable to nonparticipation and attrition [204, 261]. If nonparticipation and attrition rates are higher among individuals with characteristics related to the exposure or outcome of interest (i.e. they have higher rates of mental disorders, sickness absence or disability pension), this will result in selection bias that may challenge the validity and generalizability of the results [229]. The participation rate in HUSK was 63.1%, which is in line with what is common in population-based health studies. An analysis of nonparticipants in HUSK found higher rates of disability pensioning among nonparticipants, and in particular when the disability pension was awarded for a mental disorder [205]. Selective nonparticipation is a challenge in

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studies assessing prevalence estimates, but has been found to be a lesser problem in studies examining associations between an exposure and an outcome [204].

There are three sources of attrition in the FD-Trygd sickness benefits and disability pension registries: mortality, emigration, and transition to other benefits. The latter applies to the sickness absence registry only. In Paper 1, individuals with transition from sickness absence to disability pension were censored if it was less than 1 year between a sickness absence episode and disability pension award. Mortality and emigration were not censored in Paper 1 and Paper 2. Mortality is of less importance in the HUSK sample, as the mortality rate among individuals in their forties is low [262]. As the registries are complete for the Norwegian population, emigration will only be a challenge if the person emigrates out of the country. This emigration rate was low for Hordaland county in the years 1997 to 2004 (0.4% in 2001) [263].

### *Validity of diagnostic information in the FD-Trygd disability pension registry*

The medico-legal diagnostic information in the FD-Trygd disability pension registry is based on the primary diagnosis stated on the disability pension applications. As described in the introduction (page 33 and 34), the validity of this diagnosis with regard to the underlying health problem is characterised by uncertainty. When the primary diagnosis indicates disorders that are strongly associated with severe functional impairment, like cancer or schizophrenia, or stigmatizing disorders like alcohol dependence, the diagnostic information is likely to describe a key health problem. The majority of disability pensions are, however, awarded for mental and musculoskeletal disorders. In many cases of mental and musculoskeletal health problems it may be difficult to determine what the primary health problem is, as the work impairment could be the result of a combination of several co-occurring diagnosis [264, 265]. In cases of comorbidity between mental and musculoskeletal symptoms and conditions, it may be somewhat arbitrary which diagnosis is being used as the primary diagnosis on the disability pension application. However, common mental disorders may perhaps be less used as primary medico-legal diagnosis than

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musculoskeletal disorders in disability pension contexts, due to under-detection of mental disorders within primary care [159-161] and stigma [159, 162].

In contrast, common mental disorders may be used as medico-legal diagnosis in cases where continued work participation is deemed difficult or impossible, and where no other diagnosis seems suitable given the person's health status and age. Although disability pension in Norway is not to be awarded for social problems like unemployment, poor education or lack of skills that are desired in work-life; higher rates of disability pension are found in geographic areas with a difficult labour market [123, 124], among individuals with little or no education [120, 133] and among unskilled manual workers [122]. Mental health complaints not necessarily reaching clinical expressions may also impact on work functioning, and increase the risk of ill health retirement. Low emotional control [266], extrovert deviant behaviour [266], problem drinking [219], lower IQ [266] and mental impairment [267] are for instance found to be predictors for both disability pension award in general, and for disability pension awarded for mental disorders in particular. These are also factors that are more prevalent among individuals with lower socio-economic status [268-270], which in itself is associated with increased risk for both mental disorders and ill health retirement [133, 271, 272]. Low socio-economic status may thus further increase the risk of ill health retirement among individuals with these specific challenges.

### *Generalization issues*

Some issues may also affect generalization of the results from the present dissertation. All HUSK participants were from the same age cohort (40 to 46 years), and the results are not directly transferrable to other age-groups. Persons in their forties are a suitable group to study mental health predictors of sickness absence and ill health retirement within, as sickness absence related to pregnancy, birth or sick children is probably less relevant in this age-group compared to younger workers, and severe diseases which increase the risk of mortality have not yet developed. Individuals in their forties do also have many work-years left before scheduled age-retirement. It may thus be particularly important to gain knowledge on what causes work-disability in this age-group.



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The organisation of the Norwegian Social Insurance Scheme may also affect international generalizability. The unemployment rate in Norway is low, while the sickness absence and disability pension rates are among the highest in the OECD area [82]. There are no indications that neither the physical nor the mental health of Norwegians is worse than in other western countries [26-28, 260, 273]. It may be speculated that the generous compensation level for sickness absence and ill health retirement in Norway may provide extra incentives for individuals with health problems to leave work-life and receive ill health benefits [100, 274]. Whether this may explain some of the high sickness absence and disability pension rates in Norway compared to other countries remains to be empirically demonstrated.

Reforms and changes in the Social Insurance Scheme both during and after the data collection period in the present PhD project (1997 to 2004) may affect the generalizability of the results to the current context. The most important reform after this period was the introduction of time-limited disability benefits in 2004, which affected the inflow of disability pension awards the following years (Figure 2 and Figure 3). This benefit scheme was however discontinued in 2010, and the time-periods in Paper 2 (1997 to 2004) and Paper 3 (2001 to 2003) were chosen to avoid these changes in disability pension inflow, in particularly the changes in relative rates of different medico-legal diagnoses. Across the OECD area, mental disorders have overtaken for musculoskeletal disorders as the most prevalent diagnoses within disability benefit statistics [82, 165, 166]. Norway has also witnessed a trend with increased use of medico-legal mental disorder diagnoses and decreased use of musculoskeletal diagnoses. Mental disorders were, however, both at the end of 2003 and in 2010/2011 the second most common medico-legal diagnostic group within both sickness absence and disability pension incidence, after musculoskeletal disorders [144, 171]. Changes and reforms in the Norwegian Social Insurance Scheme, and increased use of medico-legal mental disorder diagnoses have thus probably had little effect on the generalizability of the results from 1997 to 2004 to the current context.

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### 4.3 Why do common mental disorders cause sickness absence and ill health retirement?

Anxiety and depression are remitting and relapsing conditions [5], and it has been argued that they are better understood as chronic rather than episodic disorders [275]. The results from the present dissertation may indicate that the effect of common mental disorders is long-lasting, and may lead to permanent negative outcomes like ill health retirement. There is, however, no one-to-one relationship between the presence of a common mental disorder and sickness absence or ill health retirement. Almost half of the anxiety and depression cases in HUSK did not have any sickness absence episodes exceeding 16 days during the six years follow-up. As mentioned in the introduction, whether or not presence of common mental disorders results in sickness absence or ill health retirement is probably dependent on several factors influencing on these relationships, such as severity of symptoms, comorbid presence of other ill health conditions, the working environment, the general labour market and stigma and discrimination. Factors that may contribute in making common mental disorders cause sickness absence or ill health retirement will be discussed below.

In contrast to the majority of somatic disorders, common mental disorders are characterised by the negative impact they have on the person's emotional, cognitive and social functioning. Many of the symptoms of common mental disorders have a direct impact on working capacity and occupational functioning. For instance, reduced concentration and attention, feelings of low self-worth and self-confidence, and repeated negative thoughts, are among the core symptoms of depression, whilst fear of social situations with corresponding avoidance behaviour may be prominent in anxiety [5]. The importance of these characteristics for work disability is confirmed in qualitative studies examining obstacles of return to work among individuals sick-listed for common mental disorders. Difficulties in setting limits, feelings of loss of control, high sense of responsibility and perfectionism, fear-avoidance behaviour, reduced concentration and exhaustion were among the reported barriers of return to work [276-278]. Personality traits associated with anxiety and depression, such as external locus of control and low self-esteem further explain some of the association between

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common mental disorders and work impairment [250]. Feelings of hopelessness and pessimism [279-281] and high levels of social anxiety also contribute to increased risk for ill health retirement among individuals with common mental disorders [77].

Presence of somatic symptoms may also contribute to increased risk of sickness absence and ill health retirement among individuals with common mental disorders. Common somatic symptoms of anxiety and depression, such as gastrointestinal complaints, musculoskeletal pain and sleep problems are in themselves found to be risk factors for sickness absence and ill health retirement [178, 226, 256, 258, 259, 282, 283]. Comorbidity between common mental disorders and other mental disorders, pain conditions or somatic disorders also greatly increase risk for sickness absence and ill health retirement [30, 39, 56, 58, 60, 62].

Besides the impact from symptoms, factors related to both the close working environment and the general work market may contribute to increased risk for sickness absence and ill health retirement among individuals with common mental disorders. Experiences of work-strain, low social support and conflict at the workplace are consistently found to be associated with common mental disorders [44, 119, 245, 249, 284-291], and these work-related factors are also associated with sickness absence and ill health retirement [117, 118, 197]. It has been speculated that individuals with mental health problems interpret their working environment more negatively or are more likely to hold low quality jobs than individuals without such symptoms [86, 292-294], but the empirical findings in this regard is inconsistent [197, 295].

Factors related to general work-life participation among individuals with common mental disorders may also contribute to increased risk of sickness absence and ill health retirement. Mental health problems in adolescence and young adulthood are found to be a risk factor for lower educational attainment [296-298], which give fewer opportunities in the labour market and increased risk for ill health retirement [120, 213]. Persons with common mental disorders do as a group have more unstable work histories and lower work-participation than persons without such complaints [85, 87-89]. Unemployment is in itself a risk factor for disability pension [123, 124], and when

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this is combined with a common mental disorder, this may further increase the probability of ill health retirement [86, 134].

Stigma is an important barrier of entry into the work-life for individuals with common mental disorders [25, 90, 91, 299, 300]. The main reason behind this discrimination has been attributed to perceptions regarding poorer work performance and presenteeism among employers, rather than expectations of future absenteeism [299]. Stigma may also make employees reluctant to disclose to their employer that they suffer from anxiety or depression [91]. This may delay help-seeking or queries about adjustments of their work situation, which in some cases may result in long-term sickness absence [301].

The contribution of sub case-level symptom loads of anxiety and depression on ill health retirement demonstrated in Paper 2 may have several explanations. One explanation might be that sub case-level symptom loads have developed into more severe anxiety or depression conditions during follow-up [302, 303], and this in turn leads to ill health retirement. Anxiety and depressive symptom loads measured by HADS are however found to be relatively stable over a four year period [304]. Further, an equal number of individuals are found to cross from case-level to sub case-level symptom loads on HADS as the other way around [304]. Prevalence rates of common mental disorders also seem to have been more or less unchanged between 1990 and 2003 [68]. Thus, a more likely scenario than transition from sub case-level to case-level anxiety and depression is the increased burden symptoms of anxiety and depression adds to individuals with coexisting somatic health problems [56, 58, 60] or the increased challenge even minor symptoms of anxiety and depression may place on working capacity [89].

In summary, several mechanisms may contribute to increased risk of sickness absence and ill health retirement among individuals with common mental disorders. These mechanisms may be due to cognitive, emotional and social challenges, co-occurring presence of somatic symptoms and somatic conditions, perceptions of the work

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situation, and difficulties in entering the labour market due to lower education, stigma and discrimination.

## 4.4 Implications of the results

### 4.4.1 Is the impact of common mental disorders on sickness absence and ill health retirement under-recognised?

Due to the biases inherent in the clinical context where the decision on primary medico-legal on disability pension application is made [159-162] it has been argued that mental disorders are underutilised as medico-legal diagnoses in sick-leave and disability pensioning contexts, with a resulting under-recognition of the impact of mental disorders on work disability in official benefit statistics [106, 305]. In Paper 1, common mental disorders were found to increase duration and recurrence of sickness absence. Both these outcomes increase the burden associated with sickness absence in the population, but such consequences are difficult to identify in official sickness absence statistics based on medico-legal diagnoses. For instance, long-term sickness absence has been found to account for up to one-third of the days off, and 75% of the costs associated with sickness absence [25].

In Paper 2, the association between common mental disorders and disability pension was demonstrated using independent measures. The identification of the impact common mental disorders has on disability pensions awarded for non-mental diagnoses add weight to the argument that mental disorders are generally underestimated in official benefit statistics. These findings are in line with studies showing that mental disorders that are rarely mentioned in official benefit statistics, such as sleep-problems [258, 259, 283] and health anxiety [306], are independent risk factors disability pension.

Under-recognition of the effect of a condition based on prevalence estimates in benefit statistics may not be unique for mental disorders. Sickness absence and ill health retirement are often the result of a range of co-occurring health complaints, without any individual symptom or cluster of symptoms standing out as the main cause of

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work impairment. For instance, neck pain, pain in the feet, headache, migraine, sleep problems, flushes/heat sensations, anxiety and sadness/depression have all been found to be more common among patients sick-listed for low back pain than in the general population [264, 265]. Further, high concurrent presence of anxiety, depression and other somatic symptoms are found among individuals with gastrointestinal complaints at risk for later sickness absence [282], and musculoskeletal complaints are shown to predict disability pension awarded for mental disorders even after controlling for anxiety and depression [226]. When faced with a broad spectrum of different mental and somatic symptoms, it might be arbitrary what is used as primary medico-legal diagnosis. The choice of an alternative diagnosis to a mental disorder does not necessarily imply that the physician is not aware of the mental health problems and the impact these have on work capacity [307].

Despite many physicians being aware of the mental health problems, under-detection and under-diagnosing of common mental disorders in primary health care is likely to have consequences in sickness absence and disability pension contexts. Under-detection and under-diagnosing may prevent appropriate treatment of common mental disorders [68, 308], which may prolong sickness absence and increase the risk of ill health retirement [309-311]. Further, as official benefit statistics may be used to guide health-policy priorities, an under-reporting of common mental disorders as important contributors to sickness absence and ill health retirement in the population may result in health resources and interventions being lead away from this group.

Thus, there are indications that the effect of common mental disorders is underestimated in official benefit statistics. Such an underestimation can delimit the recognition of the true impact of common mental disorders on sickness absence and ill health retirement. This may again influence on political priorities for allocation of resources to work-related interventions, which may give disadvantages for individuals with common mental disorders compared with other health problems.

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#### **4.4.2 Do anxiety and depression have different effect on sickness absence and ill health retirement?**

In the present dissertation, the effect of anxiety was found to be as strong as the effect of depression on ill health retirement (Paper 2). Further, the association between anxiety and sickness absence was seemingly stronger than the association between depression and sickness absence, with stable and long-lasting associations demonstrated (Paper 1). Finally, disability pension was found to be awarded at a younger age for anxiety disorders than for depressive disorders, resulting in anxiety disorders being the diagnostic group causing the highest number of lost working years among the mental disorders (Paper 3).

These findings are somewhat in contrast to the general focus in the literature, which has tended to give far more attention to depression than to anxiety. For instance, the disability burden associated with depression was greatly emphasized in the GBD studies [73-76], whilst anxiety was not included, despite prevalence rates being as high as those for depression [26-28, 273]. Also within the previous epidemiological studies examining the association between common mental disorders and sickness absence and ill health retirement, the focus has tended to be on depression [16, 20, 109, 111, 112, 174, 187, 192-194, 199, 200], (common) mental disorders in general [17, 39, 80, 108, 110, 113, 115, 116, 155, 157, 164-168, 170, 173, 175, 177-186, 190, 195, 312] or on mental distress [189, 196, 197, 247], with only 7 studies mentioning the contribution from anxiety specifically [40, 62, 114, 156, 188, 191, 198] (Appendix A: Table B to Table H).

Anxiety and depression commonly co-occur [3, 30, 53, 54, 61], and this may be one explanation for why anxiety has not been specifically included in previous studies. Despite the argument that anxiety and depression are expressions of the same underlying factor [30, 61, 67, 313], the customary understanding of anxiety and depression is that these are different disorders, with different core emotions (depression – sadness, anxiety – fear), and different symptom expression. In the present dissertation, anxiety and depression were categorised as separate disorders, and the results revealed differences in the effect these disorders have on sickness

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absence and ill health retirement. Anxiety has also in other studies been associated with occupational impairments in the absence of depression [314]. Presenteeism and lower productivity are major occupational challenges associated with depression [87-89, 92, 93], and these outcomes may necessarily indicate that individuals with depression often go to work despite having high symptom load [315]. The occupational impairment caused by anxiety, on the other hand, may to a larger degree be evident through avoidance of the work situation [77]. There are some indications that individuals with anxiety seek help in the health services more often than individuals with depression [316], and as long-term sickness absence is dependent on contact with the health services, more individuals with anxiety than with depression may be prescribed sick-leave or disability pension award. Previous studies not taking the effect of anxiety into account may thus have underestimated the effect of common mental disorders on sickness absence and ill health retirement.

The difference in effects between anxiety and depression may also be an artefact of the HADS questionnaire. The exclusion of somatic symptoms on the HADS items may affect the measurement of depression more than the measurement of anxiety, as several of the HADS-A items contain some indication of somatic symptomatology (Appendix A: Table I). Stronger effects of depression on sickness absence may be found when instruments including somatic symptoms of depression are used. Further, as mentioned above, the latent factor underlying HADS is still unclear [208], and what is interpreted as separate disorders of anxiety and depression in Paper 1 and Paper 2 may rather be different aspects of general mental distress [3].

The results of the present dissertation showing stronger effect from anxiety on sickness absence and ill health retirement than does depression may indicate that occupational functioning is somewhat differently expressed for anxiety than for depression, for instance in terms of more avoidance of the work situation. On the other hand, the difference in effect sizes in Paper 1 and Paper 2 may also be an artefact of exclusion of somatic symptoms in HADS, or an erroneous assumption that HADS measures two different disorders rather than common expressions of general mental distress.



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#### **4.4.3 What is the contribution from sub case-level symptom loads of anxiety and depression on ill health retirement?**

When examining the associations between symptom load and risk for disability pension in Paper 2, a dose-response association was identified, with increasing risk in concordance with increasing symptom load. Increased risk of disability pension award was also found for individuals with sub case-level symptoms compared to the reference group. In combination with high prevalence, the proportions of disability pensions attributable to sub case-level anxiety and depression symptom loads were found to approximate the proportions of disability pensions attributable to case-level symptom loads, demonstrated by the comparable PAF values. In other words, almost as many disability pension awards in the population could in theory be prevented if sub case-level anxiety and depression was eliminated, as through elimination of case-level anxiety and depression.

It is important to have the underlying assumptions of the PAF index clear in mind when the implication of the PAF values is considered. The PAF value gives the fraction of how many cases (i.e. disability pension) that would not have occurred if the exposure (i.e. common mental disorders) had not occurred [317]. The scenario of complete elimination of both sub case-level and case-level anxiety and depression is, of course, unrealistic. Further, the calculation of PAFs presumes that common mental disorders are independently associated with disability pension award, when the likely scenario is that many other factors also contributes in this association. Despite these limitations, the results of Paper 2 gives some valuable indications of the contribution from sub case-level anxiety and depression symptoms loads on ill health retirement in the general population.

The results from Paper 2 is in concordance with findings from Broadhead and colleagues, where minor depression, due its high prevalence, accounted for 51% more disability days than major depression [20]. The relevance of sub case-level symptom loads of common mental disorders has also been demonstrated in other studies, showing the negative impact these symptom loads have on public health status [318,

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319], and how they lead to clinical and functional impairment [320], decrement in health status [18] and lower quality of life [319].

The contribution of sub case-level symptom loads on functional outcomes adds weight to the argument of including these conditions when negative consequences of common mental disorders is assessed in the population [20]. The impact of sub case-level symptom loads is also of relevance for the on-going revision of the diagnostic manuals DSM and ICD, where issues around a dimensional versus a categorical approach to common mental disorders has been addressed [18].

It is however also important to bear in mind that although the burden from sub case-level symptom loads of anxiety and depression on the public health is detectable, the risk of sickness absence or ill health retirement for each individual with these symptom loads is low. Increased focus on the adverse consequences of sub case-level symptom loads of anxiety and depression implies a risk of pathologizing common and temporary heightened levels of normal mental distress. One should also be cautious in including low symptom loads into the diagnostic manuals, as new diagnoses will create a large new patient group, for whom effective treatment is lacking. Experiences from the revision of DSM-III, which resulted in DSM-IV, showed that even small changes lead to unintended and possible harmful consequences, such as unnecessary treatment with psychoactive medications with adverse side-effects, and diversion of scarce resources away from persons who really need them to individuals who do not [321].

Thus, although the contribution from sub case-level symptom loads are comparable with the contribution from case-level symptom loads on ill health retirement in the population, the individual risk for ill health retirement for each person with sub case-level symptom load is low. When interventions aimed towards the sub case-level group are considered, one should also carefully consider the risk of pathologizing relatively normal level of mental health symptoms.

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#### **4.4.4 What are the possible consequences of younger age at ill health retirement?**

Despite the limitations associated with the use of medico-legal diagnostic information, the relatively young age at ill health retirement demonstrated among individuals with common mental disorders and the associated high number of lost working years identified in Paper 3, is concerning. Work-life participation is positive for mental health [44, 86], also for individuals with severe or long-lasting mental disorders [322, 323], and most individuals with a mental disorder wants to work [83, 86].

Relatively little research has been done on the consequences of ill health retirement for the individual [324], but it has been found that ill health retirement is associated with increased mortality [44, 325], particularly when the ill health retirement happens in young age [325]. Research on unemployment has demonstrated that long periods with absence from work-life are associated with increased prevalence of health problems, including mental health problems [43, 45, 119, 125-129, 326-329].

Being outside work-life may also lead to social exclusion and loneliness [25, 203, 324], and this may be particularly relevant for younger individuals, as work-life exit among older individuals is much more common [114]. Ill health retirement often result in poorer economy and decreased socio-economic status [25, 324], which in itself is associated with poorer health [326, 330, 331]. There is strong evidence that re-employment after unemployment leads to improved self-esteem, and improved general and mental health [44], and return to work is associated with better functioning also among individuals with severe mental disorders [332]. The reverse flow from ill health retirement back into employment is, however, almost non-existent [82], and being awarded a disability benefit usually leads to a permanent cessation of paid work.

Early ill health retirement and corresponding high number of lost working years may also have severe consequences for the wider society and economy, as they provide an enormous burden on official expenditures. In addition to the high amounts of official expenditures due to disability benefits, high rates of individuals not contributing in the work force also have economic consequences in terms of lost tax income. In parallel

with raising work-disability expenditures, western countries are experiencing an increasing aging of the population, with associated increasing rates of age retirement pensions. The economic burden on those left in the workforce is thus high. In the long run, high public expenditures on disability benefits may provide a major economic challenge for the welfare state [94].

Early ill health retirement, with corresponding high number of lost working years, are thus associated with potential severe negative consequences, both for the individual and for the wider society and economy.

#### **4.5 Prevention of sickness absence and disability pension award due to common mental disorders**

The results from the present dissertation illustrate the importance of common mental disorders on health outcomes in the general population. Both for the individual and for the wider society and economy it would be desirable if interventions that were effective in reducing and preventing sickness absence and ill health retirement among individuals with common mental disorders were identified.

Return to work after long-term sickness absence is in many cases a complex process, influenced by the severity of the disorder, personal factors, work-related factors, the structure of the health care system and the compensation systems [278]. It has been argued that optimal return to work interventions takes both obstacles and opportunities due to the characteristics of the disorder, the work-place, and treatment and occupational rehabilitation services into consideration [278].

The high prevalence of sub case-level symptom loads represents a major challenge to traditional interventions. Although individuals with sub case-level symptom loads utilize the health services less than individuals with higher symptom loads, the absolute number of individuals with sub case-level symptom loads receiving professional help is considerable [320]. Persons with sub case-level symptom loads are less likely to benefit from pharmacological treatment [333, 334], and individual interventions may not necessarily be the best intervention for this group.

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In the following, three arenas for the implementation of interventions aimed to reduce and prevent sickness absence and ill health retirement among individuals with common mental disorders will be discussed: individual treatment, occupational interventions and structural interventions.

### *Improved detection and access to treatment*

A challenge for treatment interventions is the under-detection and under-diagnosing of common mental disorders in both primary health care [159-161] and disability pension contexts [309-311]. Evidence-based treatments that are effective in reducing anxiety and depression symptom levels exist [335-346]. This suggests that sickness absence and ill health retirement due to common mental disorders in some degree may be avoided by increased detection, and access to and use of effective treatment trials. Illness perceptions, expectations on duration of sickness absence and coping styles are further factors that are associated with sickness absence and work participation [347-350], and these elements may easily be addressed within psychological treatment regimes.

It is however not known whether the factors that usually are in focus during treatment of anxiety and depression are important factors also for sickness absence and ill health retirement. General symptom reduction due to treatment may thus not necessarily promote return to work among sickness absent patients. The findings are mixed in terms of whether or not treatment interventions are effective in improving occupational outcomes [351-355], and in 2008 a Cochrane review concluded that *“there is currently no evidence of an effect of medication alone, enhanced primary care, psychological interventions or the combination of those with medication on sickness absence of depressed workers”* [356]. In Norway have reforms that should increase access to treatment in the specialist health services or to medical rehabilitation not had any impact on the sickness absence or disability pension rates in the population. It is thus uncertain whether increased access to treatment is an effective intervention to reduce sickness absence and ill health retirement rates in the population.

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### *Occupational interventions*

The implementation of occupational interventions aimed to prevent sickness absence and ill health retirement among individuals with common mental disorders depends on whether the person has an existing workplace [357]. For individuals with an existing workplace, interventions may be implemented at the workplace. For individuals without an existing workplace, interventions usually focus on obtaining work in a suitable working environment.

Among work place interventions have social support from superiors and colleagues been found to have beneficial effects on both mental health and sickness absence [278, 357, 358], and early contact between the sickness absent and colleagues and supervisors may decrease time until return to work [279, 359]. Other workplace adjustments may include altering working hours, allowing absences for treatment or physical activity, and mentoring and supervision [300]. The evidence-base is however scarce regarding potentially effective workplace interventions other than social support that may prevent sickness absence or ill health retirement [357, 360].

For persons without an existing workplace, positive effect of interventions like supported employment and individual placement and support (IPS) have been found for individuals with severe mental disorders like schizophrenia or mental retardation [322, 361-363]. Interventions that are effective for severe mental disorders may however not be directly transferred to common mental disorders. The evidence base for effective interventions aimed at return to work for these individuals is much more limited [364], with an apparent lack of good randomised controlled trial (RCT) studies [357, 360].

### *Structural interventions*

Structural interventions aimed to reduce or prevent sickness absence and ill health retirement are in the current context defined as interventions aimed towards the entire population or a large group of the population, rather than towards the individual or the individual's workplace. Three such interventions will be discussed below; reduce

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stigma related to mental disorders, changes in sickness absence praxis, and reduced benefit compensation.

There is a tendency for both mental health professionals and employers to underestimate the capacities and skills of individuals with mental disorders, and to overestimate the risk these individuals represent for their employer [365]. Stigma and discrimination are thus serious barriers for individuals with mental disorders to obtain work [90, 299]. However, when well, an individual with a common mental disorder can be expected to perform at similar levels as the rest of the work force [300]. Anti-stigma programmes have been launched both in UK [366] and in Norway to educate, change attitudes and reduce discrimination against persons with mental disorders. The effect of these campaigns has not yet been evaluated.

A need to challenge the idea that it is not appropriate to work unless one is 100% fit and healthy has been spoken for [364], with an increased focus on what the individual can do at work rather than what they cannot do [367]. Graded sickness absence implies a continued contact with the workplace during episodes of heightened symptom loads, and is assumed to be more positive for health and wellbeing, and to facilitate return to work, compared with full sickness absence [150, 368, 369]. This assumption has, however, only been examined in a few studies, with inconclusive findings of any positive effect [368, 370, 371]. More studies are thus needed before we can conclude that increased use of graded sickness absence is effective in reducing sickness absence and prevent ill health retirement for the individual and in the population.

Norway has been criticized that high economic compensation for sickness absence and ill health retirement may reduce the motivation for individuals with milder health complaints to stay in work [146, 372]. Studies have found that increased sickness absence compensation is followed by increased sickness absence rates [373], that reduction in sickness absence compensation is followed by decreased number of absences and duration of absence [313], and that recovery rates raises enormously just prior to the exhaustion of sickness absence benefit rights [374]. A key recommendation from OECD to Norway has thus been to reduce the ill health benefit

compensation levels [146]. Reduced sickness and disability compensation may however also increase the gaps in health due to socio-economic position, and there has traditionally been little political willingness to reduce sickness and disability compensation in Norway.

In summary, many different types of interventions, both aimed towards the individual, the workplace and the wider society, may be effective in reducing and preventing sickness absence and ill health retirement. However, we still lack a firm evidence base to determine the relative effect of such interventions, and to what degree they can make a difference, be cost-effective and help individuals maintain gainful employment.

## 4.6 Future research

In 2004, an extensive literature review concluded that the scientific knowledge base on sickness absence and ill health retirement was surprisingly limited [95]. Since then, there has been a substantial development in methodology and number of studies conducted in the sickness absence research field. There are now an increasing number of longitudinal studies examining sickness absence and ill health retirement as consequences of mental health problems, and the results from the present dissertation add to the knowledge gained from these studies.

Although the contribution from common mental disorders on sickness absence and ill health retirement is increasingly established, there are still many questions that need answers. To be able to reduce or prevent sickness absence and ill health retirement due to common mental disorders, more knowledge about the mechanisms driving the process from work participation to nonparticipation are needed. We need to know more about how and why the characteristics of common mental disorders cause particular challenges for work participation. Studies of individuals with common mental disorders who do not experience sickness absence or ill health retirement may aid in the search for skills and characteristics that may be helpful in the avoidance of occupational impairment. As prescription of sickness absence is a common practice,



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and as ill health retirement affects a large portion of the working age population, we also need more knowledge regarding the consequences of being sickness absent or retired due to ill health. Finally, there is an urgent need for high quality RCTs which can identify effective interventions to reduce or prevent sickness absence and ill health retirement among individuals with common mental disorders.

## 5. CONCLUSIONS

In the present dissertation, information from the epidemiological Hordaland Health Study (HUSK) and data from the official and complete Norwegian registries over sickness benefits and disability pension award were utilized to examine the long-term consequences of anxiety and depression on sickness absence and ill health retirement in the general population. The results show that common mental disorders are important contributors to all-cause sickness absence and ill health retirement in the general population. Common mental disorders are risk factors for long duration and frequent recurrence of sickness absence. The associations between common mental disorders and sickness absence and ill health retirement are long-lasting, and also symptoms of anxiety and depression not reaching case-level have detectable effects on ill health retirement in the population. The present dissertation has further shown that anxiety is as important as depression in the association between common mental disorders and sickness absence and ill health retirement. The contribution from anxiety should thus be taken into consideration when interventions aimed to reduce sickness absence and ill health retirement are implemented. Common mental disorders greatly contribute to number of lost working years in the population, due to disability pension awarded in young age. Sickness absence and ill health retirement may have severe negative consequences for both the individual and the wider society and economy, and these may be intensified when the work-life exit happens in a young age. There is thus a great need for effective interventions that can reduce or prevent sickness absence and ill health retirement among individuals with common mental disorders.

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