

Interrupted careers

**A study of social divisions in long-term sickness
absence and work attrition**

Aleksander Årnes Madsen

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OSLOMET

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Summary

This dissertation examines social divisions in long-term sickness absence and work attrition. It examines whether and how these career interruptions are associated with individuals' positions in the division of labor and their gender. By focusing on specific sets of workers and monitoring their long-term labor market trajectories, the dissertation contributes to the sociological literature on the relationship between individuals' attainment in the labor market and their life chances. The dissertation consists of four articles based on analyses of administrative register data for the period 2003–2013.

The first article studies disparities in the risk of long-term sickness absence among professionals. The study investigates whether this risk varies according to socioeconomic position and the performance of care work. It also explores whether such a correlation is due to sociodemographic or labor market factors. The results show that both lower socioeconomic position and care work are associated with a higher risk of long-term sickness absence. The interaction between the two dimensions shows that the association is particularly strong for caring professionals of lower socioeconomic position. This is true for both men and women, but especially for men. The observed disparities are partly reduced after the introduction of sociodemographic and labor market factors, and more so for men compared to women.

Education–occupation mismatch is studied in the second article. The article explores whether over- or undereducation, i.e., a mismatch between educational level attained and that required by the occupation, is associated with long-term sickness absence. Both individual and occupational characteristics are accounted for by means of panel data methods. The study finds that, for both men and women, overeducation is positively associated with a higher risk of long-term sickness absence compared with individuals with an education–occupation match. For undereducated men and women, this association is negative. After individual and occupational characteristics are controlled for, the short-term association is almost eliminated. However, the association remains strong for long-term mismatched individuals. The results are robust across different specifications of over- and undereducation.

The third article investigates whether the gender segregation of labor markets is associated with job transitions and transitions to nonemployment. Women and men's attrition rates from male-dominated workplaces are compared. Moreover, the article examines whether women's attrition is associated with their minority status, work–family conflict, and socioeconomic position. The results show that women are much more likely than men to leave male-dominated workplaces. The study also finds that a higher percentage of men in the

workplace increases the likelihood of women leaving for gender-balanced workplaces, independently of socioeconomic position. Regarding work–family conflict, the study shows that family formation is associated with an increase in the likelihood of attrition to female-dominated workplaces and to nonemployment, but primarily for female manual workers.

Finally, article 4 studies the potential long-term consequences of long-term sickness absence. More specifically, the article explores prototypical labor market trajectories following individuals' first spell of long-term sickness absence and whether certain types of workers are more likely to follow adverse trajectories. Nine prototypical trajectories are identified and examined. The majority of people return to stable full-time work. However, the study reveals eight other trajectories characterized by transitions to part-time work, unemployment, new spells of sickness absence, rehabilitation, and permanent work disability. A central finding is that women and individuals in lower socioeconomic positions are more likely to follow trajectories indicating labor market marginalization.

Taken together, the self-contained articles nuance the understanding of the association between labor market attainment and attachment by studying specific segments of workers and following their career trajectories over time. In this way, they contribute to the literature on social divisions in labor market outcomes.

Sammendrag

Denne avhandlingen utforsker sosiale forskjeller i langtidssykefravær, samt overganger mellom jobber og avgang fra arbeidsmarkedet. Spørsmålet som stilles i denne avhandlingen er hvorvidt og hvordan disse arbeidsmarkedsavbrytelsene er forbundet med individers posisjon i arbeidsmarkedsstrukturen og deres kjønn. Ved å fokusere på bestemte grupper av arbeidstakere og følge deres arbeidsmarkedsforløp over tid, bidrar avhandlingen til den sosiologiske forskningslitteraturen om forholdet mellom individers arbeidsmarkedsoppnåelser og deres livssjanser. Avhandlingen består av fire artikler som alle benytter seg av administrative registerdata for perioden 2003-2013.

Avhandlingens første artikkel studerer forskjeller i risiko for langtidssykefravær mellom profesjonsutøvere. Studien undersøker hvorvidt risikoen for langtidssykefravær samvarierer med profesjonsutøvernes sosioøkonomiske posisjon og hvorvidt de utfører omsorgsarbeid. Den utforsker også om samvariasjonen kan tilskrives demografiske faktorer og arbeidsmarkedsfaktorer. Resultatene viser at både lavere sosioøkonomisk posisjon og omsorgsarbeid samvarierer med en høyere risiko for langtidssykefravær. Samspillet mellom de to dimensjonene viser at sammenhengen er spesielt sterk for omsorgsprofesjoner med lavere sosioøkonomisk posisjon. Det gjelder for både menn og kvinner, men særlig for menn. De observerte forskjellene blir delvis redusert etter at demografiske faktorer og arbeidsmarkedsfaktorer blir kontrollert for, og det mer for menn enn for kvinner.

Mismatch mellom utdanning og yrke er tema for den andre artikkelen. Artikkelen undersøker om over- og underutdanning, det vil si en uoverensstemmelse mellom oppnådd utdanningsnivå og utdanningsnivået forventet i yrket, samvarierer med risikoen for langtidssykefravær. Både egenskaper ved individene og yrkene tas høyde for ved hjelp av paneldatametoder. Studien finner at overutdanning er sterkt forbundet med en høyere risiko for langtidssykefravær sammenlignet med individer som har et utdanningsnivå som passer yrket, både for menn og kvinner. Det motsatte er tilfellet for underutdannede. Sammenhengen forsvinner nesten fullstendig ettersom analysene kontrollerer for egenskaper ved individene og yrkene. For individer som opplever en langvarig uoverensstemmelse, derimot, forblir sammenhengen sterk. Resultatene viser seg å være robuste på tvers av ulike spesifikasjoner av over- og underutdanning.

Den tredje artikkelen undersøker hvorvidt kjønnssegregeringen i arbeidsmarkedet er forbundet med overganger mellom jobber og avgang fra arbeidsmarkedet. Kvinner og menns avgangsrater fra mannsdominerte arbeidsplasser sammenlignes. Artikkelen undersøker også

hvorvidt kvinners avgang er forbundet med deres minoritetsstatus, arbeid-familie konflikt, og sosioøkonomiske posisjon. Resultatene viser at kvinner er langt mer tilbøyelige til å forlate mannsdominerte arbeidsplasser sammenlignet med menn. Studien finner også at en høyere prosentandel av menn på arbeidsplassen øker sannsynligheten for en overgang til kjønnsbalanserte arbeidsplasser, uavhengig av kvinnenens sosioøkonomiske posisjon. Når det gjelder arbeid-familie konflikt så viser resultatene at familieførøkelse øker sannsynligheten for en overgang til kvinnedominerte arbeidsplasser og avgang fra arbeidsmarkedet, men primært for kvinner i manuelle yrker.

Til slutt studerer artikkel 4 mulige langtidskonsekvenser av langtidssykefravær. Mer spesifikt så undersøker artikkelen idealtypiske arbeidsmarkedsforløp som følge av individers første langtidssykefravær og hvorvidt bestemte typer arbeidstakere i større grad følger forløp kjennetegnet av svakere arbeidsmarkedstilknytning. Ni idealtypiske forløp blir identifisert og nærmere studert. Mens majoriteten returnerer til stabilt fulltidsarbeid, kjennetegnes åtte av forløpene av overganger til deltidsarbeid, arbeidsledighet, nye sykefravær, attføring, og permanent uførhet. Et sentralt funn i artikkelen er at kvinner og personer med lavere sosioøkonomisk posisjon har en høyere sannsynlighet for å følge forløp forbundet med arbeidsmarkeds marginalisering.

Til sammen bidrar de selvstendige artiklene til å nyansere sammenhengen mellom arbeidsmarkedsoppnåelser og –tilknytning ved å studere bestemte grupper av arbeidstakere og følge deres arbeidsmarkedsforløp over tid. Avhandlingen bidrar på denne måten til litteraturen som omhandler sosiale skiller i arbeidsmarkedsutfall.

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- Article 1 Madsen, A.Å. (2018). Long-term Sickness Absence Among Professionals: Investigating Gender, Socioeconomic Position and Care work. *Nordic Journal of Working Life Studies*, 8(4). Retrieved from <https://doi.org/10.18291/njwls.v8i4.111928>
- Article 2 Madsen, A.Å. and Røberg, K.I.K. (forthcoming). Education–occupation mismatch and long-term sickness absence: A longitudinal study of over- and under-education using Norwegian population data, 2003–2013. Submitted to *Journal of Education and Work*.
- Article 3 Madsen, A.Å., Brekke, I. and Fekjær, S.B. (forthcoming). Women’s attrition from male-dominated workplaces. Submitted to *Work, Employment & Society*.
- Article 4 Madsen, A.Å. (2019). Return to work after first incidence of long-term sickness absence: A 10-year prospective follow-up study identifying labour market trajectories using sequence analysis. *Scandinavian Journal of Public Health*. Retrieved from <https://dx.doi.org/10.1177/1403494818821003>

I. Introduction

Work is a central activity in all societies. People derive their livelihood from work, it is an important determinant of their social identity, relationships, and status, and it is associated with the overall welfare of individuals across a range of measures (Kalleberg, 2007). For society, work promotes social cohesion and economic development and provides essential services for its population; this is especially true for modern welfare states with extensive social policies. Individuals' labor market participation, then, is vital at both a personal and a societal level. However, issues of labor market participation overlap with questions about how the labor market is organized. As workers exchange their labor for wages, status, and other job rewards (Kalleberg and Sørensen, 1979), the social division of work shapes the social conditions and life chances of individuals (Payne, 2000). Consequently, labor market attachment (LMA) may vary according to position in the division of labor, reflecting dissimilar conditions of work. A sociological aim of labor market analyses is to understand how social structures related to the economy impact the lives of individual workers and determine various forms of inequality (Kalleberg and Sørensen, 1979). The aim of this dissertation is to examine social divisions in absence and attrition from work. It contains four self-contained articles that discuss careers that are interrupted by absence or attrition and relates them to the social structure of the labor market by means of Norwegian longitudinal population data. More specifically, it investigates the relationship of socioeconomic position and gender with long-term sickness absence and work attrition, with the latter including job separations, unemployment, and permanent work disability.

The first article studies differences in risk of long-term sickness absence among a set of service class workers, namely professionals. The article investigates whether risk of absence is associated with socioeconomic position and care work, and it considers several labor market and sociodemographic factors. Article 2 studies the relationship between long-term sickness absence and education–occupation mismatch, with the latter referring to a mismatch of both skills (i.e., over- and underqualification) and positions (i.e., status inconsistency). The article examines the association in general and whether it varies by gender, time spent in a mismatched state, and different specifications of mismatch. Article 3 study women's attrition from male-dominated workplaces. The women's attrition rate is compared with men's, and the article examines whether women's attrition is associated with their minority status and work–family

conflict, as well as the interaction with socioeconomic position. Attrition is investigated in the form of both job change and nonemployment. Finally, the fourth article explores prototypical labor market trajectories and LMA following the first incidence of long-term sickness absence. The associations between the trajectories and socioeconomic position, gender, and other sociodemographic variables are assessed to examine whether some segments of workers are more likely to experience labor market marginalization over time.

The four articles examine careers that are put on hold or altered in some way, i.e., interrupted. Articles 1, 2, and 4 study long-term sickness absence. Norway has the highest rate of sick leave among OECD countries, almost twice that of other Nordic countries, which also have relatively high rates (OECD, 2013a). The high levels of absence have prompted concerns over the sustainability of the Norwegian welfare state and discussions of appropriate levels of absence (Bay et al., 2015; Hagelund, 2014). In general, sickness absence is a complex and multi-faceted phenomenon affecting the quality of life and economics at the level of individuals, families, firms, and society, and is related to a wide range of factors, from business cycles to individual attributes (Alexanderson, 1998). Absence from work indicates some lack of functioning on a physical, psychological, or social level, and is often considered an indicator of job quality and satisfaction, in addition to ill health (Marmot et al., 1995). Previous studies have found that the risk of absence varies by education, income, occupation (Allebeck and Mastekaasa, 2004b), and gender (Bekker et al., 2009). An aim of articles 1 and 2 is to supplement and nuance our knowledge of the influence of socioeconomic position on sickness absence by focusing on specific constellations of education and occupations and their interrelationship with gender.

Articles 3 and 4 investigate forms of attrition from work. Article 3 examines job separation, in addition to nonemployment, as a form of attrition. Women make a radical shift by leaving male-dominated workplaces, possibly sacrificing job-specific human capital and career prospects. As such, it complements studies of gender segregation and absence from work (see e.g., Melsom and Mastekaasa, 2018). Moreover, prolonged sickness absence not only entails temporary absence from the labor market, but could also mark the onset of labor market marginalization and social exclusion (Bryngelson, 2009; Ockander and Timpka, 2003). Absence from work can involve a loss of human capital and lower future income (Markussen, 2012) and predict future sick listing, unemployment, permanent work disability, and mortality (Gjesdal and Bratberg, 2003; Virtanen et al., 2006). Furthermore, from a life-course perspective, the accumulation of risks associated with absence and attrition from work may

depend upon workers' position in the division of labor. Article 4 studies social divisions in the long-term process of labor market attrition following sickness absence.

The purpose of this introduction is to present a general framework for the four articles that constitute the dissertation. The introduction continues by presenting the theoretical framework that underpins the four articles. I will elaborate on the social division of labor and its relationship with the outcomes studied, which are often outside the limits of research articles. Relevant previous studies are then reviewed. Next, I briefly describe the Norwegian context for the period under study (2003–2013). The following section presents the data and methods used. Finally, a brief summary of the four articles is followed by a short discussion and conclusion to complete the dissertation.

II. Theoretical framework

This dissertation pertains to the sociology of labor markets and work. Central to sociological inquiry and the topic of numerous studies, the field is intrinsically eclectic and incorporates insights from a range of theoretical perspectives (Kalleberg, 1983). Thus, this dissertation has no single unifying theoretical framework, but draws on several perspectives of labor markets and individuals' attachment to them. The purpose of this chapter is to introduce relevant overarching sociological perspectives on the labor market and relate these to the research aim and the four articles. The chapter has two parts pertaining to the independent and dependent variables of the dissertation. The first half of this chapter elaborates on the social division of labor. The second half is devoted to the labor market outcomes studied and their relationship with the independent variables measuring social divisions of work.

The social division of labor

Postindustrial labor markets are characterized by a division of labor. Task differentiation makes the labor market the primary area for social stratification¹ as individuals are allocated to hierarchically unequal positions. There is a long-standing debate in the social sciences over whether the inequality produced by a stratified division of labor is beneficial for society. On the one hand, stratification may be seen as necessary to ensure that the most qualified workers occupy important positions with inequality in rewards as incentives for training and effort (e.g., Davis and Moore, 1945). On the other hand, many have criticized this view for overstating the societal benefits of stratification and underplaying issues of power and conflict (e.g., Tumin, 1953). Notwithstanding the question of the formation and legitimacy of a system of stratification, it is widely acknowledged that differences in social position are associated with differences in individual life chances—that is, differences in opportunities, lifestyles, and general prospects (Bottero, 2005: 38). While life chances are often thought of in economic terms, they encompass a range of assets considered desirable in a given society, such as health (Grusky and Weisshaar, 2014). Moreover, just as assets come in many forms, so does stratification. While individuals are unequally distributed according to occupation, other social

¹ Stratification refers to “hierarchical organized social relationships entailing inequality along economic, social and cultural dimensions” (Bottero, 2005: 11).

divisions, such as gender, also exist (Bottero, 2005). In this section, I briefly elaborate on some basic concepts of stratification; these form the sociological backdrop of the articles.

Jobs and occupations

At the most fundamental level of the division of labor are jobs, which are work tasks associated with particular skills that require certain qualifications (Kalleberg, 2007: 11). Jobs are situated in workplaces, which in turn, are often nested within firms. Occupations are an aggregation of jobs in which similar tasks are performed and have similar technical requirements (Bielby and Kalleberg, 1981: 126). Hence, the term “occupations” refers to groups of activities that form the kinds of work that people do (Kalleberg, 2007). In sociological analyses of the division of labor, occupations are often the units of analysis (Bielby and Kalleberg, 1981) because they are central to the allocation of resources within a society, of either material (e.g., income) or immaterial (e.g., status) kinds (Svensson and Ulfsdotter Eriksson, 2009). However, it is important to acknowledge that occupations are proxies for conditions of employment (Chan and Goldthorpe, 2007). Hence, while they aim to capture commonalities across jobs, not all internal heterogeneity is accounted for. Some critics are skeptical of using occupations as the unit of analysis because they can have high internal heterogeneity and thus do not capture the work of individuals with satisfactory precision (Baron and Bielby, 1980). Nonetheless, an argument for using occupations in analyses of labor markets is their rising prominence. Kalleberg (2009) argues that organizational careers with investments in firm-specific skills are in decline, while occupational careers with an emphasis on general skills and training are on the rise, resulting in occupational internal labor markets. Nevertheless, the choice of whether to measure employment relations on the level of jobs, workplaces, firms, or occupations depends on the analytical aim. Both occupation and workplace are used in this dissertation.

Occupational class

The concept of occupational class in this dissertation refers to groups of occupations sharing a similar socioeconomic position² in the division of labor. The measure applied in articles 3 and 4 is based on Goldthorpe’s class scheme, which I will briefly describe. This is important because social scientists disagree widely on the concepts of socioeconomic position and social class (Sørensen, 2001), and the number of measures and their operationalization varies greatly in empirical research (Bollen et al., 2001).

² Socioeconomic position is a general term used in this dissertation to denote individuals’ socioeconomic position in the division of labor. It encompasses professions, occupations, and occupational classes.

In Goldthorpe's class scheme, class positions are defined by employment relations in labor markets and production units (Chan and Goldthorpe, 2007). At its base is the Weberian notion that classes consist of individuals with similar life chances, and that the labor market distributes these life chances according to an individual's assets (Breen, 2005). This is an 'employment-aggregate' approach that attempts to "map the stratification order at a national and cross-national level by grouping together occupations with similar labor-market and employment relations" (Bottero, 2005: 77). Generally, the scheme differentiates between employers, self-employed workers, and employees. However, it further differentiates employees in terms of their relationships with employers based on their employment contracts (Chan and Goldthorpe, 2007). Workers have either a labor contract or a service contract. The type of contract depends on the specificity of their assets, that is, their job-specific skills, expertise, or knowledge, and the difficulties of employers in monitoring workers. The service contract, compared with the labor contract, is advantageous in several respects, such as higher autonomy, job-security, salary increments, and career opportunities (Breen, 2005). Goldthorpe's schema entails 11 classes of which the major divisions are between the service class, intermediate class, manual class, and petty bourgeois. In article 4, I differentiate between the higher and lower service classes, the intermediate class, and the manual class, while in article 3, I cover the service class, intermediate class, and manual class. The petty bourgeois and the self-employed are excluded from the analyses because they are not registered in the administrative register data³.

The concept of class associated with this approach is often referred to as a "stratum concept of class" (Sørensen, 2001) or "class as life conditions" (Sørensen, 2000). A main task is to identify homogenous class categories affecting individual life chances, and it is widely used in empirical research and often employed as a general measure of socioeconomic resources (Sørensen, 2000). For example, the British National Statistics Socio-economic Classification (NS-SEC) is based on Goldthorpe's class scheme. To avoid the major theoretical debate on social class analysis (see e.g., Sørensen, 1991) and underscore the practical use of Goldthorpe's class scheme as a measure of individuals' position in the division of labor, the terms "socioeconomic position" or "occupational class" are used rather than social class. Furthermore, the term "socioeconomic position" serves the purpose of distancing itself from the concept of "status". Class and status are both conceptually and empirically distinct (Chan and Goldthorpe, 2007), and the term "status" is shrouded in misunderstanding (Sørensen, 2001).

³ See chapter V. *Data and methods* in this introduction for further information on dropping self-employed individuals from the analyses.

Thus, socioeconomic status “blurs the distinctions between two different aspects of socioeconomic position: (a) actual resources, and (b) status, meaning prestige- or rank-related characteristics” (Krieger et al., 1997: 346).

A possible objection to using Goldthorpe’s scheme is its lack of an explicit hierarchical ranking of positions (Galobardes et al., 2006b). However, the scheme contains strong hierarchical elements (Bottero, 2005). According to Goldthorpe himself, a lack of rank is mainly found within the intermediate classes, entailing a hierarchy of advantage between the service, intermediate, and working classes (Chan and Goldthorpe, 2007), which is the level of aggregation used in this dissertation.

Professions

Professions are distinct occupations in the division of labor. Historically, scholars have debated their defining characteristics, status, interests, and interrelationships (see e.g., Fauske, 2008 for an overview). As this dissertation is concerned with whether their position in the division of labor affects the life chances (i.e., risk of sickness absence) of professionals, I emphasize perspectives on labor markets, stratification, and privilege. These perspectives on professions can to some extent be labelled “neo-Weberian” (Saks, 2010, 2012).

Abbot’s (1988: 8) definition of ideal–typical professions as “exclusive occupational groups applying somewhat abstract knowledge to particular cases” is useful as a point of departure because it highlights several crucial aspects of the concept of professions. To begin with, professions are exclusive. In Weber’s (1978) terms, they operate in closed relationships. Professions strive to improve their market situation by curbing competition and closing access to outsiders. There has been much debate over whether this serves society (e.g., entails higher quality of services) or self-interests (i.e., improving professionals’ life chances); it probably does both, but the latter is of concern here. Professions seek exclusivity by claiming jurisdiction (Abbott, 1988), that is, to be sanctioned by the state to be the sole proprietor of a service by legal regulation. Thus, they seek to monopolize (Larson, 1977) certain parts of the labor market. In addition to controlling task performance, professions control the supply of labor by controlling access to professional training and qualification credentials (Freidson, 2001). Therefore, an inextricable link exists between professions and higher education, with scholars emphasizing knowledge and expertise (Saks, 2012) and a scientific basis (Brante, 2011) as defining traits. Educational and scientific institutionalization allow professions to control the abstract knowledge underlying their practical skills (Abbott, 1988). Thus, professionals differ

from the crafts described in their abstract academic knowledge and from academic generalists in their exclusive practical application of this specialized knowledge.

Closure (Murphy, 1988; Weber, 1978), the process whereby access to professions is controlled, entails exclusion. However, the labor market situation of professions can also be described as a shelter because they are protected from the power of employers (Freidson, 2001). Shelter from outside competition and control characterizes internal labor markets (Althauser, 1989; Althauser and Kalleberg, 1981). In the literature, internal labor markets often refer to bureaucratically organized or firm internal labor markets (e.g., Althauser and Kalleberg, 1981), entailing entry at the bottom, firm-specific, informal, on-the-job training, and job ladders controlled by management. However, the professional labor market is controlled by occupations (Freidson, 2001) and characterized by formal training prior to entry, absence of job ladders (mobility occurs between rather than within firms and establishments), and the requirement for a license to practice. The professional labor market materializes through the professionalization processes described above (Mastekaasa, 2008).

The ideal–typical professionals belong to the higher strata of employees in the division of labor. In Goldthorpe’s class scheme, they have a service contract. They have a high specificity of assets and are difficult to monitor (Breen, 2005). In a service relationship, professionals can “exercise autonomy and discretion, have delegated authority, and dispense their expertise on behalf of their employers, who trust them to make decisions for the good of the organization” (Bottero, 2005: 78). Following Sørensen (1999, 2001), the privileged socioeconomic position also causes (monopoly) rents: the restrictions on training opportunities and the closed employment relationships entail that the professionals accrue a higher return on their skill than would be expected given their investment. While the ideal–typical profession entails privilege, the occupationally controlled labor market has a hierarchical structure based on the profession’s authority, content and character of expertise, and jurisdiction (Freidson, 2001: 56). The literature often differentiates between professions of high and low position according to such criteria. For example, Etzioni (1969) distinguishes between full and semi-professions with the latter in a subordinate position owing to a weaker development of professional characteristics. From a neo-Weberian perspective, dominant professions (e.g., physicists) differ from marginalized professions (e.g., nurses) entailing different levels of autonomy, income, status, and power (Saks, 2015). Hence, some professions belong to the upper, while others belong to the lower service class (Breen, 2005).

Gender segregation

The division of labor is highly gendered, both in the Western world in general (Charles and Grusky, 2004) and in Norway (Reisel and Teigen, 2014b). In the literature, scholars differentiate between horizontal and vertical labor market segregation. Horizontal segregation refers to the unequal distribution of men and women according to education, industry, sector, and occupation. Vertical segregation entails men holding advantageous positions in the job hierarchy, such as managerial positions, which come with more influence, income, and prestige. In the division of labor, women are

concentrated in the middle of the labor market, in intermediate and junior non-manual work and semi-skilled manual and personal service work, “crowded” into caring, catering and clerical areas. Their greater propensity to work part-time (around half are part-timers) further skews their labor-market distribution, with part-time jobs overwhelmingly concentrated in the semi- and unskilled sectors (such as catering, cleaning, domestic service, child-care) (Bottero, 2005: 109).

Owing to the strikingly different allocations of men and women, some have characterized postindustrial labor markets as ‘hypersegregated’ (Levanon and Grusky, 2016). In the literature, the division of labor according to gender has been attributed to supply- and demand-side processes and their interdependence.

Supply-side explanations concern individual differences in abilities and preferences. From a human capital perspective (Becker, 1993), these differences are reflected in men’s and women’s human capital, which is decisive for their opportunities in the labor market (Polachek, 1981). Demand-side explanations, on the other hand, focus on the employer. In these explanations, exclusion based on employers’ attitudes and preferences is central (Bielby and Baron, 1986). In sociological explanations of both supply- and demand-side processes, the notion of gender-essential beliefs is crucial; these are “sets of widely taken-for-granted cultural beliefs about the essential natures and relative worth of men and women” (Chatillon et al., 2018). According to Levanon and Grusky (2016), supply- and demand-side forces are interdependent and mutually reinforcing because they are both based on the same essentialist beliefs. They argue that while segregation is partly a reflection and expression of the differential tastes of men and women, they are also formed in reaction to the presumed essentialism of others (e.g., employers). In addition to gender-essential beliefs, supply-side processes could also be due to physiological differences between genders and the interplay with the social environment (Berenbaum et al., 2011; Davis and Blake, 2018; Wood and Eagly, 2012), with biological dispositions mediated through proximate social processes (Ridgeway, 2011: 19).

Because men and women are allocated to different sectors of the occupational structure, socioeconomic positions differ systematically by gender with consequences for life chances. For example, in research on the gender gap in earnings, women's overrepresentation in care work is associated with a wage penalty (England and Folbre, 1999). Moreover, in addition to material consequences, gender segregation can also have cultural effects, such as by affecting workplace cultures (Bottero, 2005: 112). Finally, central to many studies of gender segregation are men's and women's roles in family formation and the potential work–family conflict facing women caring for children.

Labor–market mismatch

The division of labor raises the question of matching people to positions. As mentioned in the introduction to this section, from a functionalist perspective, inequalities in labor market rewards (e.g., income or autonomy of work) can function as incentives to ensure a satisfactory match, i.e., that the resources of individuals match the demands of their work. Generally, labor–market mismatch refers to a lack of fit between individuals and their jobs. It is a product of the skills, preferences, values, needs, and expectations of individuals on the one hand, and the characteristics and rewards associated with their jobs on the other (Kalleberg, 2007). According to Kalleberg (2007, 2008), several types of labor–market mismatches exist. For example, “work–family mismatch” refers to individuals being unable to fulfill either their job or family obligations adequately without interference from the other, while “temporal mismatch” refers to workers working too few or too many hours. There are other types of mismatches; the consequences of skill mismatches⁴ are examined in the second article of this dissertation.

Skills mismatches are situations where there is a lack of fit between people's skills or qualifications and their jobs' skill requirements. There are two general kinds of skill mismatches: *overqualification*, in which people's skills (often equated with their education and other work-related qualifications) exceed the skills required to perform the job; and *underqualification*, in which people do not have the skills required to carry out job duties adequately (Kalleberg, 2007: 12).

Mismatch can lessen productivity (Kalleberg, 2008), and may have numerous other detrimental effects, such as hampering job satisfaction and health. Furthermore, the question of

⁴ Overeducation, overqualification, overschooling, overtraining, overskilling, and underemployment are all closely related terms referring to a skill mismatch where the skill of individuals exceeds the requirements of the job. However, some economists argue that there are qualitative differences between these terms (Leuven and Oosterbeek, 2011). Nevertheless, in this dissertation, the term “overeducation” is used to denote education exceeding the educational requirements of the occupation. It is also used to denote a mismatch of positions or statuses, i.e., a mismatch of educational and occupational position.

mismatches is interrelated with other aspects of the division of labor. First, some socioeconomic groups may be especially vulnerable to mismatch, such as manual workers facing rapid technological change. Second, the threat of mismatch can also depend on the type of labor market in which workers find themselves. Individuals belonging to firm-internal labor markets are perhaps more vulnerable to mismatch as their firm-specific skills are not easily transferable to other firms (Althauser, 1989; Althauser and Kalleberg, 1981), while professionals belonging to professionally-controlled labor markets may be protected against mismatch owing to the close match between skills and occupation, and to their professions' control over the supply of labor. Finally, mismatch is also interrelated with sociodemographic variables. For example, older cohorts may be more vulnerable because of increasing credentialization, while women are more likely to struggle with maintaining a work–family balance and to face discrimination, making it more difficult to attain a match (Kalleberg, 2007).

While mismatch can be understood in practical terms, as above, it can also be conceived as a mismatch of statuses or social positions. In the literature on status inconsistency (Lenski, 1954), mismatch can be a discrepancy between the status or prestige derived from education and that associated with a current occupation. An inconsistency or mismatch occurs if an individual ranks higher on one status dimension (e.g., education) compared with another (e.g., occupation) and expects that they should match (Goffman, 1957). A status inconsistency, in turn, can be stressful as it can produce role conflict or a mismatch of expectations through mechanisms such as relative deprivation (Runciman, 1966; Runciman and Bagley, 1969).

From social divisions to individual outcomes

How do positions in the division of labor relate to absence and attrition from work? As mentioned in the introduction to this chapter, the dissertation applies a range of perspectives to investigate the outcomes studied. In the following section, I briefly elaborate on how social position relates to individual outcomes and how sickness absence and work attrition can be understood as outcomes, and summarize the explanations applied in the articles.

How does social position relate to individual outcomes?

A premise of this dissertation is that social structure matters for individuals' life chances, which entails that social position is more than just an approximation of individual characteristics. As Bielby and Kalleberg (1981) note, social positions (e.g., occupation, occupational class) are “empty places” that are causally prior to individual attainment. Focusing on occupations, they argue that occupations are differently rewarded and that access to rewards must be understood

as a product of both individual achievement and occupational resources. They differentiate between two types of rewards: (1) extrinsic rewards, which are an “incumbent’s claim on the value of the goods and services that are outputs of the technical production process” (ibid 1981: 127), such as income and security of employment; and (2) intrinsic rewards, which conversely, are “those that derive from the nature of the occupational task itself and do not involve explicit claims on the value of output” (ibid 1981: 127). Examples of intrinsic rewards are the demands, tasks, and social and physical conditions of work. Such intrinsic rewards (e.g., work environment) are central to the outcomes studied in this dissertation. In this framework, inequality in rewards cannot be attributed to only inequality in technical requirements (e.g., skills and training required), i.e., individual achievement. This is true because occupations are embedded in social relations: occupational groups have differential access to resources allowing for claims upon the value of the output and control over the production process that can affect intrinsic rewards (Bielby and Kalleberg, 1981). For example, some professions use their labor market control to improve the intrinsic rewards (e.g., job autonomy) for their incumbents over and above the characteristics of these incumbents. The structural explanation posited here is that there is an interaction between the characteristics of positions and the characteristics of people (Sørensen, 2001).

To discern the relationships between social position and the outcomes studied, the notion of causal proximity is useful. Socioeconomic position and gender can be understood as distal causes mediated through proximate determinants (Freese and Kevern, 2013). For example, the effect of socioeconomic position on long-term sickness absence can be mediated by work conditions (e.g., the frequency of awkward lifting positions associated with the job). However, causal proximity raises the question of whether the broad categories of socioeconomic position and gender can be reduced to mere placeholders for more proximate causes. On the one hand, if all proximate determinants are included and measured accurately, the effect of the distal causes, such as socioeconomic position, could be expected to be zero (Bollen et al., 2001). On the other hand, socioeconomic position and gender can be understood as fundamental causes with a massive multiplicity of connections with the outcomes studied. In the framework of fundamental causes, the effect of socioeconomic position and gender on the multi-faceted outcomes studied in this dissertation is not reducible to one set of mechanisms because the relationship is highly complex and varies over time and contexts (Lutfey and Freese, 2005). Nevertheless, the purpose here is not to commit to one notion of causality regarding the relationship between socioeconomic position/gender and absence/attrition, but to provide some concepts of how the relationship can be understood and to underscore its

complexity. Moreover, because including all relevant proximate determinants is rarely empirically feasible, it is vital to develop a strong theoretical account of the relationship studied, as Goldthorpe (2001) argues.

Are the outcomes a product of social behavior?

The dependent variables in this dissertation are labor market outcomes resulting (in part) from social behavior. Both work attrition and sickness absence presuppose labor market participation; hence, they are labor market outcomes. Work attrition in the form of job change is obviously an outcome of a social process involving employer and employee. This is less evident for sickness absence, as it can be understood as mainly a medical concern. This is reflected in the Norwegian Insurance Act, wherein sickness benefits presuppose a work disability that is clearly due to illness or injury⁵. However, while illness or injury are a prerequisite of sickness absence, they are seldom simply a reflection of health problems (see Hagelund, 2014 for a discussion of the concept of sickness absence). The social dimension of sickness absence is illustrated by fluctuations in the sickness absence rate, which are much larger than changes in public health (Ihlebaek et al., 2007). Hence, in medical sociology, it is commonplace to differentiate between *disease*, *illness*, and *sickness* denoting medical, personal, and social aspects of human ailments (Hofmann, 2002). Sickness absence can therefore be understood as *illness behavior* (Mechanic, 1995).

Illness behavior refers to the varying ways in which individuals respond to bodily indications, how they monitor internal states, define and interpret symptoms, make attributions, take remedial actions and utilize various sources of informal and formal care. Such behavior is important because it shapes the recognition of illness, the selection of patients into care, the degree of compatibility between patient and physician attributions, patterns of health practice and adherence with medical advice, and the course of illness and the treatment process (Mechanic, 1995: 1208).

In the literature, the social aspect of sickness absence is most prominent in research on absence cultures or shirking (e.g., Bradley et al., 2007; Dale-Olsen et al., 2011) and physician characteristics (e.g., Markussen et al., 2011). Consequently, sickness absence is a global measure of health resulting from a complex interplay between biological, physiological, psychological, and sociological processes. Hence, it falls under the domain of behavioral or social science (Alexanderson, 1998).

⁵ According to the Norwegian Insurance Act (§8-4), “sickness benefits are paid to a person who is disabled because of a disability that is clearly due to illness or injury. Disability caused by social or economic problems and the like do not entitle a person to sickness benefits” (author’s own translation).

Theories and factors explaining social divisions in absence and attrition

This dissertation draws on several theories and factors proposed to mediate the relationship between social position, absence, and attrition. These are explained in detail in the articles and will only be mentioned briefly here. Regarding sickness absence, a considerable amount of research is conducted without specific theories or models, especially in medical research (Allebeck and Mastekaasa, 2004a). Rather, a variety of factors are investigated without any explicit explanatory theory. Thus, below, both theories and factors proposed to link socioeconomic position and gender with absence and attrition will be mentioned. These can be categorized as those involving *conditions at work* and *conditions outside work*.

Work conditions can refer to both the physical and psychosocial characteristics of the work environment. In research on socioeconomic inequalities in sickness absence, physical work conditions are often a main explanatory factor. These include factors such as heavy lifting, awkward lifting postures, and exposure to chemicals. Physical conditions of work are perhaps primarily relevant for explaining differences between manual and service class workers, as in article 4. However, lower service class professionals, such as nurses, are probably more frequently exposed to the physical hazards of work (e.g., patient handling) compared with professionals such as physicians. Moreover, whether work allows for physical injuries could be important for long-term LMA. Jobs higher in the occupational hierarchy may allow for working while injured, while more physically strenuous jobs can make functional impairments incompatible with a return to work (RTW). For example, back pain is probably less compatible with working if the job requires heavy lifting. Additionally, the importance of physical strain for absence and attrition may vary by gender. Perhaps the strains of manual labor make women leave male-dominated blue-collar work to a greater extent.

In postindustrial labor markets dominated by service and trade, psychosocial work environment factors such as psychological health and stress become important determinants of work ability (Allebeck and Mastekaasa, 2004a). Several theoretical perspectives on how psychosocial factors can lead to absence and attrition are discussed in the dissertation. Karasek's (1979) 'demand-control' theory of job stress is perhaps the most prominent stress theory utilized in research on sickness absence. In this theory, "demands" refers to factors such as how hard and quickly people must work. "Control" (also called 'job decision latitude') refers to workers' authority over decisions, freedom to determine work performance, and whether workers can derive fulfilment from work by using and improving their skills. It is suggested that a situation with high demands and low control leads to stress that harms health. Article 1

proposes that disparities in sickness absence between professionals in higher and lower socioeconomic positions might be partly attributable to the latter's lower autonomy in combination with demanding work. Article 2 suggests that undereducated individuals may be overloaded owing to a lack of skills to meet the demands of work, while the overeducated may be understimulated in 'passive jobs'.

Another stress theory, Siegrist's (1996) "effort–reward imbalance" theory, shifts the focus from control to reward, and claims that a lack of reciprocity between cost and gains leads to emotional distress. "Effort" refers to both the demands of work and an individual's ability to cope, while "reward" means income, esteem, and control over one's occupational status. The effort–reward imbalance may be especially significant for individuals in lower socioeconomic positions because they are expected to sustain their efforts despite lower rewards and a lack of opportunities to shift to more rewarding work (Siegrist, 1996). An imbalance of effort and reward is used as a candidate explanation in article 2, where overeducated individuals may feel poorly rewarded compared with their investment in education, while the opposite is true for the undereducated.

The abovementioned stress theories propose psychosocial explanations for disparities in risk of sickness absence according to level or a mismatch of levels. However, the dissertation does more than explore hierarchical divisions in absence and attrition. To begin with, the literature on both emotional labor (Hochschild, 2003) and burnout (Maslach, 2003) proposes that human service work is especially stressful. This is primarily because of the emotional demands associated with caring for others, but could also stem from factors such as threats by violent clients. In article 1, the psychosocial cost of care work is a candidate explanation for disparities in sickness absence between caring and noncaring professionals, with the former term referring to professionals working in close contact with clients. Moreover, article 3 investigates whether being in the minority in the workplace makes women more likely to separate from their jobs. Mechanisms such as tokenism (Kanter, 1977), homophilous association (McPherson et al., 2001), and homosocial reproduction (Moore, 1988) are suggested as candidate explanations for women's minority status in the workplace leading to attrition. According to these theories, minorities run the risk of being seen as representatives of their minority group and becoming excluded and ignored by the majority.

The articles also discuss theories and factors outside work. Sick leave has a multifactorial background, and many causes are not directly related to the work environment (Alexanderson, 1998). To begin with, socioeconomic disparities in sickness absence could be due to differences in lifestyles, i.e., health behavior (e.g., smoking and obesity). In the literature,

income and education are considered to be especially relevant to health behavior. Education can reflect general knowledge and health literacy, while income provides material resources that facilitate healthy living (Galobardes et al., 2006a; Piha et al., 2010). Furthermore, in article 2, the stress theories proposed to explain the relationship between over- and undereducation and long-term sickness absence are supplemented with the more general theories of role conflict (Jackson, 1962) and relative deprivation (Runciman, 1966). In these theories, society at large is the frame of reference. Here, mismatch is thought to have detrimental effects caused by conflicting expectations of roles or feelings of deprivation compared with others, with stress as a possible result. Additionally, article 3 investigates whether women's attrition can be attributed to work-family conflicts. This is a prominent proposed explanation in the literature, with typically male-dominated work being incompatible with family formation. Furthermore, it is suggested that the impact of family obligations follows a classed pattern, where female manual class women are more likely to leave male-dominated settings because they prioritize family over work (Torre, 2017).

Finally, the relationship between social position and absence and attrition could be due to selection. There is considerable debate over the importance of selection for explaining social inequalities in health (see e.g., Chandola et al., 2003; Foverskov and Holm, 2015; Kröger et al., 2015). Selection may be "direct" or "indirect." Direct selection is the dependent variable affecting the positions that individuals attain, i.e., reverse causation. By contrast, indirect selection involves a third variable affecting both the dependent variable and attainment, indicating a spurious relationship (Blane et al., 1993). Regarding sickness absence, direct selection is present if absence-prone workers (e.g., workers with worse health) systematically sort into certain positions in the division of labor. If the association between position and sick leave is confounded by common factors (e.g., genetic factors and early life determinants), the selection is "indirect" (Torvik et al., 2015). Regarding minority attrition, it is plausible that women in male-dominated settings are a selected group more resistant to leaving (Cha, 2013), especially women in higher socioeconomic strata who have been habituated to and survived being a minority by attaining a higher level of education in a male-dominated discipline before entry (Torre, 2017).

III. Previous research

There is a large body of studies relevant to this dissertation. The four articles include research from several disciplines, such as sociology, economics, psychology, and epidemiology. Because three of the articles are on sickness absence, many of the studies reviewed are from the Nordic countries, owing to their universal coverage of sick pay and the availability of administrative register data.

Socioeconomic disparities in sickness absence

Socioeconomic disparities in long-term sickness absence are well established (Allebeck and Mastekaasa, 2004b). Studies can be categorized according to whether their aim is to document or to explain the prevalence of socioeconomic differences. Moreover, individuals' positions in the division of labor have been studied using both a general measure of socioeconomic position and social class schemes, with the former being the most common.

Several studies in Finland have investigated occupational class differences in sickness absence. In three recent studies, Pekkala et al. (2017a, 2017b, 2018) measured occupational class by differentiating between manual, lower nonmanual, and upper nonmanual workers using population data of long-term sickness absence periods of over 10 working days. These studies found that hierarchical differences in sickness absence remained large from 1996 to 2013 for both genders (2017b); the largest occupational class differences were in the prevalence of musculoskeletal diseases (2017a); and the largest socioeconomic differences in musculoskeletal diseases were in shoulder disorders and back pain, and for the length of absence in rheumatoid arthritis and disc disorders (2018). Using the same categories of occupational class and studying sickness absence periods over 9 working days, Ervasti et al. (2013) found a clear gradient in onset and recovery from absence caused by depression. The same categories were also applied by Sumanen et al. (2017), who studied specific age groups for all types of absence. The study found that relative hierarchical differences remained stable from 2002 to 2016, irrespective of age group and gender. In three studies by Piha et al. (2007, 2010, 2013), occupational class meant the categories of manual workers, routine nonmanual workers, semiprofessionals, and managers and professionals, and the study found similar results to the first study by Pekkala et al. (2017b) for periods of sickness absence over 3 working days. Interestingly, Piha et al. (2010)

found that only education and occupational class, not income, were independent determinants of sickness absence.

The number of studies of socioeconomic differences in sickness absence in terms of social class schemes are sparse, with only three Norwegian studies relying entirely on such schemes. The Goldthorpe scheme was used by Krokstad and Westin (2002) to study sickness absence periods over 3 days among men from a region of Norway. They found a clear gradient in absence, but of a somewhat modest magnitude. Hansen and Ingebrigtsen (2008) used the same scheme on a national representative sample for sickness absence periods of more than 14 days and found class differences in sickness absence, especially among men. Finally, Steinsland and Hansen (2011) used four social class schemes, including the Goldthorpe scheme, to study absence of more than 14 days. They found a modest but clear gradient, but none of the schemes stood out as especially well-suited to study sickness absence, and none had a satisfactorily predictive ability.

While numerous studies have investigated determinants of sickness absence in general (e.g., work environment factors), until recently, studies explaining the socioeconomic disparities in sickness absence have been lacking (Allebeck and Mastekaasa, 2004b). Recent research indicates that many of the socioeconomic disparities in sickness absence can be explained by physical work factors. A study of a random sample of the working population in western Sweden found that differences in the prevalence of sickness absence (>14 days) between five occupational classes of workers were completely or almost completely explained by physical working conditions for women and men, respectively (Löve et al., 2013). Similarly, in a Danish study, physical working conditions explained most of the occupational class differences in absence lasting for a minimum of 8 weeks, with some of the absence also explained by health behavior and psychosocial working conditions (Christensen et al., 2008). Physical workload also explained a substantial proportion of the socioeconomic differences in sick leave periods over 16 days for both genders in a Norwegian study (Corbett et al., 2015). A study in Finland of sickness absence periods over 3 days provides further evidence that physical working conditions are the most important factor for explaining occupational class differences in sickness absence. The study also found some explanatory evidence for health behavior and mixed results for psychosocial working conditions (Laaksonen, Piha, et al., 2010). Finally, two French studies found strong support for physical work conditions (Melchior et al., 2005; Niedhammer et al., 2008), with one also finding evidence that psychosocial stress was important for occupational class differences in sickness absence (Melchior et al., 2005).

Gender segregation and sickness absence

Women are widely known to have higher sickness absence rates than men (Bekker et al., 2009). Generally, scholars have had difficulty explaining the gender gap (Mastekaasa, 2016; Østby et al., 2018; Smeby et al., 2009). Nevertheless, several studies have investigated the relationship between men's and women's positions in the division of labor and sickness absence. As most postindustrial societies are strongly gender segregated, it is natural to seek explanations in the conditions of female- and male-dominated work⁶. Studies can be sorted into those that investigate the overall gender distribution at once and those that focus on specific gender-segregated sectors or occupations in the labor market.

In several studies, Mastekaasa et al. (2005; 2000; 2014; 1998; 2018) have examined whether gender disparities in sickness absence can be attributed to labor market gender segregation, i.e., whether women have more disadvantageous work conditions than men. Two studies of the Norwegian labor market compared men and women in the same occupation and workplace and found that gender differences in absences of over 3 days were not due to women being in less advantageous jobs (Mastekaasa and Dale-Olsen, 2000; Mastekaasa and Olsen, 1998). Similar results were replicated in a study of 17 European countries for periods of sickness absence over 1 week with detailed control for occupations (Mastekaasa and Melsom, 2014). By contrast, a study of sickness absence periods of over 60 days among municipality employees in Finland found that control for occupation explained a substantial proportion of gender differences in absence (Laaksonen, Mastekaasa, et al., 2010). Regarding the gender composition of occupations and workplaces, a study of sickness absence periods of over 2 weeks found a modest U-shaped pattern for Norwegian women, where those in male- and female-dominated settings were more likely to be absent compared with women in gender-balanced settings. For men, no such pattern was found (Mastekaasa, 2005). A weak U-shaped pattern for both women and men was found in two Swedish studies of absence periods of over 1 month (Bryngelson et al., 2011) and absence periods of over 7 days (Leijon et al., 2004). Finally, the observed U-shaped pattern could be due to selection. After applying individual fixed effects, Melsom and Mastekaasa (2018) found that in the Norwegian labor market, the

⁶ There are several other candidate explanations for the observed differences in sickness absence between men and women besides differences in conditions of work owing to gender-segregated labor markets. For instance, it is well documented that women are more likely to be absent when pregnant. Moreover, studies have investigated whether the double-burden of women, i.e., work–family conflict, is responsible for women's high sick leave rates. So far, research has been inconclusive or has indicated that combining work and family does not cause higher absence rates for women. See Mastekaasa (2016) and Bekker et al. (2009) for comprehensive reviews of gender and sickness absence.

association between the proportion of women in the occupation and sickness absence periods of over 8 days was negative. Hence, the study indicates that the abovementioned relationship between gender segregation and absence is due to a selection of absence-prone women into female-dominated occupations rather than adverse working conditions.

The current literature on sickness absence, then, indicates that women are in more rather than less advantageous occupations compared with men. Considering that men are overrepresented in manual occupations that are physically stressful, this is perhaps not surprising. Nevertheless, an alternative approach to studying the general working population is to examine particular gender-segregated occupations. To this end, several studies have examined factors explaining the risk of sickness absence in care work, which refers to occupations in the health and social sector, where many women work. These studies focus on risk factors related to the interpersonal component of such work. In two studies of risk of sickness absence periods of over 20 days among health and social workers (e.g., nurses and physicians) in Norway, Aagestad et al. (2014, 2016) found that the main contributory factors to increased risk compared with the general working population were violence, threats of violence, emotional demands, and awkward lifting. Furthermore, emotional dissonance and role conflict have been found to be an important predictor of sickness absence among employees working with clients (Indregard et al., 2017). In two studies of human service workers in Denmark, violence and threats, emotional demands, and role conflict were among the psychosocial factors significantly predicting sickness absence in one study (Rugulies et al., 2007), while in another study, psychosocial work factors were related to burnout, which in turn, predicted sickness absence periods of over 2 weeks (Borritz et al., 2010). Several other studies have examined the psychosocial costs of caring work, especially in research on burnout. These are reviewed in article 1.

Adverse consequences of labor market mismatch

Position in the social division of labor matters for the risk of sickness absence, as the review above shows. However, a mismatch of positions could also be important, as argued in the previous chapter and studied in article 2. Several forms of mismatch exist (see Kalleberg, 2007). Mismatches of skills are the most commonly studied form, and are often operationalized as a mismatch between educational credentials and occupational requirements. Overeducation, i.e., when the education exceeds the requirements for the job, has been frequently studied in relation to earnings in economics and job satisfaction in organizational psychology. Studies of noneconomic outcomes of mismatch, such as health, are lacking (Kalleberg, 2008). However,

several decades after the popularity of status inconsistency theory (see Vernon and Buffler, 1988 for a review of the first phase of research), the past decade has seen a resurgence of studies on mismatch and health.

Most importantly, there are only two studies of mismatch and sickness absence, and neither of these concern the general working population. Gjerustad and Soest (2011) studied a mismatch of occupational aspirations and achievement among a sample of Norwegian adolescents and their relationship with sickness absence periods of over 16 days. The results showed that men and women who had not achieved their aspirations had more sickness absence days than those with a match, and mismatch partly mediated the relationship between socioeconomic position and sickness absence. Faresjö et al. (1997) did not study sickness absence per se, but in their study of mismatch between education and socioeconomic position and its association with mortality among a cohort of middle-aged Swedish men, they also had data on sick leave. In their study, men in lower socioeconomic positions in relation to their educational achievement had more days and periods of sickness absence than matched men, while the opposite was true for men in higher socioeconomic positions in relation to their educational achievement.

Other studies have explored the relationship between mismatch and mental health (Lundberg et al., 2009), self-rated health (Hultin et al., 2016), and mortality (Garcy, 2015). These and other studies are reviewed in article 2. However, a strategy to address selection problems has been lacking. It is plausible that health problems could be a hindrance for achieving a skills match. In the economics literature on overeducation and wages, a growing number of studies have used fixed-effects techniques in an attempt to consider selection (Leuven and Oosterbeek, 2011)⁷. Learning from this, Zhu and Chen (2016) found in a recent study that applying individual fixed effects eliminated the association between overeducation and mental well-being in a nationally representative sample of Australians.

Gender segregation and work attrition

The strong gender segregation characterizing postindustrial labor markets has received much attention in the social sciences. The studies reviewed above investigating whether the gender composition of occupations and workplaces influences sickness absence are but a few of the many inquiring into the consequences of segregation. Much prior research has investigated the process of how men and women are allocated to different areas of the labor market in the first

⁷ See Leuven and Oosterbeek (2011) for a review of the economics literature on overeducation and wages, and a discussion of the difficulties in finding a satisfactory identification strategy.

place, i.e., their career choices. For example, the increase of women in male-dominated occupations, and the lack of a similar trend for men in female-dominated ones, have been documented in many countries (England, 2010). However, less attention has been given to the numerical minority's movement out of segregated sectors following gender-atypical career choices. In research on gender minority attrition, the study of Jacobs (1989) is highly influential.

Jacobs' (1989) study of American women documented a significant amount of career movement of women between female-dominated, gender-balanced, and male-dominated occupations during the period of study (Jacobs, 1989). The mobility patterns of women in male-dominated occupations were followed up in later studies. Chan (1999) examined whether the significant mobility documented in Jacobs' (1989) study was applicable in a British context. He found that rather than 'revolving doors', where women move in and out of female- and male-dominated occupations throughout their careers, previous employment in female-dominated occupations made women less likely to move to male-dominated occupations. This was especially evident for heavily female-dominated occupations. Moreover, work and family conditions did not explain mobility patterns, except that women in high status occupations were less likely to move (Chan, 1999). Similarly, Torre (2014) found that the previous occupational trajectories of American women affected their likelihood of leaving male-dominated occupations, and that women who moved from female- to male-dominated occupations were more likely to leave the latter.

In addition to studies on the influence of women's previous career trajectories on attrition from male-dominated occupations, a few general studies have examined the impact of their minority status and work-family conflict. A study by Torre (2017) examined whether the association between minority status and women's propensity to leave male-dominated occupations varied by occupational status. She found that while women's propensity to leave low-status occupations increased with the proportion of men, the opposite was the case for women in high-status, male-dominated occupations. Maume (1999) also investigated the impact of being in a minority, and found that as the percentage of men in occupations increased, men were more likely to receive wage increases, while women were more likely to become jobless. Regarding work-family conflict, Cha (2013) investigated whether overwork and motherhood contributed to women's propensity to leave. She found that only mothers working more than 50 hours a week were more likely to leave. Moreover, two other studies found no significant relationship between motherhood and attrition from male-dominated occupations (Glass et al., 2013; Rosenfeld and Spenner, 1992). In addition to studies of women's attrition, there are studies of their experiences with being a minority. For example, studies have found

that as the percentage of men increases, women report less coworker support and more work–family conflicts (Cook and Minnotte, 2008; Taylor, 2010). There are also studies of women reporting harassment and experiencing bias (e.g., Dresden et al., 2017).

While there are some general studies of women’s attrition from male-dominated settings, men’s attrition from female-dominated ones has rarely been studied. However, a recent study by Torre (2018) documents that men do not stay in female-dominated occupations for long, maintaining high levels of gender segregation. This was especially evident for men in lower occupational classes.

Long-term consequences of absence from work

Careers interrupted by temporary absence from work could mark the onset of weaker LMA in the long term. For example, for some women, family formation (i.e., childbirth) is associated with labor market withdrawal, job separation, and lower wages (Albrecht et al., 1999; Estes and Glass, 1996). Sickness absence is another potential marker of deteriorating attachment because it is associated with a higher risk of recurrence of absence, (Laaksonen et al., 2013), unemployment (Hultin et al., 2012), and permanent work disability (Gjesdal and Bratberg, 2003). Additionally, it can lead to adverse economic and social conditions (Bryngelson, 2009). Consequently, the process of an RTW following work disability has been investigated in a wealth of studies. Comprehensive reviews indicate that negative RTW outcomes are consistently predicted by lower levels of education, lower socioeconomic position, female gender, and greater age, in addition to other factors (Cancelliere et al., 2016; Vries et al., 2017). However, research on RTW following work disability is challenging owing to its complexity, with both choice of outcomes and follow-up times posing methodological challenges (Baldwin et al., 1996; Butler et al., 1995; Pransky et al., 2005; Young et al., 2005). However, in recent years, researchers have utilized multi-state models, latent trajectory analysis, and sequence analysis (SA) in an attempt to capture the long-term heterogeneous process of an RTW.

Several Nordic studies have utilized multi-state models to estimate transition probabilities between different labor market states following long-term sick leave (Gran et al., 2015; Øyeflaten et al., 2012, 2014, Pedersen et al., 2012, 2014; Wiberg et al., 2017). These studies describe the complex transitions between states following an RTW and highlight that previous states influence the future transitions a person is likely to make. Moreover, the transition probabilities were significantly affected by factors such as gender and socioeconomic position, but no firm conclusions were drawn. However, a study by Øyeflaten et al. (2014) examining transitions between work, partial sick leave, full-time sick leave, medical

rehabilitation, vocational rehabilitation, and receipt of disability pension was an exception, as women, blue-collar workers, and those with a previous history of sickness absence had a higher probability of transitioning into permanent work disability.

Latent trajectory analysis is intended to reduce the heterogeneous trajectories of individuals to a few groups. Laaksonen et al. (2016) studied sickness absence trajectories preceding work disability retirement among Finnish residents, and examined whether socioeconomic factors could discriminate between the trajectories. They identified six trajectories, but the associations with socioeconomic factors were weak. Six trajectories were also identified in a study by Farrants et al. (2018), who examined sickness absence and disability pension trajectories following a spell of sick leave of 21 days or more because of depressive episodes. In that study, women and individuals with lower levels of education were at greater risk of following a trajectory of recurrence of sickness absence and receiving a disability pension.

Finally, SA has been applied in some studies to identify prototypical trajectories following sickness absence. These studies have compared trajectories following sick listing for mental health reasons compared with other reasons (Pedersen et al., 2016), musculoskeletal diagnoses (McLeod et al., 2018), and interventions (Lindholdt et al., 2017; Pedersen et al., 2017), and among sewing machine operators (Jakobsen et al., 2018). By allowing for sequences of multiple labor market states, the sequence analyses have illustrated the various complex prototypical pathways following sickness absence. However, besides Pedersen et al. (2016), who found that gender, age, and educational level did not explain why individuals sick listed for mental health reasons were more likely to follow trajectories with worse RTW prospects, none of these studies investigated whether the trajectories follow social divisions.

Research gaps

The review above shows several studies of general socioeconomic disparities in sickness absence and studies focusing on adverse consequences of care work. The aim of article 1 is to link these two strains of research and zoom in on a segment of service class workers, i.e., professionals. The review also shows a lack of studies on labor market mismatch and sickness absence. Among the studies of mismatch and health outcomes, few consider selection. The aim of article 2 is to contribute to closing this research gap. Furthermore, while labor market gender segregation has received considerable attention from researchers, there are surprisingly few

general studies⁸ of minority attrition from gender-segregated sectors of the labor market. There is a lack of general studies outside of the U.S. and U.K. considering other forms of segregation besides those in education and occupations, and studies considering selection. To fill this research gap, article 3 studies women's attrition from male-dominated workplaces in the general Norwegian working population. Finally, there has been a call for studies of the complex labor market pathways following work disability. A few recent studies have used innovative methods to answer this call. Article 4 contributes to this set of studies by using SA on administrative register data to study labor market trajectories following long-term sickness absence. It also examines whether socioeconomic position and gender are associated with these trajectories, an area of research that has been lacking.

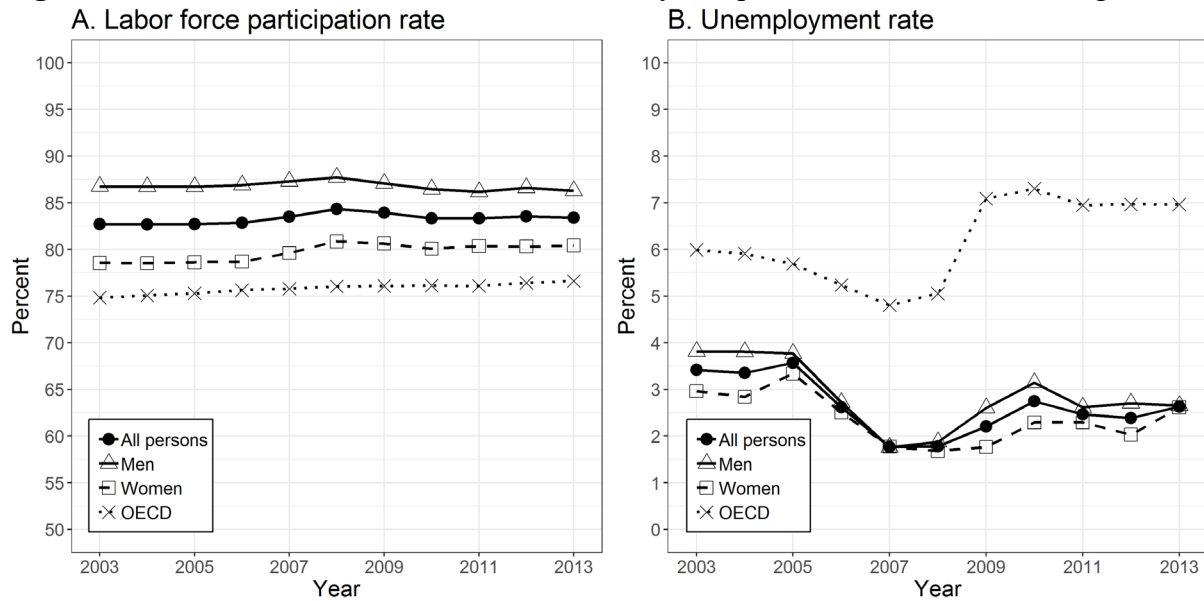
⁸ However, studies focusing specifically on female turnover in science, technology, engineering, and mathematics are more numerous.

IV. The Norwegian context

Norway has what many consider to be a Nordic welfare state model. While the academic consensus and empirical support for this ideal type was strongest at the time of Esping-Andersen's (1990) influential account of welfare state models, it continues to reflect distinguishing features of the Nordic welfare states to this day (Kautto, 2010). Kautto (2010) offers a general overview of the agreed characteristics of this ideal type. A prominent feature is the extensive role of the state and the wide scope of public policies. Most social insurance schemes, such as sickness benefits, have an earnings-related component that applies universally to all workers. There is a strong focus on redistributive policies, which are generous and have broad coverage, in combination with an emphasis on free or strongly subsidized service provision. The Nordic welfare states are also characterized as female-friendly; they have a dual earner–carer regime with extensive provision for child and elder care services. These welfare states are also distinguished by local and publicly funded and produced health and social service provision catering to the needs of the entire population. Finally, the Nordic countries have high employment rates for both men and women, which are crucial for funding the generous social policies. While prominent changes since the 1990s have challenged the notion of a Nordic model, the welfare state in Norway seems to be largely intact (Kautto, 2010). For example, the Norwegian sickness benefit has remained relatively unchanged since 1978 (Hagelund and Bryngelson, 2014). However, the social welfare policies, including the sickness benefit, have seen increased focus on activity requirements and enabling policies in recent years (Bay et al., 2015).

To contextualize the Norwegian labor market, Figure 1 shows two key statistics for the study period in this dissertation. Panel A shows the labor force participation rate for Norwegian men and women compared with the OECD average. The figure shows that the overall participation rate for Norwegians aged 25–64 years was close to 85% during the period 2003–2013, with a slightly higher participation rate for men than for women. The participation rate was higher than the OECD average across all years, regardless of gender. Panel B shows the unemployment rate for the same period. The unemployment rate fluctuated between 2–4% for all Norwegians, which was lower than the OECD average for all years.

Figure 1. Annual labor market statistics for Norway compared with the OECD average



Note: Individuals aged 25–64 years: “OECD” refers to the OECD average for all individuals; “all persons” refers to all Norwegian people. Source: OECD.Stat (<https://stats.oecd.org>).

Sickness absence benefit

In Norway, all members of the National Insurance scheme are entitled to a sickness benefit if they are occupationally disabled owing to a disability that is clearly caused by their own illness or injury. Further requirements for receiving a benefit are that they must have worked for at least 4 weeks and must have lost a pensionable income because of the illness amounting to at least 50% of the National Insurance basic amount. Absences of 16 days or fewer are covered by employers, while those over 16 days are covered by the National Insurance scheme. A physician must certify all absences over 3 days. Employees can receive 100% of the most recent wage covered by the benefit, but the benefit paid by the insurance scheme does not exceed six times the basic amount (NOK 437,286 in 2010). Sickness benefits are paid for up to 52 weeks, and the recipient must have worked for at least 26 weeks to be entitled to receive the benefit again. Furthermore, individuals receiving the benefit must attempt work-related activities as soon as possible, create a follow-up plan with the employer within 4 weeks, and provide an extended medical certificate if the absence exceeds 8 weeks. The sickness benefit can be graded to allow for working while sick⁹.

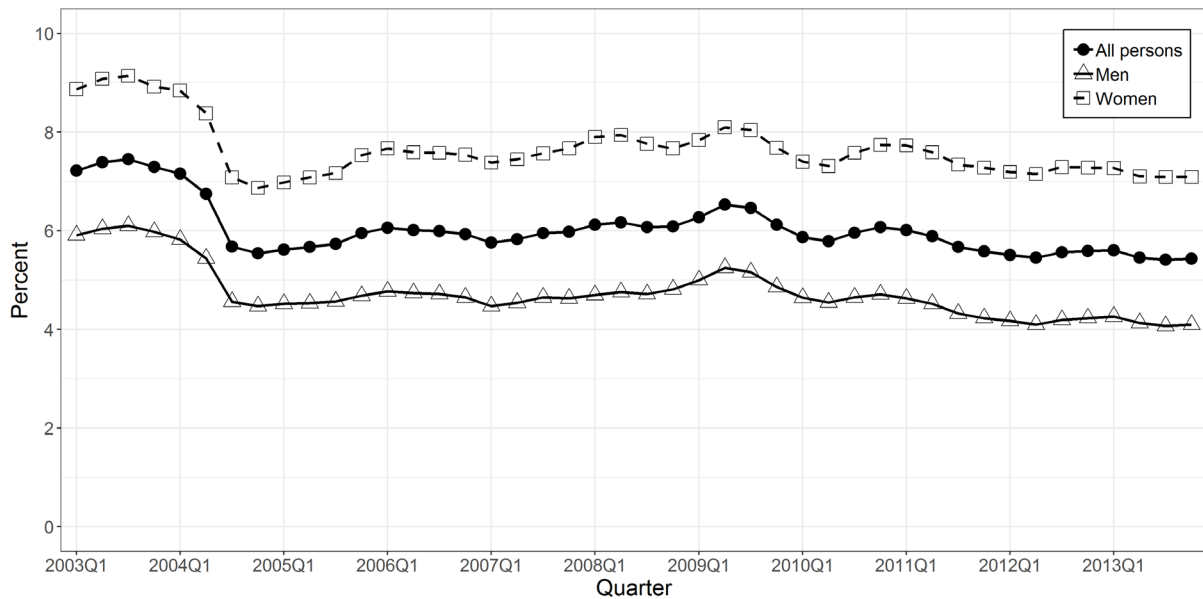
The present (2019) Norwegian sickness benefit described above is more or less the same as that implemented in 1978 (Hagelund, 2014). The year 2001 saw the advent of the “Inclusive Workplace Agreement,” which focused on the activation and follow-up of the absentees at their

⁹ For a description of the current sickness benefit in detail, see <https://www.nav.no/en/Home/Benefits+and+services/Relatert+informasjon/sickness-benefits-for-employees>.

workplace in dialogue with their employer and physician. Most changes to the benefit scheme during the period 2003–2013 were modifications of this agreement, but did not alter the scheme fundamentally. Stricter requirements for participation, follow-up, and documentation of work ability were implemented¹⁰. In addition, in 2004, the period of work required to qualify for the benefit was raised from 2 to 4 weeks.

Figure 2 shows the percentage of workdays lost because of physician-certified sickness absence (>3 days) in Norway. This is not the measure used in articles 1, 2, and 4, and it includes absences of up to 16 days, but it is commonly used in Norway to reflect the rate of absence (Hagelund, 2014). The figure shows that the rate fluctuated somewhat during the study period (2003–2013). The trend was similar for men and women, with women having a consistently higher rate of absence compared with men. See Hagelund (2014) for an explanation of the observed fluctuations in the sickness absence rate during this period.

Figure 2. Percentage of workdays lost owing to physician-certified sickness absence in Norway.



Note: Physician-certified sickness absence for periods of >3 days, adjusted for season and influenza: measured quarterly from 2003 to 2013. Source: Statistics Norway (<https://www.ssb.no/statbank/table/09665/>).

Other social insurance benefits¹¹

A rehabilitation benefit is intended to secure the livelihood of individuals in different forms of rehabilitation with the prospect of an RTW. Hence, it is a measure to secure the labor force participation of individuals with a weakened attachment to it. Long-term sickness absence is

¹⁰ See Hagelund (2014: 190–196) for a detailed timeline of the changes in the Norwegian sickness benefit scheme from 1978 to 2011, which includes a description of the changes in the “Inclusive Workplace Agreement” during the observational period of this dissertation (2003–2013).

¹¹ Only article 4 considers these benefits.

often but not necessarily a precursor to receiving these benefits. During the period 2003 to 2010, rehabilitation benefits consisted of a medical rehabilitation allowance, vocational rehabilitation allowance, and a time-limited disability pension. In March 2010, these were replaced by the work assessment allowance (Svele, 2010). To qualify for rehabilitation benefits, a person's ability to work must have been reduced by minimum of 50%. Illness is not a requirement for receiving a rehabilitation benefit, but it must have contributed to the loss of work ability. Active participation in some form of rehabilitation is required. While the work assessment allowance can be granted for up to 4 years, medical rehabilitation was granted for a maximum of 1 year, vocational rehabilitation for 3 years, and a time-limited disability pension for 4 years. It is and was possible to extend this period under special circumstances. Finally, rehabilitation benefits amount to 66% of the most recent income to a maximum of six times the basic amount (NOK 437,286 in 2010). See Svele (2010) or Mandal et al. (2015) for a detailed description of the rehabilitation benefits.

For individuals that complete appropriate rehabilitation measures but do not return to work successfully, a disability pension can be granted if their earning capacity has been permanently reduced by illness or injury. The claimant must be between 18 and 67 years old (as for the sickness and rehabilitation benefits) and have at least a 30–50% loss of work capacity. A disability pension consists of a basic pension independent of income and a supplementary pension, which depend on the receiver's previous income. In total, the benefit amounts to an average of 50–60% of the previous income (Tufte, 2013). The disability pension can be graded if the claimant is partially able to work.

Registered job seekers are eligible for an unemployment benefit if their working hours are reduced by at least half and they have had an income amounting to at least 1.5 times the basic amount. The claimant can receive the benefit for a maximum of 1 or 2 years, depending on their previous income.

Parental leave benefit

While the onset of the abovementioned benefits for claimants are directly measured in at least one of the articles in this dissertation, the Norwegian parental leave benefit must also be briefly described because it forms part of the background for article 3. Because the benefit has undergone several changes during the observational period, only a superficial account is presented. Most importantly, the parental leave provisions are generous and allow the mother and father to take leave for a combined total of 9 months or more. As for the other benefits

mentioned, the parental leave benefit covers the loss of income for up to six times the basic amount.

V. Data and methods

This chapter reviews the data and methods used in the dissertation. The data are drawn exclusively from public administrative registers and cover the entire Norwegian population. To exploit the rich longitudinal data, various panel data methods are used to answer the article's research questions. In the following section, I provide a detailed description of the register data and the methods used, and discuss approaches to inference.

Administrative register data

Statistics Norway (SSB) provided the administrative register data. The data are gathered from several public registers and contain individual-level records of the entire Norwegian population. A unique personal identifier makes it possible to link information on individuals across registers because almost all Norwegian government agencies use it as the primary key for their databases (Lyngstad and Skardhamar, 2011). Information on demographics is available from the Central Population Register (DSF), income and wealth from the Tax Administration, and educational enrollment and attainment from the Norwegian National Education Database (NUDB), while employment and social security benefits are covered by the Norwegian Labor and Welfare Administration (the FD-Trygd database). The register's advantages in sociological research include

the ability to maintain data on the total population; the possibility of studying small subpopulations; a virtually continuous timeline in longitudinal data sets; using panel data designs with no sample attrition; having few or no nonresponses or other missing data; making connections between different observation units, such as family members, and the ability to construct research designs that are practically impossible with surveys (Lyngstad and Skardhamar, 2011: 613).

The dissertation profits greatly from the strengths of the register data. Because the registers cover all permanent residents, there are no concerns over representativity or attrition bias. The latter phenomenon is of particular importance in longitudinal studies and often severely impairs surveys (Røed and Raaum, 2003). Considering that all the studies of the dissertation are longitudinal, the absence of selective nonresponse is a considerable advantage. The studies also benefit from the high quality and scope of outcomes and characteristics available. The abundance and scale of data capture much of the heterogeneity in individual preferences and opportunities (Røed and Raaum, 2003). For example, the detailed information

on education, occupation, and income facilitates the measurement of socioeconomic resources, while the precision of the data allows for very detailed controls (e.g., occupational fixed effects) (Lyngstad and Skardhamar, 2011). What is more, the objective data bypass the problem of respondents refraining from reporting sensitive information (e.g., receiving welfare benefits) because they do not have to be queried (Lyngstad and Skardhamar, 2011). Additionally, the registers allow for precise aggregation at many levels, as individuals are linked to their household, workplace/establishment¹², occupation, region, and so on (Røed and Raaum, 2003). Hence, “contextual factors” such as the level of gender segregation in thousands of workplaces can be measured.

Another advantage of register data important for this dissertation is the possibility of studying small subpopulations and rare events. “Within national register data, even relatively small groups become large, and events that are unlikely to take place for any given agent are frequent, measured in absolute numbers” (Røed and Raaum, 2003: F273). In article 4, the identification of alternative trajectories to stable full-time employment may not have been possible without population data with information on rare events, such as receiving a disability pension. Both articles 1 and 3 involve the study of minority groups: men in female-dominated occupations (e.g., registered nurses) and women in male-dominated occupations (e.g., engineers) and workplaces. Furthermore, article 3 studies an event that is rare in absolute numbers: women’s attrition from male-dominated workplaces.

The register data also have some limitations. A major disadvantage is the lack of “soft” information, such as individuals’ attitudes, intentions, motivations, or priorities (Røed and Raaum, 2003). Hence, in many cases, researchers must resort to indirect (Lyngstad and Skardhamar, 2011) or proxy (Olsen, 2011) measures. This is the case in this dissertation, as the data do not allow for an inspection of the underlying mechanisms producing a relationship, such as the relationship between the degree of gender segregation in the workplace and women’s attrition. Additionally, a lack of precision in the measurement of the factors studied can introduce bias in both dependent and independent variables (Olsen, 2011). Furthermore, while it is not a disadvantage of administrative registers per se, the most sensitive register data may not be available to all researchers. A major limitation of this dissertation is the lack of information on diagnoses for long-term sickness absence. Diagnoses would have been

¹² Article 3 studies workplace mobility. Technically speaking, the data used in this dissertation do not contain information on workplaces, but on establishments. Establishments are in turn nested within firms. Workplaces instead of establishments are used for two reasons: (1) the word is more intuitively understood and speaks directly to the theories applied in article 3, and (2) in many cases, an establishment equals a workplace, and the terms are often used interchangeably in studies with Nordic administrative register data.

especially important for differentiating between candidate explanations for variations in absence in article 1 and 2. Moreover, it could have illuminated why some individuals became detached from the labor market following their first absence, as studied in article 4.

Confidentiality in access to register data is of utmost importance because they contain private and sensitive information. The Statistics Act, the law governing SSB, legally regulates most register data for research (Lyngstad and Skardhamar, 2011). Only SSB is in possession of the unique personal identifier linking the administrative registers, and the individuals are anonymized before the data are used for research (Røed and Raaum, 2003). Furthermore, there are strict restrictions on access to the register data. The data is only provided to researchers affiliated with acknowledged Norwegian research institutions who can document the need for the data in their scientific work (Lyngstad and Skardhamar, 2011). Researchers must convincingly justify the scientific need for the data and document high standards of data security that prevent unauthorized access to be granted access by the Norwegian Data Inspection authorities (Røed and Raaum, 2003). Before obtaining access, researchers must also sign a confidentiality agreement.

Variables

The variables used in the dissertation are described in the articles. However, I will clarify some operationalizations and inconsistencies between the articles.

Long-term sickness absence

In articles 1, 2, and 4, long-term sickness absence is the primary outcome variable¹³ and is defined as sickness absence over 16 days. As mentioned above, in Norway, the employer pays sickness benefits for the first 16 calendar days. From day 17, the National Insurance Scheme pays sickness benefits for up to 52 weeks. In Norwegian research on sickness absence, long-term absence is often referred to as absence exceeding the employer period. However, other operationalizations are possible depending on the policies and research questions. For example, the Norwegian National Insurance Scheme defines long-term absence as an absence over 12 weeks¹⁴. Nevertheless, as in several Norwegian studies, long-term absence refers to absence periods of over 16 days in articles 1, 2, and 4. However, the three articles have different operationalizations besides the common cutoff defining long-term absence as periods of over

¹³ Article 4 includes several other labor market outcomes as well (e.g., disability pension).

¹⁴ See <https://www.nav.no/en/Home/Benefits+and+services/Relatert+informasjon/sickness-benefits-for-employees>.

16 days. Article 1 examines time to absence on a daily time scale and thus models time in addition to the occurrence of absence. Article 2 operationalizes sickness absence as occurring at least once within a year and does not model time to the event. Finally, article 4 defines the occurrence of long-term sickness absence as the most dominant event within a quarter (see article 4 for an explanation of how dominance is determined). Thus, the operationalizations differ according to the level of detail in the time scales. Article 2 used a yearly time scale owing to the yearly registration of the main independent variables. Article 4 did not use a more detailed time scale because excessively heterogeneous sequences make classification of prototypical labor market trajectories difficult (Cornwell, 2015).

Occupational class

The measurement of socioeconomic position in the form of occupational class in articles 1, 3, and 4 are all based on Goldthorpe’s class scheme (Breen, 2005) adapted to Norwegian register data (Hermansen, 2013). In article 1, Goldthorpe’s scheme is used to verify the vertical distinction between professions belonging to the upper and lower service classes¹⁵. Articles 3 and 4 use slightly different variants of the scheme. Article 3 uses Goldthorpe’s own four-class version (Breen, 2005), while article 4 uses the four-class version proposed by Götz et al. (2018). Table 1 shows the operationalizations of the schemes in articles 1, 3, and 4.

Table 1. Aggregations of Goldthorpe’s class scheme used in the dissertation.

	<i>11 class scheme</i>	<i>Article 1</i>	<i>Article 3</i>	<i>Article 4</i>
I	Upper service class	High SEP	Service class	Upper service class
II	Lower service class	Low SEP		Lower service class
IIIa	Routine nonmanual employees, higher grade		Intermediate class	Routine nonmanual workers
IIIb	Routine nonmanual employees, lower grade		Manual class	
Iva	Small proprietors with employees		Petty bourgeoisie	
IVb	Small proprietors without employees			
IVc	Farmers and other self-employed workers in primary production		Intermediate class	
V	Lower-grade technicians and supervisors of manual workers			
VI	Skilled manual workers			
VIIa	Semi- and unskilled manual workers (not in agriculture)		Manual class	Manual workers
VIIb	Semi- and unskilled manual workers in agriculture			

Source: Goldthorpe’s 11-class (maximally disaggregated) version (Breen, 2005: 41). Note: SEP = Socioeconomic position.

¹⁵ A prestige measure (Ganzeboom and Treiman, 1996) is also used to verify the distinction between professions of high and low socioeconomic positions, in addition to a substantive evaluation.

There are two key distinctions between the schemes used in articles 3 and 4. First, article 4 differentiates between upper and lower service classes while article 3 does not. In article 3, the upper and lower service classes are merged because the literature on women's attrition from male-dominated settings emphasizes differences between blue- and white-collar occupations (e.g., Torre, 2017)¹⁶. Second, in article 3, lower-grade routine nonmanual workers (IIIb) are included in the manual class, while in article 4, they are counted as routine nonmanual workers. The allocation of higher and lower nonmanual workers (IIIb) varies across Goldthorpe's own aggregations of the class scheme depending on the research purpose (Breen, 2005: 41). The minor difference of implementation between articles 3 and 4 in this dissertation can be attributed to differences in the fields of study. Article 3 follows Goldthorpe's own four-class version of the class scheme. Article 4, on the other hand, deviates from this owing to its public health focus. In public health research, it is common to group routine nonmanual workers together, and the article follows an aggregation proposed by Götz et al. (2018).

The remaining differences between the uses of Goldthorpe's class scheme are negligible owing to the lack of information on self-employed workers in the register data. The petty bourgeoisie and other self-employed people are thus excluded from the analyses in both articles 3 and 4. Hence, only managers and supervisors represent individuals with control over productive assets in the analyses. They are workers with disciplinary authority over the work of others, but without ownership control (Muntaner et al., 2010). The exclusion of self-employed workers is not likely to bias the analyses seriously because they only constitute 6% (approximately 150.000 individuals) of the Norwegian workforce, which is a lower proportion than that in other European countries (Grünfeld et al., 2016).

The Goldthorpe scheme was chosen as a measure of occupational class because of its widespread use in sociological research and its distinction between service and nonservice workers. The latter is key to the analyses in the articles and is emphasized in relevant prior studies.

Statistical methods

The four articles constituting this dissertation use different statistical methods. The common factor of these methods is that they exploit the longitudinal properties of the administrative register data and accommodate categorical or qualitative dependent variables. Articles 1 and 4 are descriptive and concern the timing of events or states. Articles 2 and 3 profit from the panel

¹⁶ Additional analyses (not shown in article 3) show no differences in patterns of female attrition between the lower and upper service classes.

data in considering selection. Below, the statistical methods used in the dissertation are presented. SA is presented at greater length because it is the lesser-known method. The short format of the article in which SA is applied further justifies a more elaborate presentation of this method.

Cox proportional hazards regression

Event history analysis (Allison, 2014; Box-Steffensmeier and Jones, 2004) in the form of Cox regression (Cox, 1972) is used in article 1. Event history analysis is also called survival analysis because it is often used to study the survival of some unit (e.g., patients) until failure (e.g., death), and is widely used in epidemiological research. In general, event history analysis models both the duration of time spent in a state and the transition to a subsequent state, which is an event. In addition to exploiting information on time to events, it can also include censoring and can incorporate time-varying covariates. These properties are advantageous in studies of sickness absence. First, sickness absence is an event that occurs in time, so models that do not consider duration waste information (Allison, 2014). Second, many individuals do not experience sickness absence during the observation period and their data are thus right-censored. A model that cannot account for right-censoring may produce misleading estimates (Box-Steffensmeier and Jones, 2004). Finally, the risk of sickness absence may be contingent on time-varying factors, and these can be accommodated in an event-history framework (Allison, 2014).

The hazard rate gives the rate at which units fail (or durations end) by time t given that the unit survives until t (Box-Steffensmeier and Jones, 2004: 14). The Cox proportional hazards regression model (Cox, 1972) asserts that the hazard rate for the j th subject in the data is

$$h(t|x_j) = h_0(t) \exp(x_j\beta_x)$$

where $h_0(t)$ is the baseline hazard function and β_x are the covariates and the regression parameters. The baseline hazard, $h_0(t)$, is given no particular parameterization and can be left unspecified (Cleves et al., 2010), which means that Cox regression models do not have an intercept, as it is “absorbed” into the baseline hazard function (Box-Steffensmeier and Jones, 2004); it is therefore “semiparametric.” The fact that the model makes no assumptions about the shape of the hazard over time is a considerable advantage, and has made Cox regression hugely popular. It does assume that whatever the distributional form of the baseline hazard rate, it is the same for everyone. In other words, the proportionality assumption posits that the effect of each variable is the same at all time points (proportional). However, according to Allison

(2014), violations of this assumption do not severely bias estimates. Nevertheless, there are several tests available to examine nonproportionality (Box-Steffensmeier and Jones, 2004), and these have been applied in article 1.

Researchers often study time to first failure, which makes sense in many cases (e.g., survival until death). However, sickness absence is a recurrent event, and discarding information after first absence can underestimate the true effect sizes considerably (Christensen et al., 2007). To account for the repetitive nature of sickness absence, a conditional gap time model is used (Prentice et al., 1981). This is preferred among variance-corrected models with multiple failure data (Box-Steffensmeier and Zorn, 2002)¹⁷. The conditional model posits that an observation is not at risk of a later event until all prior events have already occurred. Moreover, estimates are stratified by event number (i.e., failure order) so that the different events are allowed to have varying baseline hazards (Box-Steffensmeier and Zorn, 2002). Gap time, as opposed to elapsed time, is chosen as the risk of multiple absences are thought to develop sequentially. This is true because past spells of sickness absence have been found to predict future absence episodes (Laaksonen et al., 2013). Hence, the time to event is reset to zero after each event. Robust standard errors are achieved by clustering on individuals (Allison, 2014). Finally, the Breslow method is used to manage ties. This is the most commonly used method in duration data (Box-Steffensmeier and Jones, 2004).

Multinomial logistic regression

Multinomial logistic regression is used in articles 3 and 4 because it is appropriate for nominal dependent variables, which are categorical variables with three or more alternative outcomes and no unique order. Maximum likelihood estimation is used to evaluate the probability of membership to the different categories of the dependent variable. The choice of reference category is important, and it usually makes sense to make the largest category the reference because it results in the most reliable estimates. However, there could be theoretical or substantive reasons for selecting a particular reference category (Menard, 2010). In articles 3 and 4, the choice of reference category was straightforward because the most meaningful reference categories were also the largest¹⁸.

¹⁷ Frailty models are an alternative. See Box-Steffensmeier and Zorn (2002) and Box-Steffensmeier and Jones (2004) for the pros and cons of frailty models for repeated events in failure data.

¹⁸ In article 3, staying in male-dominated workplaces was the obvious reference category, as attrition from this category was studied. In article 4, stable full-time employment was the natural reference category, and was compared with trajectories deviating from the norm.

Article 4 uses ordinary multinomial logistic regression with cross-sectional data¹⁹. Article 3 extends its use to longitudinal panel data. In article 3, the longitudinal data structure is taken advantage of by applying multinomial logistic regression with individual fixed effects, as proposed by Chamberlain (1980) and recently implemented by Pforr (2014). By means of conditional maximum likelihood estimation, a separate intercept for each individual is estimated for each outcome, which absorbs all time-invariant unmeasured heterogeneity. By conditioning the intercepts out of the likelihood function, the incidental parameter problem is circumvented (Allison, 2009; Menard, 2010). Selection is very likely to be a serious threat to analyses of women's attrition from male-dominated workplaces (Cha, 2013). Therefore, it is a huge advantage to account for time-invariant unmeasured heterogeneity. However, this approach also has some considerable drawbacks. First, time-invariant covariates are excluded, as only variation between years within individuals is used to estimate the association between the time-variant explanatory variables and the dependent variable. This is not a serious issue in article 3, as the explanatory variables of interest are time-variant. Second, reliance upon within-individual variation results in individuals with no variations in the dependent variable being dropped from the sample. On the one hand, this is not problematic because the aim of article 3 is to study individuals experiencing a change in the dependent variable (i.e., attrition). On the other hand, excluding individuals with no variation in the dependent variable is a threat to external validity. Third, with no estimates of intercepts, neither probabilities nor partial effects can be computed, and we are left to make inferences about odds ratios (Greene, 2012). As Pforr (2014) argued, this is a disadvantage because odds ratios and logit effects are criticized as unintuitive and are not easily comparable across nested models or different groups (see Allison, 1999; Mood, 2010). Therefore, comparisons of odds ratios across groups in article 3 must be made with caution. Nevertheless, a model accounting for time-invariant unmeasured heterogeneity is preferred despite its drawbacks, because the selection effects are likely to be very strong. Finally, to account for the repeated measures of individuals over time in article 3, Huber–White sandwich standard errors were estimated (Pforr, 2014).

Linear probability models

The abovementioned limitations of conditional logit models in analyses of discrete outcomes can be bypassed if the outcome is binary by using a linear probability model (LPM). An LPM is simply a linear regression model applied to a dichotomous dependent variable that estimates

¹⁹ Multinomial logistic regression was used to explore the association between baseline variables in 2003 and prototypical labor market trajectories.

the average marginal changes in the probability of experiencing an outcome for each independent variable (Menard, 2010). A conventional recommendation is to avoid LPMs and to use logit or probit models instead, because LPMs can violate the homoscedasticity assumption and predict probabilities outside of the 0–1 interval (Greene, 2012). However, according to Hellevik (2009), these concerns have little practical importance; predictions outside the permitted range are rare, and there is no systematic tendency for significance probabilities to differ between an LPM and logistic regression. Overall, there is a very high degree of agreement between the results of an LPM and those of alternatives such as logistic regression (Hellevik, 2009).

Hellevik (2009) concludes that LPMs are preferable to logit models in many cases because the interpretation is more intuitive and accessible, and that the latter is only superior in studies of rare phenomena. Because long-term sickness absence is not a rare event, LPMs are adopted in article 2. In addition to facilitating the interpretation of the results in article 2, an LPM allows for fixed effects without (1) excluding intercepts, (2) excluding individuals without variations in the dependent variable, and (3) complicating comparisons across groups. Hence, there are strong reasons to prefer an LPM in article 2. In the supplementary materials, we also ran conditional logistic regression. Although the magnitude of the coefficients cannot be directly compared, the LPMs and conditional logistic regressions yielded similar substantial patterns.

Sequence analysis

SA²⁰ is “the statistical study of successions of states or events” (Gauthier et al., 2014: 1) such as labor market careers and family formation processes. The main purpose of SA is to detect patterns among individual sequences, which are often highly complex (Cornwell, 2015). SA is applied in article 4 to explore how the careers and LMA of individuals unfold after the first occurrence of long-term sickness absence. The common and classic blueprint of SA is that it is intended to (1) measure the (dis)similarity between sequences by means of some metric, (2) group and often visualize similar sequences, and (3) use the results as inputs for variable-based approaches such as regression analysis; this is the approach in article 4 and the one explained below. However, it must be noted that SA is not one uniform method, and a range of applications that are suitable for different purposes exist (Aisenbrey and Fasang, 2010). In general, SA has two main advantages. First, sequences are studied as whole units. By

²⁰ See Cornwell (2015) or Blanchard et al. (2014) for recent textbooks on sequence analysis (SA) for social scientists.

simultaneously accounting for short-term transitions and long-term dynamics, SA considers the global interdependencies between states over time (Studer et al., 2018). Methods focusing on time to a specific event (instantaneous transitions), such as event history analysis (presented above), do not provide an overall view of the organization of trajectories (Abbott, 1995; Abbott and Tsay, 2000; Studer and Ritschard, 2016). SA is thus a powerful tool for studying trajectories as such, which is the main aim of article 4. Second, SA is an explorative method without any distributional assumptions and is particularly well suited to analyzing nonstandard and ‘outlier’ life courses (Aisenbrey and Fasang, 2010: 450). Hence, it has the power to detect trajectories deviating from the norm, such as the pathways to labor market marginalization revealed in article 4.

What is a sequence? A sequence is an ordered list of elements drawn from a finite alphabet (Abbott, 1995). The position of the elements reflects their order, a set of adjacent identical elements is a spell, and a change between two elements is a transition (Cornwell, 2015). In social science research, the alphabet refers to discrete social events or states²¹, and in a sequence, these are usually ordered by time²². An individual sequence contains information on (a) experienced states, (b) time spent in each state (state distribution), (c) timing of states (the temporal position within the sequence), (d) duration (length of a spell), and (e) sequencing or the order of states. However, the order, timing, and duration are sufficient to characterize sequences entirely (Studer and Ritschard, 2016). A measure of dissimilarity considers this information when comparing sequences pairwise. Optimal matching (OM) is by far the most common dissimilarity measure, and is even sometimes used synonymously with SA (Martin and Wiggins, 2011). Below, this measure will be described because it is used in article 4, although several other measures also exist.

OM²³ defines the dissimilarity between two sequences as a function of the minimum number of transformations required to turn one sequence into another (Martin and Wiggins, 2011). Sequences are transformed by inserting or deleting an element in a given position (called an ‘indel’) or by substituting elements. Substitutions and indels emphasize different aspects of sequences. Substitutions emphasize the timing and temporal order of states, while indels emphasize the occurrence of states. Because a major benefit of SA is the prominence given to

²¹ The alphabet in article 4 consists of 10 elements or states: first long-term sickness absence; second long-term sickness absence; third long-term sickness absence, fourth or higher-order long-term sickness absence, rehabilitation, unemployment, disability pension, part-time work, full-time work, and a rest category (other states). Additionally, missing is treated as a separate state.

²² There is no assumption of real time, as opposed to symbolic time, in SA. One could use SA to study any type of ordered process (Abbott, 1995: 95).

²³ See, for example, Martin and Wiggins (2011) for an introduction to optimal matching analysis.

the timing and order of states, researchers often accentuate substitutions (Aisenbrey and Fasang, 2010: 426). The extent to which sequences need to be transformed to resemble each other is quantified by assigning indels and substitutions a penalty or cost. The total sum of costs incurred by aligning two sequences indicates their dissimilarity (Cornwell, 2015). A substitution cost matrix specifies the costs of substituting states, while the cost of indels has to be considered relative to substitution costs (Martin and Wiggins, 2011).

A major criticism of OM is that the setting of substitution costs is arbitrary (Abbott and Tsay, 2000; Levine, 2000). It is argued that theory in social sciences is rarely sufficiently precise to aid cost setting. For instance, considering the states in article 4 in this dissertation, it is difficult to quantify the cost of substituting full-time work with part-time work or full-time work with long-term sickness absence based on some theory. To remedy this, data-driven substitution costs have been proposed (Aisenbrey and Fasang, 2010); these have become widely popular in OM analyses. The most common approach is to base substitution costs on transition rates: substitutions with high transition rates are less costly. However, transition-based substitution costs are only useful if there is a theoretical justification for assuming that the costs are the same independent of the direction of the transition or whether one of the directions is impossible (Aisenbrey and Fasang, 2010). To avoid this shortcoming, article 4 adopts a data-driven approach proposed by Studer and Ritschard (2016), whereby two states are seen as similar if there is a high probability that both will be followed by a common state n units of time later. In article 4, the substitution costs are calculated based on a common future 1 year ahead. Substitutions are emphasized as the cost of indels are set to half the maximum substitution cost²⁴. OM results in a dissimilarity matrix contain the pairwise distances between sequences.

The next step in SA analysis is to make use of the dissimilarity matrix to detect common holistic sequence patterns, which is to reduce the data set complexity to ideal or prototypical trajectories. The most common method for detecting classes of sequences is agglomerative hierarchical²⁵ cluster analysis, which is designed to detect cases that are less distant from each other (Cornwell, 2015; Dlouhy and Biemann, 2015). The algorithm starts with single sequences as distinct clusters and proceeds to combine the two closest clusters iteratively to form successively larger clusters (Cornwell, 2015). Ward's minimum variance method is the recommended method for OM analysis (Dlouhy and Biemann, 2015), and is therefore used in

²⁴ Other cost schemes (e.g., classic OM) were also tested, yielding similar results. Moreover, Dlouhy and Biemann (2015) argue that the choice of cost settings is less crucial than one might anticipate from the existing SA literature.

²⁵ The main alternative to hierarchical clustering is partitional clustering. See Cornwell (2015: 131) for a description of partitional clustering and its disadvantages.

article 4. By means of a substantive evaluation, a visual inspection of the agglomeration of clusters (a dendrogram), and “stopping rules” (Studer, 2013), the researcher decides on the number of clusters (the partition) that best represents the sequence data. A criticism of cluster analysis in SA is that it produces results whatever their pertinence (Levine, 2000) and can lead researchers to arbitrarily “fish for patterns” (Wu, 2000). Therefore, a validation of the results is important, and in SA, it is primarily the cluster solutions that are validated (Aisenbrey and Fasang, 2010). According to Cornwell (2015: 138), “the most important criterion for establishing validity is that the solution in question identifies classes that capture some intuitively and theoretically meaningful order in the sequences.” Thus, the choice of clusters in article 4 has been guided by substantive evaluation. Additionally, it is also important to validate the clusters by objective statistical criteria. Studer (2013) suggests several measures of the quality of the cluster partitions. These measures helped to determine the number of clusters in article 4 and ensured that the partitions were of high quality (see the supplementary materials in article 4).

Visualization is very useful for representing prototypical trajectories. While OM in combination with cluster analysis reduces the complexity of the data by categorizing it, the separate clusters still contain a large number of individuals, long sequences (i.e., many time points), and several states; this complex information is challenging to visualize (Brzinsky-Fay, 2014). Article 4 visualizes the prototypical trajectories by means of state distribution plots (Billari and Piccarreta, 2005), which aggregate the frequency of each state at each time point (Fasang and Liao, 2014). In other words, they display the proportion of individuals in a given state over time for each cluster. This type of plot provides a good overview of the distribution of states, but ignores individual sequences. Hence, it is important to keep in mind that the plot does not show individual trajectories and thus conceals the movement of individuals back and forth between states over time (Fasang and Liao, 2014). However, such summarization plots avoid the problems of overplotting associated with sequence graphs representing individual sequences (Brzinsky-Fay, 2014).

Finally, it is common to examine the dependency of the cluster membership on covariates by means of logistic regression (Gabadinho et al., 2011). In this way, it is possible to investigate whether individual characteristics are associated with certain prototypical trajectories. However, only constant attributes or covariates measured before the starting point of a trajectory can be examined, because trajectories are analyzed as a whole when they are treated as dependent variables (Studer et al., 2018). Including covariates measured later would disturb the role of time and the temporal order of events, which is the problem of anticipatory

analysis (Hoem and Kreyenfeld, 2006). Additionally, the use of inferential methods should be conducted with caution because the cluster procedure also has uncertainty, as explained above. Within-cluster homogeneity and between-cluster heterogeneity are not reflected in the parameter estimates of the logistic regression (Studer, 2013).

In article 4, sequence analyses were performed using TraMineR (Gabadinho et al., 2011) and Weighted Cluster (Studer, 2013) packages for R.

Approaches to inference

Social life comprises a series of nested complex systems—individual human organisms embedded in families, networks, and workplaces—which in turn are all embedded in nations and eras. The central trick of social inquiry is figuring out how to make orderly, accurate statements about these systems in the face of their enormous complexity and our limited capacity both to measure and to intervene (Freese and Kevern, 2013: 27).

The formidable task of social scientists is to make substantial and reliable inferences about social reality. The statistical methods mentioned above are applied to this end. In this section, I briefly comment on the approaches to inference made in this dissertation.

Causal inference

Because explanations in the social sciences entail statements of cause and effect (Freese and Kevern, 2013), most quantitative empirical analyses are intended to estimate the causal effect of an independent variable on a dependent variable (Winship and Morgan, 1999). However, the notion of causality is much debated in both philosophical and methodological terms. Some philosophers argue for ‘causal pluralism’ (Reiss, 2009), and observational data, which in many cases represent the only viable data for social scientists, make experiment-like causal inferences challenging for empiricists. Although some statements in this dissertation come across as causal, the intention is not to make any strong causal claims. Articles 1 and 4 are descriptive, while articles 2 and 3 make an improvement in a causal sense by controlling for all stable individual characteristics.

In regression analysis, the control variable method entails that causal effects can be obtained by adjusting for variables thought to be related to both the explanatory and outcome variables (Morgan and Winship, 2015); this is the approach in article 1. The rationale of a probabilistic account of causality is that causes should be correlated with their effects, and that biases and spurious relationships can be adjusted for by conditioning them upon certain background factors that may affect the probability of the putative effect (Reiss, 2009).

Controlling for relevant variables, then, is thought to increase the likelihood that regression estimates have a causal interpretation (Angrist and Pischke, 2009). However, because it is likely that some important confounders are unobserved, causal claims can seldom be derived from the standard control variable method²⁶. Thus, only the association between the independent and the dependent variable is provided by article 1. However, as Goldthorpe (2001) has argued, such sophisticated descriptions lay the groundwork for explanations by establishing important regularities. In article 1, these regularities are discussed in light of several candidate explanations.

Individual fixed effects are an attempt to address unobservable factors with nonexperimental panel data²⁷ and are used in articles 2 and 3. The idea is to use each individual as its own control by comparing it with itself over time, i.e., the within-individual change in a dependent variable conditional on a change in independent variables. The average of the within-individual differences across the whole population gives an estimate of the ‘average treatment effect on the treated’ (Allison, 2009). This is achieved by including individual-specific intercepts in a regression that captures the impact of any unobserved but temporally stable characteristic of an individual on some outcome (Gangl, 2010). Hence, this approach controls for both easily observable characteristics, such as sex, and often for unobserved ones, such as intelligence, parents’ child-rearing practices, and genetic makeup (Allison, 2009). This is a considerable advantage in articles 2 and 3 because individuals experiencing a mismatch between their education and occupation or women in male-dominated workplaces are most likely to be highly selected individuals. Not surprisingly, the gain in power to identify causal relationships compared with the standard control variable method has made fixed effects estimation very popular (Gangl, 2010). However, this approach has limitations. To begin with, the fixed effects design requires within-individual variation. Thus, fixed-effects estimates may have little external validity as those experiencing a change in the independent variables, “the treated,” might be a selected group (Gangl, 2010; Winship and Morgan, 1999). Moreover, the fixed effects estimates are susceptible to bias owing to measurement error or lack of within-individual variation in the data (Angrist and Pischke, 2009). Finally, this approach does not consider time-varying unobserved confounders, as only stable unobserved characteristics are accounted for (Allison, 2009). Considering these disadvantages, overly strong causal claims must be avoided when interpreting fixed-effects estimates (Angrist and Pischke, 2009: 227).

²⁶ See, for example, Angrist and Pischke (2009: 51–68) and Morgan and Winship (2015: 194–214) for omitted-variable bias in regression analysis.

²⁷ Panel data contain repeated observations of the same individuals over time.

SA, as employed in article 4, is exploratory and descriptive. In fact, its sociological founding father, Andrew Abbott, criticizes the notion of causality in the social sciences and puts forward a shift in focus from “causes to events” (Abbott, 2001)²⁸. The approaches presented above attempt to model a specific temporal ordering of variables (“X causes Y”), where deviations from the model contribute to the error term and the researcher aims to address problems of endogeneity. On the other hand, SA makes no assumptions about the order in which social processes unfold and is appropriate for making sense of heterogeneous interdependent chains of events (Cornwell, 2015). Hence, it is a powerful tool to analyze complete individual trajectories. In article 4, SA is combined with multinomial logistic regression to study the association between prototypical labor market trajectories and baseline variables. As noted in the methods section for SA in this introduction, the parameter estimates do not have a causal interpretation.

Statistical inference

The aim of the articles using regression analysis is to make inferences regarding the true value of statistical parameters. In the social sciences, the customary approach to statistical inference is frequentist inference in the form of null hypothesis significance testing. In this method, a null hypothesis, H_0 , is tested against an alternative hypothesis, H_1 , and is either kept or rejected given a certain level of confidence $1 - \alpha$. The convention is $\alpha = 0.05$. Given that H_0 is true, the test will wrongly reject the null hypothesis in only $\alpha \times 100\%$ of the cases. The p-value of a given statistical parameter is the lowest level of significance at which a null hypothesis can be rejected, which is the probability of committing a type I error (Gujarati and Porter, 2009).

There are several criticisms of the naïve use of null hypothesis significance testing (Gill, 1999). These include (1) equating statistical significance with substantive significance, (2) emphasizing implausibly large effects solely because they are statistically significant, and (3) mechanically interpreting an insignificant effect as a zero effect (Bernardi et al., 2017). Considering this critique, classical hypothesis testing is complemented with other heuristics to ameliorate the inference process in the dissertation. First, the ‘substantive significance’ of the results is evaluated²⁹. This is especially important in large samples, such as register data, where

²⁸ Abbott’s perspective on causality is by no means a requirement for using SA. Most social scientists use SA as a pattern-detecting tool without rejecting common perspectives on causality. SA is under rapid development, and recently, several attempts to bring causality into the exploratory SA toolkit have been made. For example, two recent studies have introduced matching (Barban et al., 2017) and multi-state models (Studer et al., 2018) to SA.

²⁹ Articles 3 and 4 pose some problems for judging substantive significance. In article 3, conditional logistic regression does not provide an intercept and only odds ratios can be calculated. Average marginal effects, for example, would have given a better indication of the substantive significance of the independent variables. In

statistical significance is easily achieved (Gujarati and Porter, 2009). Second, confidence intervals are reported and visualized, which is a recommended alternative to null hypothesis significance testing (Bernardi et al., 2017; Gill, 1999). “Confidence intervals have a great virtue: as the sample size increases, the size of the interval decreases, correctly expressing our increased certainty about the parameter of interest” (Gill, 1999: 663), and they “make transparent the degree of precision of our estimations and shift our attention towards their size” (Bernardi et al., 2017: 6). Finally, the articles are accompanied by several robustness checks to reveal how the models behave under various specifications. Robustness testing allows the researcher to explore the stability of their main estimates to plausible variations in model specifications (Neumayer and Plümper, 2017).

An appropriate question is whether statistical significance testing is relevant for population data, such as administrative register data. As Aaberge and Laake (1984) have argued, it is important to differentiate between sampling statistics and statistical modeling. In stochastic models, the population can be understood as one of many realizations of the underlying mechanisms being studied. The parameters to be estimated can be considered to be the outcome of a stochastic process whereby the actual observed parameters only give an imprecise estimate of the true parameter value. As Hoem puts it, “individual life histories are seen most fruitfully as realizations of stochastic processes each of which is subject to random variation, and that this should be taken into account even when the set of observations contains all members of a population or population segment” (Hoem, 2008: 439). The difference between population and sample data is that the former provide more information and hence more precise and reliable estimates of the underlying process (Aaberge and Laake, 1984). Thus, measurements of uncertainty are important tools when making inferences, even if population-level data are available.

article 4, the multinomial logistic regression does not offer much besides indicating whether some groups are more likely to be members of a prototypical trajectory.

VI. Article summaries

Article 1: Long-term sickness absence among professionals

Madsen, A.Å. (2018). Long-term Sickness Absence Among Professionals: Investigating Gender, Socioeconomic Position and Care Work. *Nordic Journal of Working Life Studies* 8(4).

Retrieved from <https://doi.org/10.18291/njwls.v8i4.111928>

The first article investigates whether the risk of long-term sickness absence among professionals depends upon their socioeconomic position and whether they perform care work. It also explores whether the variation in risk can be attributed to sociodemographic or labor market factors. The article adds to previous research on socioeconomic differences in long-term sickness absence by studying a specific segment of the middle class, namely professionals. It also complements a vertical distinction between occupational groups by studying a horizontal division between caring and noncaring professionals. The horizontal division is motivated by research on burnout and emotional labor, which has emphasized the stress of care work. The article estimates the relative risk of long-term sickness absence by means of conditional gap time event history analysis that treats absence as a recurrent event. Moreover, separate analyses by gender are conducted, and several dynamic and stable factors are included to account for differences in risk between professional groups.

The results show that both lower socioeconomic position and being a care worker were associated with long-term sickness absence. The group with the highest risk was professionals of lower socioeconomic position doing care work. Generally, the results were similar for men and women. However, for the high-risk group of caring professionals of lower socioeconomic position, the relative risk was moderately higher for men than for women. The observed correlations were partly reduced after sociodemographic and labor market factors were controlled for, particularly for men. Although the two dimensions of the typology captured the difference in risk well, there was some overlap between professional groups. For example, general teachers (low SEP) had a similar relative risk to psychologists (high SEP), while physicians (caring) had a similar relative risk to civil engineers (noncaring). The article discusses the policy implications of the results in light of the combined challenges of high rates of sick leave in Norway and recruiting and retaining professionals in face of ongoing demographic shifts due to population aging.

Article 2: Education–occupation mismatch and long-term sickness absence

Madsen, A.Å. and Røberg, K.I.K. (forthcoming). Education-occupation mismatch and long-term sickness absence: A longitudinal study of over- and undereducation using Norwegian population data, 2003–2013. Submitted to *Journal of Education and Work*.

Article 2 explores whether education–occupation mismatch in the form of overeducation and undereducation is associated with the risk of long-term sickness absence. Scholars argue that a mismatch of statuses (e.g., education and occupation) affects health over and above the well-known association between socioeconomic position and health. The health-harming effect of mismatch, it is argued, is caused by stress. In previous literature, the stress was thought to stem from role conflict or a feeling of relative deprivation. Current scholars argue that it could also be caused by a mismatch between demands and control at work, or from rewards not matching efforts. While the theoretical explanations all imply that overeducation leads to harmful stress, the effect of undereducation is less clear. Depending on the interpretation of the theories, undereducation could be both harmful and advantageous. The empirical evidence, while not unequivocal, seems to support a negative association between overeducation and health: worse mental health, higher mortality, a higher risk of cardiovascular diseases, worse self-rated health, and lower job satisfaction. On the other hand, studies of undereducation are lacking, and some indicate lower mortality and better mental health for undereducated compared with matched individuals.

The article accounts for both individual and occupational characteristics by means of individual and occupational fixed effects. In this way, both selection and socioeconomic position are controlled for. To measure mismatch, the article estimates the average level of education for each occupation each year, and those who were more than one standard deviation above or below the mean of their occupation were defined as overeducated or undereducated, respectively. In addition to measuring the general association between education–occupation mismatch and long-term sickness absence, the article investigates the importance of time spent being mismatched, and whether the associations are sensitive to different degrees of mismatch. All analyses were run separately by gender.

The results show that the probability of long-term sickness absence was higher for the overeducated, but lower for the undereducated, compared with individuals with an education–occupation match. Initially, the association was strong; however, after accounting for

unobserved individual and occupational time-invariant heterogeneity, the association became modest to negligible. Nonetheless, a strong association remained for individuals who were mismatched for a prolonged period of time. Therefore, the observed disparities in risk of long-term sickness absence according to the numbers of years being mismatched indicate that mismatch primarily has a long- rather than short-term influence. The results were somewhat sensitive to the specification of mismatch, but the overall pattern remained robust. Finally, the association between education–occupation mismatch and long-term sickness absence was similar for men and women.

Article 3: Women’s attrition from male-dominated workplaces

Madsen, A.Å., Brekke, I. and Fekjær, S.B. (forthcoming). Women’s attrition from male-dominated workplaces. Submitted to *Work, Employment & Society*.

Article 3 investigates women’s attrition from male-dominated workplaces. The article’s point of departure is the substantial degree of gender segregation characterizing postindustrial labor markets. Despite a trend toward desegregation as many women move into male-dominated fields, their propensity to leave can contribute to the preservation of high levels of segregation. In the literature, women’s attrition has been attributed to their minority status and work–family conflict. Regarding the former, mechanisms such as gender-related stereotypes and biases, exclusion, minority discrimination, majority favoritism, and harassment are proposed as explanations for females leaving male-dominated settings. Moreover, a lack of flexible family-friendly working arrangements could also cause attrition and hamper women’s career prospects in male spheres.

The article contributes to the literature in several ways. First, while previous studies have measured segregation and mobility at the occupational level, the workplace seems more relevant, as theoretical explanations of women’s attrition focuses on actual interaction between individuals in a social setting. Furthermore, segregation at the occupational level does not necessarily correspond to segregation at the workplace. Second, because it is likely that women in male-dominated workplaces are a selected group, the article improves on previous studies by considering selection to a larger extent. Finally, previous general studies of women’s attrition have been from liberal welfare states such as the U.S. and U.K. This study is the first in a social democratic context.

The article studies all Norwegian women who left a male-dominated workplace at least once during the period 2003–2013, and takes selection into account by using multinomial

logistic regression with individual fixed effects. The article distinguishes between attrition to gender-balanced workplaces, female-dominated workplaces, and nonemployment. The analyses are threefold: first, the degree of attrition over time is assessed descriptively. Second, to assess the importance of minority status and work–family balance, the percentage of men in the workplace and childbirth are used as explanatory variables. Third, the article explores whether the association between the independent variables and long-term sickness absence varies by occupational class.

The results show that women leave male-dominated workplaces much more frequently than do men. They leave to a larger extent for gender-balanced workplaces, and especially for female-dominated workplaces. The attrition rate to nonemployment was equal for men and women, indicating that the disparity in attrition was entirely due to women switching out of male-dominated workplaces, but not out of the labor force. The regression analyses revealed that an increase in the percentage of men led women to switch from male-dominated workplaces to gender-balanced workplaces, but not to female-dominated workplaces or nonemployment. On the other hand, childbirth made women leave for female-dominated workplaces or nonemployment, but not for gender-balanced workplaces. Thus, the two mechanisms seemed to function in separate ways. Furthermore, the separate analyses by occupational class revealed that the probability of leaving male-dominated for gender-balanced workplaces increased with an increase in the percentage of men for all occupational classes. By contrast, the association between female attrition and childbirth seemed to apply only to women in the manual class, who had a higher propensity to switch to female-dominated workplaces following childbirth.

Article 4: Return to work after first incidence of long-term sickness absence

Madsen, A.Å. (2019). Return to work after first incidence of long-term sickness absence: A 10-year prospective follow-up study identifying labour market trajectories using sequence analysis. *Scandinavian Journal of Public Health*. Retrieved from <https://dx.doi.org/10.1177/1403494818821003>

Article 4 identifies prototypical labor market trajectories following the first incidence of long-term sickness absence, and assesses whether baseline sociodemographic and labor market characteristics are associated with the RTW process and LMA. The aim is to investigate whether the first spell of absence could signal paths of weaker long-term attachment, and whether some groups are more prone than others to follow less desirable trajectories. The register data provide quarterly information on several labor market states over a span of 10

years (2004–2013): full-time work, part-time work, unemployment, long-term sickness absence, rehabilitation, disability pension, and other states (e.g., studying and parental leave). The sample consists of all individuals ($N = 9607$) who experienced their first spell of long-term sickness absence in the first quarter of 2004. SA is applied to take advantage of the comprehensive data and identify prototypical labor market trajectories.

The analyses revealed that most individuals (68.2%) successfully returned to stable full-time work—indicating strong LMA—while the remaining individuals were distributed across other prototypical trajectories, five of which indicated weaker LMA. Three trajectories involved part-time work: either stable part-time, stepping up from part-time to full-time, or stepping down from full-time to part-time. One trajectory revealed extensive unemployment, while three revealed different patterns of long-term rehabilitation. Finally, one trajectory involved a quick transition to permanent disability. Several baseline factors were associated with a long-term RTW process. A higher odds ratio of membership to trajectories with weaker LMA was found for females and older participants, while being married/cohabitating, having children, working in the public sector, and having higher education, income, and occupational class were associated with a lower odds ratio of trajectories that included unemployment, rehabilitation, and disability pension. These results were consistent with three indicators of LMA.

Overall, the article provides an overview of possible labor market trajectories following long-term sickness absence and indicates groups of individuals who are more vulnerable to labor market marginalization. By applying SA to administrative register data, the article offers valuable insights into the highly heterogeneous trajectories of sick-listed individuals and illustrates the usefulness of SA for public health research.

VII. Discussion

This chapter discusses the findings of the four articles and their contribution to answering the overall research question of the dissertation. To begin with, the chapter assesses the contribution of the dissertation to the literature and relates it to the relevant research fields. Next, policy implications are discussed. Finally, I assess the limitations of the dissertation and future avenues for research before ending with a brief conclusion.

Contribution to the literature

The general aim of this dissertation is to examine social divisions in different forms of career interruptions. The concept of social divisions entails a categorical approach to social differences in the outcomes studied (Payne, 2000). Individuals were categorized according to their education–occupation match, type of profession, occupational class, type of gender-segregated workplace, and gender. These social divisions were in turn linked to the reward structure of the division of labor. In chapter 2 of this introduction, labor market rewards were sorted into extrinsic and intrinsic types (Bielby and Kalleberg, 1981). The former refers to factors such as income, while the latter refers to conditions of work, such as work environment. Based on prior studies and theories, the articles constituting the dissertation emphasize the intrinsic rewards for explaining the social disparities in absenteeism and attrition from work. The choice of measure of occupational class reflected this, as it emphasized employment relations and work conditions (e.g., job autonomy) (Muntaner et al., 2010). Moreover, one of the articles also investigated the long-term implications of absence. The four articles are self-contained and contribute independently to specific fields of research. Nevertheless, these fragments all feed back to the large body of social science literature on social divisions in labor market outcomes in general, and labor market participation and attachment in particular.

The literature review in chapter 3 of this introduction mentioned several Nordic population-level and longitudinal studies of socioeconomic disparities in sickness absence. These studies have documented socioeconomic differences in risk of absence according to broad categories of occupational class and their interrelationship with education and income (e.g., Pekkala et al., 2017b). In addition, there are study findings that care workers have a heightened risk of adverse health outcomes, such as burnout and sickness absence (e.g., Aagestad et al., 2016). Article 1 united these strands of research, both theoretically and

empirically, by studying differences in risk of sickness absence among professionals according to socioeconomic position and care work. Moreover, by studying a segment of the middle class, it answers the call for more nuanced analyses of occupational structure with the expansion of the service sector (Weeden and Grusky, 2005). The article also overlaps with questions of labor market gender segregation, as several professions are dominated strongly by either males or females. The heightened absenteeism of care workers in lower socioeconomic positions was discussed in light of the challenge of recruiting and retaining such workers.

Article 2 also provides a nuanced understanding of the influence of position in the division of labor on absence from work besides the already well-documented disparities in risk according to broad occupational classifications. By studying education–occupational mismatch, article 2 responds to the growing interest in the significance of mismatch for health outcomes. Additionally, adverse consequences of overeducation have implications for the larger discussion over the potential oversupply of graduates in light of educational expansion³⁰. Thus, article 2 highlights that underutilization of educated workers not only represents a potential waste of human capital and productivity, but also could have detrimental effects on individuals' LMA and health.

Articles 1 and 2 emphasize that the intrinsic rewards of work mediate the relationship between social position and long-term sickness absence. This includes both the physical and psychosocial demands of work. That conditions of work are important for the observed disparities is well founded in the theoretical and empirical literature, as the short review in this introduction and the more extensive reviews in the separate articles show. However, most episodes of absence because of sickness have a multifactorial background and are not necessarily related to the work environment (Alexanderson, 1998). Thus, it is important to acknowledge other candidate explanations for observed differences besides the intrinsic rewards. For example, the extrinsic rewards from work in the form of income could be an alternative explanation for the observed disparities, as higher income grants access to material resources and services for individuals (Galobardes et al., 2006a). However, compared with education and occupation, income seems less important for explaining socioeconomic

³⁰ There is a large debate over whether educational expansion has led to credential inflation. Støren and Wiers-Jensen (2016) review this literature and investigate whether Norwegian master graduates are increasingly overeducated for their jobs. They find that from 1995 to 2013, there was no increase in the number of overeducated master graduates, and thus conclude that the empirical evidence for credential inflation and increasing overeducation in Norway is weak. Notwithstanding the question of credential inflation, there is a considerable number of overeducated and undereducated individuals in Norway. In 2013, 20% of workers were overeducated while 16% were undereducated, which approximates the OECD average (OECD, 2013b). Hence, the relevance of investigating the detrimental effects of mismatch does not rest on the existence of an increasing trend of overeducated individuals.

disparities in sickness absence, at least in a Nordic setting with relatively narrow income differences and progressive taxation levelling inequality in monetary resources (Piha et al., 2010). Nevertheless, several other factors could confound the observed social divisions in absenteeism, such as a systematic selection of absence-prone workers into certain positions. Compared with article 1, article 2 makes a stronger claim for estimating the true effect of (a mismatch of) positions on absenteeism because it controls for all time-invariant unobserved heterogeneity. As article 2 shows, the general association between education and occupation mismatch becomes weak once selection is taken into account. However, for individuals who are mismatched for several years, the effect was substantial, even after controlling for selection. Hence, article 2 informs the literature on mismatch with regard to the importance of (1) taking selection into account and (2) measuring time spent in a mismatched state. For this reason, the reported relative differences in risk of sickness absence between professionals, as studied in article 1, are likely to be overestimated. Previous studies have found that the association between working in female-dominated occupations such as nursing and sickness absence have been overstated owing to lack of control for selection (Melsom and Mastekaasa, 2018).

Articles 1 and 2 also investigated whether gender was important for the observed associations between the measures of position and absenteeism. In article 2, there were no noteworthy differences in the risk of absence according to education–occupation mismatch by gender. However, article 1 showed that the relative risk of absence for men in caring professions was moderately higher than that for women. The relative risk for men in this group was reduced to a greater extent after sociodemographic and labor market factors were taken into account. While comparisons of hazard ratios across models must be made with caution (Mood, 2010), at least the results, in line with other studies, show that the heightened relative risk of absence associated with care work is not limited to women (Aagestad et al., 2014; Lund et al., 2005). Hence, article 1 suggests that whatever exposure to risk leads to sickness absence in professions, it is likely that men and women react similarly³¹.

Labor market gender segregation, which was reflected in the professions studied in article 1, was specifically addressed in article 3 by investigating women’s attrition from male-

³¹ There could be considerable differences in the absolute rates of sickness absence between men and women despite similar relative rates. Interestingly, Mastekaasa (2016) investigated the number of days absent because of sickness in 402 occupational groups and found a very strong correlation between men and women for the period 2010–2012. Hence, men and women in the same occupations tend to be absent to a similar degree in Norway. Mastekaasa concludes that this indicates that the same work environment factors in occupations contribute to sickness absence for men and women. This supports an interpretation of similar relative rates of sickness absence between male and female professionals as indicating that men and women react similarly to the conditions of work associated with sick leave.

dominated workplaces and their variations by occupational class. While article 1 showed that women were overrepresented in parts of the occupational structure associated with higher rates of sickness absence, article 3 showed that women were also by some margin more likely than men to leave male-dominated settings. Hence, women are not only sorted into female-dominated work, but also, to a large extent, sorted out of male-dominated spheres of the labor market once they have entered. By investigating explanatory factors associated with women's attrition, the study contributes to the understanding of how the gendered division of labor is upheld despite increasing numbers of women entering male-dominated sectors. Furthermore, while social divisions at the occupational level were studied in the other articles, article 3 took advantage of administrative register data to study *workplace* gender segregation. This is a considerable strength because the mechanisms proposed in the literature for female attrition are likely to operate at the workplace rather than at the occupational level.

Articles 1–3 draw on several theories and explanations proposed in the respective literature, as reviewed in chapter 2 of this introduction and in the separate articles. Therefore, it is pertinent to discuss briefly the implications of the articles for the theories. Unfortunately, despite the virtues of the administrative register data available for this dissertation, my analyses do not permit direct tests of the theories used, as discussed in chapter 5 and below. Nonetheless, the studies indirectly inform the literature in several ways.

First, the results in article 1 show clear disparities in long-term sickness absence according to professionals' socioeconomic position and whether they do care work, for both genders. Although the study supports the explanations proposed in the literature, it cannot discriminate between them. For example, the socioeconomic disparities could be due to physical or psychosocial work conditions, and the emotional demands of care work could lead to burnout and in turn, absence from work; however, as discussed in article 1, other explanations cannot be excluded. On the other hand, articles 2 and 3 offer more direct support for specific explanations. In particular, article 2 supports some explanations and is at odds with others. The theories of role conflict (Goffman, 1957) and job demand–control (Karasek, 1979) entail negative reactions (i.e., stress) to all types of mismatch, while theories of relative deprivation (Runciman, 1966) and effort–reward imbalance (Siegrist, 1996) can be interpreted as involving relative deprivation for the overeducated and relative gratification for the undereducated. The results of article 2 support the latter set of explanations. Regarding article 3, the fixed-effects design entails that as the proportion of men in the workplace increases, women are more likely to leave, which makes tokenism (Kanter, 1977), homophilous association (McPherson et al., 2001), and homosocial reproduction (Moore, 1988) plausible mechanisms. However, the study

design did not allow for the choice of one of these explanations over the others. Moreover, work–family conflict was another candidate explanation that was supported by the analyses in article 3 because women were more likely to leave male-dominated workplaces following family formation. Nevertheless, the analyses could not explain why some women left after having children. This could be for reasons such as a change in priorities or difficulties with balancing children and work in male-dominated settings.

Compared with articles 1–3, article 4 was more exploratory. The aim was to provide an empirical account of the complex labor market trajectories of individuals. Whereas articles 1–3 investigated various forms of temporary career interruptions, article 4 considered whether the first absence from work could mark the onset of long-term labor market marginalization. The article thus answers the call for analyses of the potential consequences of sickness absence (Alexanderson and Norlund, 2004). The article supplements articles 1 and 2 in particular by illustrating potential detrimental pathways following absence. The analyses revealed a set of prototypical trajectories over a 10-year span and found that some groups were more likely to follow adverse trajectories. While approximately two-thirds of individuals returned to stable full-time work, the remaining individuals followed eight diverse trajectories. Consequently, the article adds to the small set of prior studies aiming to account for the heterogeneous labor market trajectories following work disability. Whereas all studies included in this dissertation take a longitudinal approach, article 4 puts elapsed time at the forefront of the analysis by means of sequencing methods. Moreover, although the SA does not account for whether a period of absence *causes* some individuals to withdraw from the labor market, it highlights potential long-term pathways. Article 4 also shows that lower socioeconomic position and female gender were associated with adverse trajectories, indicating weaker LMA.

Implications for policy

There are several implications for social policy that can be derived from this dissertation. Because none of the articles have investigated particular policy reforms or interventions, the implications do not pertain to specific policies. At the most general level, the dissertation informs the debate on social inequalities in life chances. It follows the vast amount of research documenting social disparities in labor market conditions, and finds that as in many other studies, women and individuals of lower socioeconomic position have a higher risk of adverse outcomes. Moreover, it documents that these groups are more likely to become marginalized from the labor market in the long run. The dissertation thus draws attention to the opportunity

structure of labor markets and the inequality created in outcomes, which informs the discussions over the equalizing capacity of welfare states (Esping-Andersen, 1990).

At a more practical level, the dissertation raises questions over social efficiency in the form of welfare state functioning and sustainability. It informs the debate over public spending on social welfare, which is particularly relevant in the Norwegian context, with extensive spending on welfare provisions invoking concerns over the sustainability of the welfare state (Bay et al., 2015). Simultaneously, the studies raise questions over the retention, recruitment, and underutilization of the human capital of workers.

The concerns over the high rates of sick leave among women (Bekker et al., 2009) and the lack of health care workers and teachers (Reisel and Teigen, 2014b) pose a double threat to the functioning of the welfare state addressed in article 1. The article stresses the need for social policies that both reduce rates of absence and make these female-dominated professions attractive for current workers and potential new pools of recruits (i.e., men) in the face of an aging population and the growth in demand for knowledge workers. Although a high rate of sickness absence could reflect a more inclusive working life (Hagelund, 2014) or the selection of absence-prone workers (Melsom and Mastekaasa, 2018), the high turnover rates and intention to leave documented in occupations such as nursing (Hayes et al., 2012) make it probable that there are some issues with the work setting of these professionals, as highlighted in article 1.

Arguably, the future demand for workers is highest in occupations characterized by the highest gender segregation, i.e., for health care and teaching on the one hand, and science, technology, engineering, and mathematics on the other (Reisel and Teigen, 2014c). While article 1 highlights the challenges of retaining workers in female-dominated parts of the labor market, article 3 does so for male-dominated ones. The relatively high attrition rates of women in male-dominated workplaces, as documented in this study, inform social policies on gender equality as they raise questions of justice and efficiency (Reisel and Teigen, 2014a). A lack of equality in opportunity may be present if women in male-dominated settings are more likely to leave owing to their minority status or work–family conflict, as discussed in article 3. In addition, women sacrificing human capital when leaving male-dominated sectors can be considered a loss of efficiency. These are important issues for policy makers.

The underutilization of human capital is costly for employers and society in general. However, article 2 shows a potential additional cost of overeducation besides the mismanagement of skills and abilities, as overeducated individuals have a higher risk of long-term sickness absence. This risk was only substantial for overeducated individuals over a longer

period. Hence, the detrimental effects of mismatch are probably not applicable to individuals in transition, such as graduates entering their first job and experiencing a temporary misfit. To reduce mismatch, Kalleberg (2007) proposes that creating quality jobs, investing in education and training, and building a safety net to protect individuals against the harms of mismatch are central issues for social policy. While these concerns are perhaps more urgent in an American context, investing in higher education without creating a sufficient amount of jobs where education can be utilized is also a concern in Norway (OECD, 2013b). Reducing overeducation will not only increase productivity as individuals make full use of their human capital, but also help reduce expenditure on sick pay.

Article 4 informs policy makers about particular groups that are vulnerable to marginalization from the labor market and how this process unfolds. This information is highly relevant in light of the ongoing focus on activation requirements and enabling policies in Norway (Bay et al., 2015). Although the article does not examine why individuals with lower educational levels, income, and occupational class are more likely to follow adverse trajectories, this might be because of a higher prevalence of comorbid disorders, fewer material resources to cope with sickness, less social support, less control over work, poorer treatment compliance, and greater treatment resistance (Ervasti et al., 2013).

Limitations and avenues for future research

Although the limitations of each study are addressed in the separate articles, I reflect on two broader issues relevant to all of them, namely those of explanation and causality. I also propose avenues for future research.

A major strength of this dissertation is the administrative longitudinal register data that are utilized in the analyses. However, as noted in the chapter on data and methods in this introduction, the registers lack information on many relevant mediating factors; therefore, indirect or proxy measures are the next best option (Lyngstad and Skardhamar, 2011; Olsen, 2011). Articles 1–3 would have benefitted greatly from information on work conditions, such as the physical and psychosocial work environment, because this is emphasized in the relevant literature for these studies. Moreover, information on individuals' attitudes, intentions, motivations, and priorities would have aided the studies greatly. Data on mediating factors could have enabled further adjudication between different theories and advanced our understanding of the origins of the observed associations. For example, in article 2, undereducated individuals, both men and women, had a lower likelihood of absenteeism than did individuals whose occupations matched their education. This 'protective effect' of

undereducation is also found in other studies (Garcy, 2015; Lundberg et al., 2009). In the literature, the consequences of undereducation are poorly understood; there is a lack of plausible theories and studies testing these theories directly. Future studies of education–occupation mismatch and health in general, and sickness absence in particular, should investigate more proximate causes of this association.

Information on reasons for leaving male-dominated workplaces in addition to information on work environment is lacking in article 3. While the theories applied in article 3 seem more established than those in article 2, there is a lack of studies testing them in the general working population. Thus, more research is needed on minority attrition from gender-segregated sectors of the labor market. In a similar vein, article 1 would benefit from information on mediating factors in the relationship between type of profession and sickness absence. In recent years, several studies have investigated explanatory factors for the relationship between sickness absence and socioeconomic position (Christensen et al., 2008; Corbett et al., 2015; Löve et al., 2013) and care work (Aagestad et al., 2014, 2016; Indregard et al., 2017; Rugulies et al., 2007). While these studies aid the interpretation of the results in article 1, their measures of explanatory variables are only cross-sectional. Hence, future studies would benefit from longitudinal data with repeated measures of explanatory variables. Furthermore, there were some groups of professionals in article 1 that deviated from the observed pattern, which could warrant further research. For example, psychologists had a relatively high rate of absence for both genders.

In addition to a lack of more proximate covariates, the studies of this dissertation also have limitations with regard to estimating causal effects. As mentioned in the methods section of this introduction, none of the studies make strong causal claims. Hence, future studies could improve on this dissertation in that regard. To start with article 1, selection is likely to bias estimates. Selection effects are documented in studies of socioeconomic position and health (Foverskov and Holm, 2015; Kröger et al., 2015), and there is also some evidence for them in sickness absence (Torvik et al., 2015). Exploiting the panel data structure by using individual fixed effects is a candidate solution. However, this approach is problematic because it requires variation in the independent variable. This makes it a suboptimal solution for article 1, because individuals are unlikely to shift between types of professions, such as from nursing to engineering. A matching strategy is perhaps a way forward for future studies (see e.g., Morgan and Winship, 2015). In articles 2–3, on the other hand, it is meaningful to apply individual fixed

effects³² to remedy bias caused by selection. Therefore, the estimates in these articles are more convincing from a causal point of view. However, there are several limits to a fixed-effects approach, as mentioned in the chapter on methods. A substantial drawback in articles 2 and 3 is the neglect of between-individual variation, which lessens the external validity of these studies. Future studies should find ways to make use of the variation between individuals while still taking selection into account. In addition, although article 3 controls for all unmeasured time-invariant individual heterogeneity, a case could also be made for applying workplace fixed effects, as in a study by Bygren (2010). However, including both individual and workplace fixed effects was not feasible owing to limitations on the multinomial logistic regression used in article 3 (see Pforr, 2014). Controlling for individual characteristics was deemed to be of more importance. Future studies could improve on article 3 by also controlling for time-invariant unmeasured workplace factors.

Article 4 has several limitations that are mentioned in the article. Here, I would rather mention some promising avenues for future research, as SA is developing at a rapid pace. While SA is primarily regarded as a descriptive tool, recent developments have started to address selection problems, among other aspects. First, a recent study proposed a new matching approach (Barban et al., 2017) that can improve future studies following a similar design as article 4. Second, by combining SA with multi-state models, Studer et al. (2018) made it possible to estimate the relationship between time-varying covariates and trajectories. This is a very promising approach for future studies of the complex process of an RTW following work disability. Finally, discrepancy analysis (Studer et al., 2011) offers an alternative way to estimate the association between covariates and sequence trajectories that sidesteps the limitations of logistic regression (Studer, 2013).

Conclusion

This dissertation has examined social divisions in career interruptions by means of Norwegian longitudinal population data. The focus has been on divisions of labor according to types of socioeconomic position and gender, and their association with long-term sickness absence and work attrition. The four articles constituting the dissertation revealed that (1) lower socioeconomic position and care work were associated with a higher risk of absence for professionals of both genders; that (2) long-term overeducated individuals had a higher risk of

³² Article 2 also controls for detailed occupational categories because it is unlikely that the distribution of education–occupation mismatch in the occupational structure is random. Control for socioeconomic position (i.e., occupation) when estimating the effect of mismatch has been emphasized in the literature (Blalock, 1966).

sickness absence, while undereducated individuals had a lower risk compared with matched individuals for both men and women; that (3) women in male-dominated workplaces had a high attrition rate, and their minority status and work–family conflict were associated with an increased risk of attrition to gender-balanced workplaces, female-dominated workplaces, and nonemployment, depending on their occupational class; and finally, that (4) the RTW process following the first spell of absence from work was complex, with many potential pathways, some of which marked the onset of future labor market marginalization. Lower socioeconomic position and female gender were associated with a risk of adverse trajectories.

Overall, the dissertation has provided a multi-faceted account of the association between individuals' positions in the division of labor with absence and attrition from work. It has contributed to the sociological enterprise of understanding how social structure affects individual life chances. Consequently, the dissertation indicates that individuals' labor market attachment is related to the reward structure of labor markets.

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Article 1

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Long-term Sickness Absence Among Professionals: Investigating Gender, Socioeconomic Position and Care Work¹

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ABSTRACT

This study investigates whether the risk of long-term sickness absence among professionals depends upon their socioeconomic position and whether they do caring work. It also explores whether the variation in risk can be attributed to sociodemographic and labor market factors. The event history analysis is based on longitudinal register data from the entire population of Norwegian professionals from 2003 to 2013. The results showed that both low socioeconomic position and being a care worker was associated with long-term sickness absence. The group with the highest risk was professionals of lower socioeconomic position doing caring work. While the results were similar for men and women, the relative risk of sickness absence was higher for male professionals. Sociodemographic and labor market factors partly explained the observed association, and even more so for men. Several candidate explanations for the remaining association as well as potential implications for social policy are discussed.

KEYWORDS

Care work / health inequalities / interpersonal work / long-term sickness absence / professionals / socioeconomic position / welfare professions

Introduction

Professionals are a vital part of the modern welfare state and are invaluable for the functioning of the educational, health and legal system. Concerns over shortages of teachers and health care professionals in several European countries (European Commission 2014), including Norway (Gunnes & Knudsen 2015; Roksvaag & Texmon 2012), highlight the importance of minimizing attrition. A high rate of long-term sickness absence (LTSA) may impede this effort. Norway has the highest rate of sickness absence among the OECD countries (OECD 2013: 36), and this is associated with undesirable outcomes such as dependence on disability pensions (Kivimäki et al. 2004) and mortality (Vahtera et al. 2004).

This study explores differences in the risk of LTSA between professionals and test a classification of professions along two dimensions. Joining two strands of research on health outcomes, the classification captures a vertical division of socioeconomic position

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(SEP), and a horizontal division of whether the primary function of the professional is to care for the welfare of others. While the socioeconomic gradient in sickness absence is well documented (Allebeck & Mastekaasa 2004), the classifications are often crude and one-dimensional. Studies of care providers argue that caring work is stressful (Hochschild 2003; Maslach 2003). However, there is a lack of comparative studies of care professionals and research linking care work to LTSA. The novel contribution of this study is the investigation of whether SEP and doing care work is associated with LTSA among professionals, and whether sociodemographic and labor market factors explain the differences in risk, using longitudinal population data. By supplementing the common emphasis on differences between levels with the inclusion of a caring dimension, and by focusing specifically on professionals, it expands the research on occupational differences in the risk of LTSA.

The article is organized as follows. First, the Nordic context is outlined with an emphasis on social insurance policies and the role of professionals. Second, a classification of professionals according to SEP and care work is presented. Next, previous research on predictors of LTSA is reviewed. On the basis of the review, three hypotheses are proposed in addition to important sociodemographic and labor-market explanatory factors. Then, the data, method and results are presented. Finally, the results of the analyses are discussed in light of previous studies and their implications for social policy.

Professionals in a Nordic welfare state

The Nordic welfare states are characterized by their generous and universal policies known to promote population health (Bambra 2011). While the Nordic welfare regimes share many similarities, there are also several international differences (Bambra 2013). Concerns over budgets and demographic changes during the past two decades led to a number of reforms aiming to reduce costs and beneficiaries, weakening Nordic welfare state exceptionalism (Hvinden 2004). As a consequence, there has been an increase in conditionality, and only Norway has remained unique in universalism and generosity (Kangas & Kvist 2013). For example, the Norwegian sickness benefit provides full compensation for loss of income due to sickness for up to one year, whereas several reforms have lowered the wage replacement levels and tightened the conditions in Sweden (Hagelund & Bryngelson 2014). Moreover, a means-tested benefit and weaker employment protection during sick leave (Brage 2007) separates the flexicurity in Denmark from the protectionism of Sweden and Norway (Bambra 2013).

Professionals are central to the process of transforming welfare states. They are the frontline staff facing the challenge of population aging. Especially in the Nordic countries where the tasks of the family have been assumed by the state (Esping-Andersen 1999). For example, the global nursing shortage implies an aging nursing workforce caring for increasing numbers of elderly people (Oulton 2006). Furthermore, the question of a transforming and sustainable welfare state is intertwined with gender. Since women constitute a large share of welfare state professionals, demographic shifts (e.g., global aging) will increase the demand for their labor. The increase in female labor market participation of the last decades also means that more women qualifies for income replacement benefits (Hvinden 2004). This emphasizes the need to uphold labor market participation, knowing that women have a high and increasing level of sickness absence

(Dale-Olsen & Markussen 2010). Hence, there is potentially a shortage of supply and a challenge of retaining a professional workforce key to future welfare state functioning, and thus a need for knowledge of determinants associated with risk of LTSA for these groups.

Theoretical framework: a classification of professionals

There has been a call for novel and more detailed analyses of the relationship between the division of labor and individual-level outcomes in the wake of the educational expansion and the increasingly growing and heterogeneous salaried middle class (Oesch 2006). The ‘occupationalization’ of the labor market (Grusky 2005) has put the study of occupations on the agenda, of which professions are the most well organized (Freidson 2001). There is much debate about what defines professions. However, most agree that they are exclusive occupations occupying a distinctive segment of the occupational structure owing to processes of jurisdiction (Abbott 1988), closure (Murphy 1988), shelter (Freidson 2001) or monopoly (Larson 1977). Their exclusive labor market position grants them autonomy over work. Through their mandatory and particular higher educational training, professionals acquire their profession’s abstract and complex body of formal knowledge, which they apply to particular cases (Abbott 1988). Thus, professionals differ from the crafts in their abstract academic knowledge and from academic generalists in their exclusive practical application of this specialized knowledge.

The study of the relative risk of LTSA among professionals is interesting for several reasons. First, professionals constitute a large part of the labor force in general and the middle-class in particular, and are vital to welfare state services. Second, it is well established that individuals working in the lower strata of the occupational structure have a higher risk of LTSA than those at the top (Allebeck & Mastekaasa 2004). This calls for a more detailed analysis of different segments of the occupational structure. Comparing the risk among professionals contribute to nuancing our knowledge of occupational differences. Finally, it is more reasonable to study occupational differences in risk of sickness absence among professionals than other middle-class workers. The close connection between their specialized knowledge and practical application implies more homogeneity across workplaces compared to other occupations consisting of academic generalists and firm specific trainees. Therefore, it can be reasonable to attribute differences in risk of LTSA between professionals to some intrinsic traits of professional practice in general rather than just workplace-specific characteristics.

In addition to study the relative risk among all groups of professionals, I classify them along two dimensions common in the sociology of professions. First, I separate professionals according to their SEP. A professional’s SEP refers to the social and material resources available to them through their position in the social hierarchy and is related to numerous health determinants (Galobardes et al. 2006a). According to Freidson (2001), several professions are in a subordinate position in the division of labor since they have not established sufficient cognitive and cultural authority to dominate their jurisdiction. These are often called semi- or para-professions (e.g., nurses and teachers) and are in contrast to ideal-type professions (e.g., physicians and architects). The former has often (but not necessarily) a shorter university college education, lower entry requirements, a less specialized and a more interdisciplinary education, a weaker



knowledge base, less autonomy and control over work, more routine tasks, and more females (Brante et al. 2015; Etzioni 1969). I separate between professionals with high and low SEP to explore whether professionals with a lower position have a higher risk of LTSA.

Second, professionals are classified according to whether caring for the welfare of others is the main professional concern. The dichotomy employed here is frequently applied under different names where caring (Abbott & Wallace 1990), personal service (Halmos 1967), personal (Larson 1977), and relational (Moos, 2004) professionals are contrasted to professionals who do not work in close contact with clients with personal needs. Caring professionals have a 'primary commitment to care for their clients; personalized care is central to their practice as professionals. The needs of clients are said to take precedence in their work' (Abbott & Wallace 1990: 1). The interpersonal relation between client and caring professional entails helping the client to overcome some personal challenge, which often requires emotional and personal involvement. Many have argued that caring work implies health harming physical and mental strain (e.g., emotional labor or burnout) that can in turn heighten the risk of LTSA.

Previous research on predictors of LTSA and hypotheses

LTSA is associated with numerous factors (see Allebeck & Mastekaasa 2004 for a comprehensive review). In the classification of professionals, I put forward SEP and caring work as important for explaining interprofessional differences in risk of LTSA.

The SEP of professionals may reflect health behavior (i.e., lifestyle factors), psychosocial processes (e.g., control and autonomy), and physical exposures (e.g., heavy lifting) (Galobardes et al. 2006a). Among these factors, previous studies indicate that physical work conditions are the main explanatory factor for occupational disparities in sickness absence (Christensen et al. 2008; Löve et al. 2013). While physical factors seem more important than psychosocial ones for explaining the social gradient, the latter has also gained support (Melchior et al. 2005; Niedhammer et al. 2008). According to stress theories (e.g., Karasek 1979), mismatch between demands and control cause strain, and control over work seems especially important (Michie & Williams 2003). Professionals with a lower SEP may experience heavier physical and psychosocial demands (e.g., lifting or work-based stress) and have fewer resources (e.g., autonomy or control) to cope with these demands than professionals with a higher SEP. As prior research suggests, I expect there to be a difference in risk of LTSA according to the professional's SEP. The first hypothesis is:

Hypothesis 1: Professionals with a lower SEP will have a higher risk of long-term sickness absence relative to professionals with a higher SEP.

The argument for a distinction between caring and noncaring professionals is that the handling of clients with personal needs implies a heightened risk of LTSA. Workers in health care and social services have a high risk (Lund et al. 2007), and a recent study found that awkward lifting, threats of violence, actual violence, and emotional demands explained a substantial part of the difference in the risk of LTSA for women in these services compared with women in the general working population (Aagestad et al. 2016).

While comparative research on whether care providers have a higher risk of LTSA is scarce, the hazards of caring work have been highlighted by studies of burnout (Maslach 2003) and emotional labor (Hochschild 2003). Research on burnout has found that caring work results in stress and exhaustion (Barron & West 2007; Wieclaw et al. 2006), and burnout is associated with sickness absence (Ahola et al. 2008; Borritz et al. 2010). Emotional labor is also associated with sickness absence, both in the general working population (Aagestad, Johannessen et al. 2014; Lund et al. 2006) and in human service work (Indregard et al. 2017; Rugulies et al., 2007). In addition to the psychosocial factors associated with burnout and emotional labor, threats of violence and actual violence (Aagestad, Tyssen, et al. 2014; Michélsen et al. 2014; Rugulies et al. 2007) as well as physical strain (Andersen et al. 2012) have been found to predict sickness absence among workers caring for clients. In summary, there is evidence that interpersonal caring work increases the risk of sickness absence, but comparative studies are scarce. An ambition of this study is to explore whether caring professionals experience a higher risk of LTSA than other professionals. The second hypothesis is:

Hypothesis 2: Caring professionals have a higher risk of long-term sickness absence than non-caring professionals.

The two previous hypotheses imply that both the SEP and client orientation of a professional affect the risk of LTSA. However, the strain of interpersonal work may be contingent upon the professional's SEP, and either enhances or moderates it. Low SEP professionals constitutes the lower middle class and have less autonomy and are under greater supervision (Brante 2013), which could entail greater exposure to physical and psychosocial risks (Galobardes et al. 2006a). According to Wharton (1993), workers with less autonomy are more exposed to the negative consequences of emotional labor, while those with sufficient autonomy profit from interpersonal work. Moreover, recent reforms of standardization are believed to be in conflict with caring work resulting in straining working conditions (Trydegård 2012). Loss of professional discretion and autonomy following these reforms might be more prevalent among caring professionals of low SEP (Kamp & Dybbroe 2016). Finally, low SEP professionals are frontline staff with frequent contact with clients with severe problems, such as the threats and violence experienced in nursing (Spector et al. 2014), whereas professionals with a high SEP may be spared the most straining client relationships because of their position. The final hypothesis is of an interaction effect of SEP and caring:

Hypothesis 3: The effect of doing interpersonal caring work on risk of long-term sickness absence is contingent upon the SEP of the professional. Low SEP caring professionals have the highest risk of LTSA.

Additionally, I will explore whether the risk of LTSA among professionals can be attributed to sociodemographic and labor market factors. First, the risk of LTSA might vary by gender since the labor market in Norway is highly gender segregated and women have higher rates of LTSA than men (Dale-Olsen & Markussen 2010). Some studies have shown that physical working conditions explain more of the social gradient in sickness absence for women than for men (Christensen et al. 2008; Löve et al. 2013), implying an interaction between gender and SEP. Moreover, caring work might be more



straining for men, as the relationship between emotional demands and sickness absence has been found to be stronger for them (Aagestad, Johannessen, et al. 2014; Lund et al. 2005). Hence, the association between LTSA and SEP and caring work could be dependent on gender.

Second, factors outside work, such as those related to the family, can confound the association between professionals and LTSA. Previous research has found that both divorce/separation (Dahl et al. 2015) and pregnancy (Rieck & Telle 2013) entail a higher risk, while having children primarily implies a lower risk of sickness absence (Mastekaasa 2012). If family-related characteristics are unequally distributed among professionals, the differences in risk of LTSA can reflect this. In addition, since nonwestern immigrants are both overrepresented in some professional groups and have a higher risk of LTSA (Dahl et al. 2010), the analyses must take immigration background into consideration.

Finally, the variation in risk of LTSA could reflect several labor market factors. For instance, income is an indicator of SEP, which measures material resources available to improve health (Galobardes et al. 2006a) and is interrelated with education and occupation as determinants of sickness absence (Piha et al. 2010). A relationship between the SEP of professionals and LTSA could be the result of differences in pay levels. Furthermore, working-time arrangements could also be of importance. Higher levels of absence are associated with the shift work of healthcare professionals (Merkus et al. 2012) and some use part-time work as a coping strategy (Ingstad & Kvande 2011). Workplace gender composition is another relevant factor since elevated levels of LTSA are found in both extremely male-dominated and female-dominated workplaces (Bryngelson et al. 2011). Lastly, professionals are distributed differently among the public and private sector, which might be of importance because of the lower levels of absence in the private sector (Mastekaasa 2016).

Data and methods

Data and study population

This study uses administrative register data provided by Statistics Norway and consists of official registers on welfare benefits, employment, income, and education for the entire Norwegian population. The strengths of register data are long panels, no self-report bias, and practically no missing information. The population under study consists of all individuals born between 1950 and 1987 who, after receiving professional diplomas, were employed as professionals during the period of January 2003 until December 2013. Self-employed individuals were excluded owing to a lack of data.

I used information on both education and occupation to identify professionals, reflecting formal training as mandatory before qualifying for professional practice. The Norwegian Standard Classification of Education (NUS2000) and the International Standard Classification of Occupation (ISCO-88) provide detailed information on education and occupation. Table 1 summarizes the 25 groups of professionals identified based on the existence of some form of closure or jurisdiction through legislation or credentials. The concept of professions is contested and the occupational structure is ever changing. Thus, the list in Table 1 is not meant to be exhaustive but contains most professions

Table I Classification of professions

	Caring	Noncaring
High socioeconomic position	Clergyman	Architect
	Dentist	Economist (MBA/MPhil)
	Physician	Civil engineer
	Psychologist (cand. psychol.)	Lawyer
	Veterinary surgeon	Pharmacist
Low socioeconomic position		State authorized public accountant
	Dental hygienist/technician	Bioengineer
	General teacher	Journalist
	Physiotherapist/ergonomist	Librarian
	Preschool teacher	Optician
	Radiographer/audiometrist	Pharmacy technician
	Registered nurse	Registered public accountant
	Social worker	Undergraduate engineer

Note: Social workers consist of social workers, social educators, and child welfare officers. General teachers include both general teachers and subject teachers. Economists holding a Master of Business and Administration (MBA) or Master of Philosophy (MPhil) in economics qualify for a statutory regulated title as 'civil' or 'social' economist. The two titles are not directly transferable to countries outside of Scandinavia.

and semi-professions and is consistent with previous research (Mastekaasa 2008; Tuft 2013). Close to all groups of professionals can be identified with one ISCO-88 code. It is primarily economists and engineers who are identified using several ISCO-88 codes since economists often work as business executives and there are several subcategories of engineering. Furthermore, only individuals who had a professional education as their highest and latest registered level of education were included. The yearly information on occupation means that professionals can move in and out of the dataset. They were considered to be under risk of LTSA only when working in an occupation identified as a profession and holding a matching professional education.

On the basis of these selection criteria, the population consisted of 2,274,229 person-rows.

Dependent variable: LTSA

The data provide information on all physician-certified LTSAs (> 16 days) in the period from January 1, 2003, until December 31, 2013. Sickness absence was operationalized as a combination of two factors. The first of these is a dummy variable indicating the onset of absence. The variable indicates whether an observation (individual professional employment spell) ended in failure (LTSA). Each individual can have multiple failures, which would indicate that sickness absence is a recurrent event. Second, there is a variable containing time elapsed in days employed after either being registered as a professional or most recent failure to either failure (absence) or right censoring (end of professional employment or data period). The analyses did not distinguish between different grades of LTSA.



Professions and a typology of professions

All professional groups as shown in Table 1 were included in the analysis as dummy variables with civil engineers as the reference category. Furthermore, Table 1 shows the classification of professionals according to SEP and orientation toward interpersonal caring work. In the analyses, the dimensions were included as dummy variables with professionals of high SEP not doing caring work as baseline.

I separated professionals into high and low SEP in a two-stage process. First, I identified professions based on whether they hold a subordinate position in the professional division of labor (e.g., nurses) or lack authority to dominate their jurisdiction (e.g., journalists). Second, to verify this classification and to help determine borderline cases (e.g., economists), I used two well-known indicators of SEP. Several occupational-based measures of SEP exist (Galobardes et al. 2006b). Both subjective evaluations of occupational standing and measures of employment relations and resources are commonly used. Both aspects were covered by using the Standard International Occupational prestige Scale (SIOPS) and the Erikson-Goldthorpe-Portocarero (EGP) class scheme (Ganzeboom & Treiman 1996). Only clergy were not in accordance with these indicators but were classified as having a high SEP since they belong to classic ideal type professions and require a long university education.

Second, caring professionals were identified according to whether the basic premise of the professional practice is to care for the welfare of others and whether they involve a high degree of interpersonal encounters. The remaining noncaring professionals belong to the spheres of technology, architecture, economy, pharmacy, and law. The classification is in accordance with the categories of health professionals, teaching professionals, and social and elderly care workers in Wieclaw et al. (2006) and life professionals in Tufte (2013).

The classification could be sensitive to the inclusion and exclusion of particular professions. Appendix Figure S1 and S2 shows robustness checks of excluding each of the 25 professions from the classification in the analyses. The results remained robust.

Sociodemographic and labor market factors

The analyses were conducted separately by gender. Other sociodemographic factors included marital status [unmarried, married/cohabitating, divorced/separated, and widow(er)], number of children under 18 (none, 1, 2, and ≥ 3), pregnancy (yes/no), and immigration status (Norwegian, first generation western, second-generation western, first-generation nonwestern, and second-generation nonwestern). Labor market factors were the log transformed yearly income (inflation adjusted to 2011), part-time work (≤ 30 hours a week), percent of females at the workplace, and sector (public/private).

Control variables

Dummy variables for year of birth were included to control for unmeasured heterogeneity between age cohorts. I controlled for number of prior spells of sick leave before the

observation period (2003) or first registration of working as a professional ($0, \leq 3, \geq 4$) to take sickness absence history into consideration. I also controlled for the distance of workplace from regional centers (urban/rural).

Statistics

The data are structured as individual professional employment spells. Each spell can end in either LTSA (temporary or permanent) exit from professional employment or right censoring. Subjects not in professional employment or already listed as long-term sickness absentees at a particular point in time cannot be at risk of another spell of LTSA at that time. Survival analysis is appropriate to model the risk of LTSA because time to event is of interest and the data are right censored (Allison 2014).

An extension of Cox proportional hazards regression was used to model the effect of working as a professional while controlling for other covariates. Conditional gap time models are appropriate because LTSA is an ordered repeatable event, and are the preferred solution for variance-corrected models in multiple failure data (Box-Steffensmeier & Zorn 2002). In a conditional gap time model, time to LTSA is reset after each event. The analyses were clustered on individuals and stratified on order of events to account for the repeated nature of the data. This means that individuals were not at risk of a later event until they had experienced all previous events, and baseline hazards were allowed to vary by number of events experienced.

The primary advantage of the semiparametric Cox model is that it makes no assumption about the distributional form of the baseline hazard rate. However, it assumes that the effect of each variable is the same at all points in time (proportional). Violation of the proportionality assumption (the effect of type of profession is dependent on time) can cause biased estimates. Nonproportionality was examined using the tests recommended by Box-Steffensmeier and Jones (2004), and the results remained robust across various model specifications.

Results

The descriptive statistics in Table 2 shows the proportion of person-rows with spells of long-term sickness absence and the proportion or mean values of family related and labor market factors by type of professional. It also shows the total number of person-rows and individuals. The average number of sickness absence spells per person-row was 17%; however, it varied by type of professional. Professionals with high SEP not doing caring work had an average of 7%, while professionals with low SEP doing caring work had 21%. Other noteworthy differences between the different types is that professionals with low SEP doing caring work had a much larger stock of women, the lowest mean income, more often worked part-time, worked more often in the public sector, and were by far the most numerous.

Table 2 reveals that the professionals belonging to the different types of professions varied by several characteristics. In Table 3, the relative risk [hazard ratio (HR)] of long-term sickness absence according to type of professional is estimated using Cox regression. The analyses are separated by gender. Model 1 shows the unadjusted HRs,

**Table 2** Descriptive statistics (mean values)

	High SEP noncaring	Low SEP noncaring	High SEP caring	Low SEP caring	Total
Long-term sickness absence	0.07	0.10	0.11	0.21	0.17
Women	0.35	0.46	0.57	0.89	0.75
Marital status					
Unmarried	0.37	0.46	0.33	0.38	0.38
Married/Cohabitation	0.56	0.47	0.58	0.51	0.52
Divorced/separated	0.06	0.07	0.08	0.11	0.10
Widow(er)	0.00	0.00	0.00	0.01	0.01
Women pregnant	0.14	0.12	0.15	0.11	0.12
Number of children under 18					
0	0.38	0.43	0.38	0.37	0.38
1	0.21	0.21	0.22	0.23	0.22
2	0.29	0.26	0.26	0.27	0.27
≥3	0.12	0.11	0.14	0.13	0.13
Immigration status					
Norwegian	0.97	0.95	0.85	0.95	0.95
First-generation western	0.01	0.01	0.07	0.02	0.02
Second-generation western	0.00	0.00	0.00	0.00	0.00
First-generation nonwestern	0.02	0.04	0.08	0.03	0.03
Second-generation nonwestern	0.00	0.01	0.01	0.00	0.00
Part-time work	0.02	0.08	0.16	0.32	0.24
Income (NOK)	787 559	500 701	618 201	370 847	458 689
Women at workplace	0.40	0.44	0.75	0.83	0.73
Public sector	0.25	0.33	0.84	0.88	0.74
Year of birth (median)	1970	1972	1971	1971	1971
Urban workplace	0.87	0.77	0.72	0.65	0.70
Number of prior sick leaves					
None	0.72	0.62	0.68	0.40	0.49
≤ 3	0.24	0.30	0.26	0.40	0.36
≥ 4	0.04	0.08	0.06	0.20	0.15
Individuals (n)	44 722	34 172	26 133	182 211	287 238
Observations (n)	290 048	226 906	199 883	1 557 392	2 274 229

Note: Observations are person-rows; SEP = Socioeconomic position; Norway, 2003-2013.

model 2 adjusts for family related factors, immigration status, birth cohort, prior sick leaves, and distance from regional centers, and model 3 further adjusts for labor market factors.

The conditional gap time models show that low SEP and doing caring work was associated with a higher relative risk of LTSA. However, the magnitude varied by gender and was reduced after the introduction of relevant determinants. For men, compared to professionals with high SEP not doing caring work, which is the reference category, the unadjusted relative risk of LTSA at any point in time was 48% higher for professionals

Table 3 Relative risk (hazard ratio) of long-term sickness absence according to type of professional (95% CI in brackets)

	Men			Women		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Type of professional (baseline = high SEP noncaring)						
Low SEP noncaring	1.48*** [1.41,1.55]	1.39*** [1.33,1.46]	1.37*** [1.30,1.43]	1.35*** [1.31,1.40]	1.32*** [1.28,1.37]	1.30*** [1.25,1.34]
High SEP caring	1.65*** [1.57,1.74]	1.52*** [1.44,1.60]	1.26*** [1.19,1.34]	1.31*** [1.27,1.36]	1.26*** [1.22,1.30]	1.10*** [1.06,1.14]
Low SEP caring	3.79*** [3.65,3.94]	2.75*** [2.65,2.86]	2.08*** [1.97,2.20]	1.96*** [1.91,2.01]	1.79*** [1.74,1.83]	1.61*** [1.57,1.66]
Marital status (baseline = unmarried)						
Married/Cohabitation		0.90*** [0.87,0.93]	0.90*** [0.87,0.93]		0.94*** [0.93,0.95]	0.94*** [0.93,0.95]
Divorced/Separated		1.07* [1.01,1.12]	1.07** [1.02,1.13]		1.21*** [1.19,1.24]	1.20*** [1.18,1.23]
Widow(er)		0.85 [0.68,1.07]	0.84 [0.67,1.05]		1.04 [0.98,1.10]	1.04 [0.99,1.11]
Pregnant					7.82*** [7.73,7.91]	7.82*** [7.73,7.90]
Number of children under 18 (baseline = none)						
1		1.01 [0.97,1.04]	1.01 [0.97,1.05]		1.01* [1.00,1.03]	1.02*** [1.01,1.04]
2		0.99 [0.95,1.03]	0.99 [0.95,1.03]		0.89*** [0.88,0.90]	0.91*** [0.90,0.92]
≥ 3		0.94* [0.89,0.99]	0.95* [0.90,0.99]		0.78*** [0.77,0.79]	0.81*** [0.79,0.82]
Immigration status (baseline = Norwegian)						
First-generation western		1.16*** [1.06,1.27]	1.16*** [1.06,1.26]		1.07*** [1.03,1.11]	1.07*** [1.04,1.11]
Second-generation western		0.85 [0.45,1.57]	0.85 [0.46,1.58]		0.93 [0.79,1.09]	0.92 [0.78,1.09]
First-generation nonwestern		1.36*** [1.27,1.45]	1.34*** [1.25,1.44]		1.31*** [1.28,1.35]	1.29*** [1.25,1.32]
Second-generation nonwestern		1.33* [1.01,1.75]	1.31* [1.00,1.73]		1.35*** [1.23,1.48]	1.33*** [1.22,1.46]
Part-time			0.69*** [0.66,0.73]			0.88*** [0.87,0.89]
Ln(income)			0.85*** [0.82,0.87]			1.09*** [1.07,1.10]
Percent of females at workplace			1.04*** [1.03,1.04]			1.03*** [1.03,1.04]
Public sector			1.15*** [1.10,1.19]			1.15*** [1.14,1.17]

(Continued)



(Continued)

	Men			Women		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Year of birth fixed-effects	No	Yes	Yes	No	Yes	Yes
Controls [†]	No	Yes	Yes	No	Yes	Yes
Individuals (n)	87 176	87 176	87 176	200 062	200 062	200 062
Observations (n)	562 028	562 028	562 028	1 712 201	1 712 201	1 712 201

Note: Significance probabilities: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; CI = confidence interval, SEP = Socioeconomic position, ref. = reference category; Stratified by order of events; † = control for number of prior sick leaves and distance of workplace from regional centers; Cox proportional hazard regression model; Norway, 2003–2013, $N = 2,274,229$.

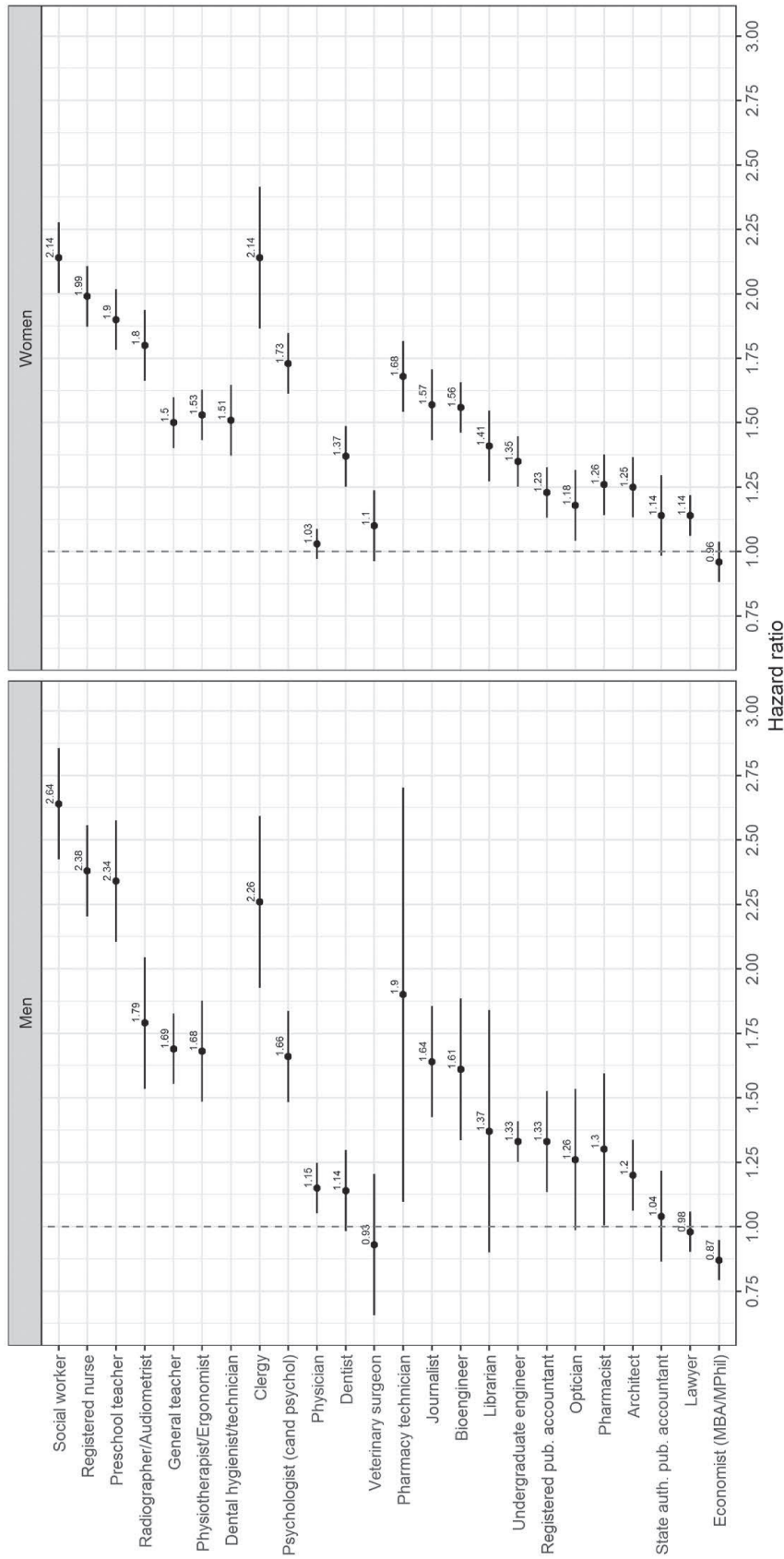
with low SEP not doing caring work (HR 1.48), 65% higher for professionals with high SEP doing caring work (HR 1.65), and 279% higher for professionals with low SEP doing caring work (HR 3.79). Differences in the unadjusted relative risk of LTSA were comparatively lower for women: low SEP noncaring professionals had 35% (HR 1.35), high SEP caring professionals had 31% (HR 1.31), and low SEP caring professionals had 96% (HR 1.96) higher risk of LTSA compared to high SEP noncaring professionals. Hence, the unadjusted results support all three hypotheses and shows that (H1) SEP, (H2) caring work, and especially (H3) a combination of both implies a higher risk of LTSA for men than for women.

The introduction of family-related factors and the control variables in model 2 results in lower relative risk of LTSA according to type of professional, particularly for male low SEP caring professionals. Thus, the higher risk of LTSA for these professionals can partly be attributed to differences in age, prior sick leaves, marital status, pregnancy, number of children, and immigration status. In line with previous research, divorce/separation heightens the risk of LTSA while having more than one child lowers the risk. These associations were stronger for female than for male professionals. Nonwestern immigrants have a higher risk of LTSA, both for men and women, also in line with previous research.

The added labor markets factors in model 3 reduce the differences in risk of LTSA further for both types of caring professionals but, as in model 2, not significantly for low SEP noncaring professionals. For caring professionals, the higher risk of LTSA compared to high SEP noncaring professionals can partly be attributed to differences in work-time, income, workplace gender composition, sector, and distance of workplace from regional centers. In the fully adjusted model, men have a higher relative risk of LTSA than women. Male low SEP noncaring professionals have 37% (HR 1.37), high SEP caring professionals have 26% (HR 1.26), and low SEP caring professionals have 96% (HR 1.96) higher risk of LTSA compared to male high SEP noncaring professionals, while the corresponding results for women are 30% (HR 1.30), 10% (HR 1.10), and 61% (HR 1.61), respectively. Part-time work reduces the risk of LTSA for both genders, supporting the notion of part-time work as a protection against absence. Increasing income decreases the risk of LTSA for men, while it, surprisingly, increases the risk for women. Public sector professionals of both genders have a higher rate of LTSA, and the rate increases with an increasing share of females at the workplace for men and women.

The classification of professionals could hide important interoccupational

Figure 1. Relative risk (hazard ratio) with 95% CI of long-term sickness absence among professionals, by gender.



Note: CI = confidence interval; reference category = civil engineer; adjusted for marital status, pregnancy, number of children under 18, immigration status, part-time work, income, sector, percent of women at workplace, centrality of workplace, prior sickness absence; year of birth fixed effects; stratified by order of events; Cox proportional regression model; male dental hygienist/technicians were excluded due to low n; Norway, 2003–2013, N = 2,274,229.



differences in risk of LTSA. Figure 1 shows the relative risk of professionals compared to civil engineers (baseline) adjusted for the same factors as in model 3 in Table 3 (see appendix figure S3 for unadjusted HRs). The figure shows that the two dimensions of the classification capture the variation in risk between professionals well for both genders, despite some overlap, and seems to follow a gradient. The most diverging results were among high SEP caring professionals. Furthermore, the magnitude of the relative risk compared to civil engineers seems substantial.

Professionals of low SEP doing caring work had all a higher risk of LTSA than civil engineers and other professionals of high SEP not doing caring work, for both genders. This was especially evident for healthcare professionals. The least consistent results were found for high SEP caring professionals. Clergy and psychologists, both male and female, had a high prevalence of LTSA comparable to low SEP caring professionals. These professionals have in common that they work with straining human troubles, which could possibly explain the high relative risk of LTSA. Physicians, dentists, and veterinary surgeons, on the other hand, had a comparatively lower risk of LTSA. Physicians are known for their high prevalence of sickness presenteeism (Aronsson et al. 2000), which could perhaps explain their low relative risk of LTSA. Among professionals not doing caring work, there was a distinct gradient from pharmacy technicians to economists. However, there were some overlap with caring professionals. Especially pharmacy technicians, journalists, and bioengineers had HRs of the same magnitude as teachers, physiotherapists/ergonomists, and radiographers/audiometrists. This similarity in risk of LTSA is perhaps due to these professions being borderline cases, as their work has a strong relational component comparable to caring professionals. For instance, pharmacy technicians and bioengineers deal with patients and clients in healthcare.

Discussion

The aims of this study were to investigate whether the risk of LTSA among professionals was dependent on their SEP and whether they were primarily oriented toward caring for the needs of others, and whether variation in risk could be due to sociodemographic and labor market factors. The analyses confirmed all three hypotheses: (H1) professionals of lower SEP had a higher risk of LTSA compared to professionals of higher SEP, (H2) professionals doing caring work had a higher risk compared to professionals not doing caring work, and (H3) a combination of low SEP and caring work entailed the highest relative risk of LTSA. While the two dimensions of the typology capture the differences in risk well, there were variations within the four types.

Overall, the results were similar for men and women. However, male caring professionals had a higher relative risk of LTSA, which was particularly evident for those of low SEP. This is in line with previous studies that have found that men are more vulnerable to the psychosocial risks of caring work, such as emotional demands (Aagestad, Johannessen, et al. 2014; Lund et al. 2005; Wieclaw et al. 2006). The higher risk for men in these female-dominated professions could also be the result of differential assignment of work tasks (Messing et al. 2003) or a specific job culture in female-dominated professions (Evans & Steptoe 2002).

The differences in relative risk of LTSA between professionals due to SEP and caring work could partly be attributed to sociodemographic and labor market factors.

They accounted for more of the relationship for men than for women since there was a more pronounced reduction in the HRs for men with the introduction of these factors, particularly for male low SEP caring professionals. Regarding the independent association between these factors and LTSA, family-related factors seemed more important for female professionals, and as found in other studies (Dahl et al. 2015; Mastekaasa 2012; Rieck & Telle 2013), married/cohabitating women had a lower and divorced/separated had a higher risk, pregnancy multiplied the risk, and having more than one child under 18 were associated with a lower risk of LTSA. Moreover, first- and second-generation nonwestern immigrants of both genders had higher levels of LTSA, in line with previous research (Dahl et al. 2010). Labor market factors seemed equally important for men and women: Part-time work was associated with a lower risk of LTSA, which is perhaps due to less exposure to the straining effects of work. A study has found that part-time was used to reduce the strains of work among nurses (Ingstad & Kvande 2011). Income is inversely related to LTSA (Piha et al. 2010), as found for men in this study. However, surprisingly, this was not the case for women. The fact that higher income was associated with a higher risk of LTSA for female professionals warrants further research. Finally, both the proportion of female coworkers and working in the public sector were positively associated with LTSA, as previously found (Bryngelson et al. 2011; Mastekaasa 2016).

Significant interprofessional differences in risk of LTSA for both men and women remained even after taking several important sociodemographic and labor market factors into account. While the results indicate correlations and any causal inferences must be made with caution, there are several plausible mechanisms that may explain the observed variation in LTSA between professionals. Firstly, low SEP and caring work may be associated with health hazards at work. While physical work conditions are the most likely explanations for the socioeconomic gradient in LTSA (Christensen et al. 2008; Löve et al. 2013), also psychosocial factors are pertinent (Melchior et al. 2005; Niedhammer et al. 2008). Similarly, certain physical and psychosocial hazards have also been linked to heightened risk of LTSA for caring work (Aagestad et al. 2016) and researchers have particularly emphasized the emotional demands as straining (Indregard et al. 2017; Rugulies et al. 2007).

Second, Tufte (2013) suggests that the value orientation or professional ethics of caring professionals may make them more prone to absence. The altruistic mindset, instilled through their education, urges care providers to involve themselves in helping others. Too much involvement can lead to emotional exhaustion and burnout, especially when facing clients with severe problems (e.g., cancer). A recent study found that nurses with high levels of altruistic prosocial motivation were more likely to report burnout than nurses with lower levels (Dill et al. 2016). Furthermore, prioritizing the needs of clients may lead to disregard of one's own health resulting in accumulated strain and sickness presenteeism, which is known to be high among caring professionals (Aronsson et al. 2000). Sickness presenteeism is associated with sickness absence (Gustafsson & Marklund 2011).

Third, differences in risk of LTSA could be due to selection into occupations. A recent study found that the heightened risk of LTSA in female-dominated occupations (e.g., nursing) could be attributed to unobserved heterogeneity rather than occupation-specific characteristics (e.g., working conditions) (Melsom & Mastekaasa 2017). Thus, it is likely that both men and women more inclined to be on sick leave are sorted into



caring professions indicating that sorting mechanisms as opposed to work environment mechanisms are present. Likewise, there is evidence of selection being the most plausible explanation for the association between SEP and health (Foverskov & Holm 2015). While this study considered several important determinants of LTSA, a limitation is the lack of control for unobserved heterogeneity.

Finally, the observed pattern may not be a result of differences in occupational hazards per se, but rather depends on whether the professional practice allows for minor sicknesses. It may be that professionals performing physically stressful tasks or caring for the sick have fewer opportunities to work when sick, whereas the flexibility often associated with high SEP jobs allows them to manage. The results of this study may reflect these conditions.

In addition to the suggested mechanisms, others are possible. This underscores the main limitation of this study—a lack of a causal design and explanatory variables accounting for the aggregated patterns of risk outlined by the typology. More research is needed to investigate the underlying mechanisms producing variation in risk between professionals. The strengths of this study, on the other hand, are the novel focus on types of professionals, and the typology employed provides a synthetization of two strains of research on work and health. The high-quality longitudinal population data following professional labor market careers for up to 11 years, and the treatment of LTSA as a recurrent event, thus avoid the underestimation of the risk that characterizes many studies (Christensen et al. 2007), gives a robust description of the relative prevalence of LTSA.

The present findings have implications for social policy. Policies aiming to combat the shortage of care workers can be summarized as those whose aim is to improve the conditions and attractiveness of caring work and those whose aim is to recruit new pools of workers (Hussein & Manthorpe 2005). A high rate of absence among caring professionals can have consequences for the retention and recruitment of workers, and a high-risk low-staffed work environment can jeopardize the quality of care (Halbesleben et al. 2008). To begin with, besides temporarily weakening the workforce, sickness absence may have long-term effects on retention by weakening future labor market attachment (Bryngelson 2009; Gustafsson & Marklund 2011). Moreover, a straining physical and psychosocial work environment, as indicated by high rates of LTSA, in addition to low wages (England et al. 2002), can be detriment to the attractiveness of caring work for both current and potential workers. For men, improving the conditions and appeal of caring work seems particularly important. They represent a new pool of workers to recruit from. However, both recruitment and retention of male workers can be impeded by the conditions of care work (Warming 2013), as highlighted by the higher relative risk of LTSA among male caring professionals in the present study.

The policy implications of a high rate of LTSA among caring professionals depend on institutional specificities. Compared to other developed countries, the Nordic welfare states manage the emerging care deficit primarily by public services (Anttonen & Zechner 2011). A large public sector and generous universal policies can be advantageous for the retention and recruitment of caring professionals, as it provides better conditions for care workers in terms of relative wage levels (Hussein & Manthorpe 2005) and reduces the individual consequences of becoming sick listed from working in a hazardous environment. However, a very high reliance on public spending can make these welfare states vulnerable to high levels of LTSA among care workers. It entails a large strain on budgets, especially as the care deficit urges expansion of the workforce and stresses

the need to reduce absence rates. Reforms have been introduced to reduce costs, especially in Sweden and Denmark; however, the reduction in redistributive policies has not been replaced sufficiently by regulatory policies. Implementation of regulatory policies could both compensate for tightening the income maintenance system and contribute to reduce costs (Hvinden 2004). Moreover, as almost all women are working in the Nordic countries, there are nearly no spare labor force in this category (Hussein & Manthorpe 2005). If recruitment from new pools of workers fail and high rates of LTSA among caring professionals prevail, Nordic countries are lacking work-family facilitating policies, which could compensate for a lack of workers. This could, in turn, coupled with declining coverage levels, endanger the high female labor market participation (Martens 2018) of which many are caring professionals.

Conclusion

The present study contributes to the literature by providing a nuanced and detailed analysis of inter-professional differences in risk of LTSA using longitudinal population data following professional careers for up to 11 years. By exploring the intersection between SEP, caring work, and gender, the study assesses the importance of sociodemographic and labor market factors and offers a reliable account of the relative prevalence of LTSA among professionals. Both low SEP and caring work were associated with a higher risk of LTSA, and especially a combination of both. While the two dimensions captured the differences in risk well, there was some overlap between professional groups. Moreover, although the association was partly explained by differences in sociodemographic and labor market characteristics, there were still substantial differences in risk of LTSA after accounting for these factors. Regarding gender, the pattern was similar for men and women with the relative risk of LTSA to some extent higher for male caring professionals. Considering the emerging shortage of care workers, the higher prevalence of LTSA among low SEP caring professionals, as found in this study, highlights the importance of investigating the determinants and consequences of absence among this group.

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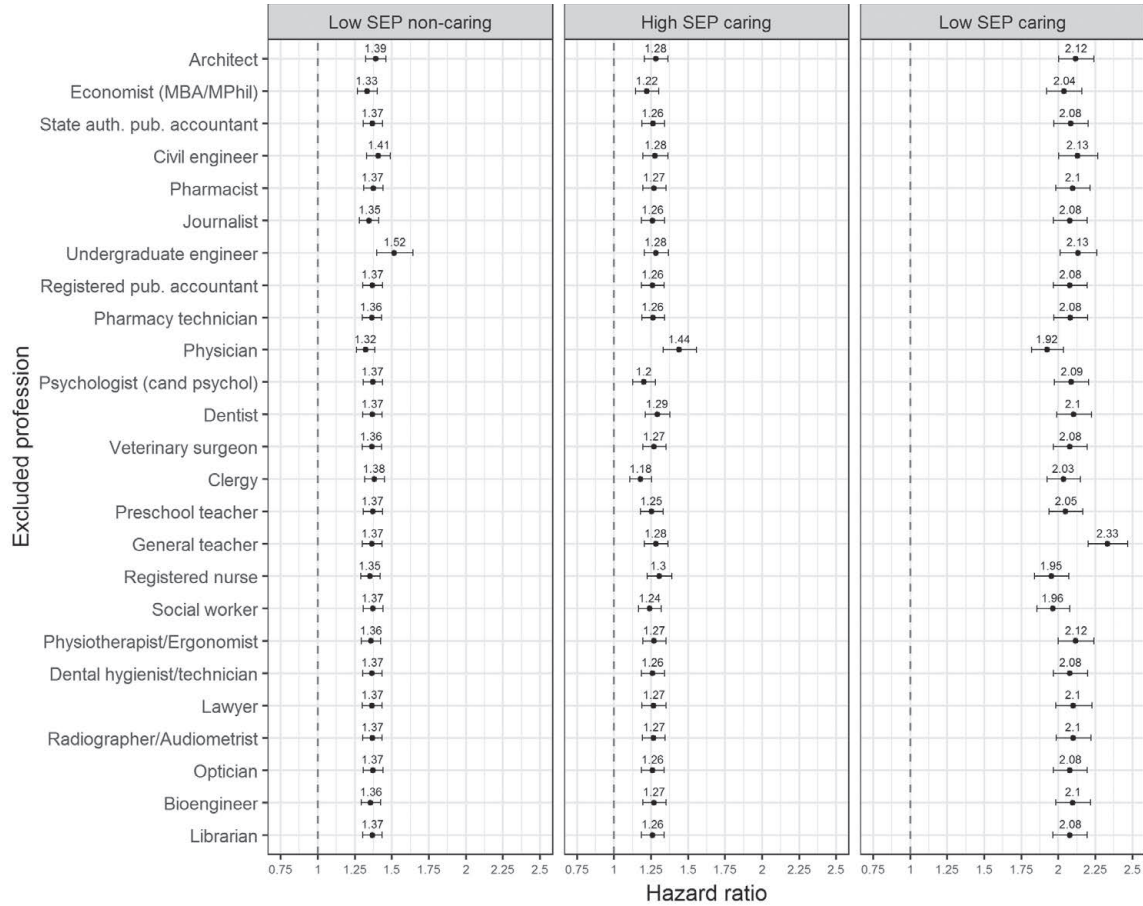
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Appendix

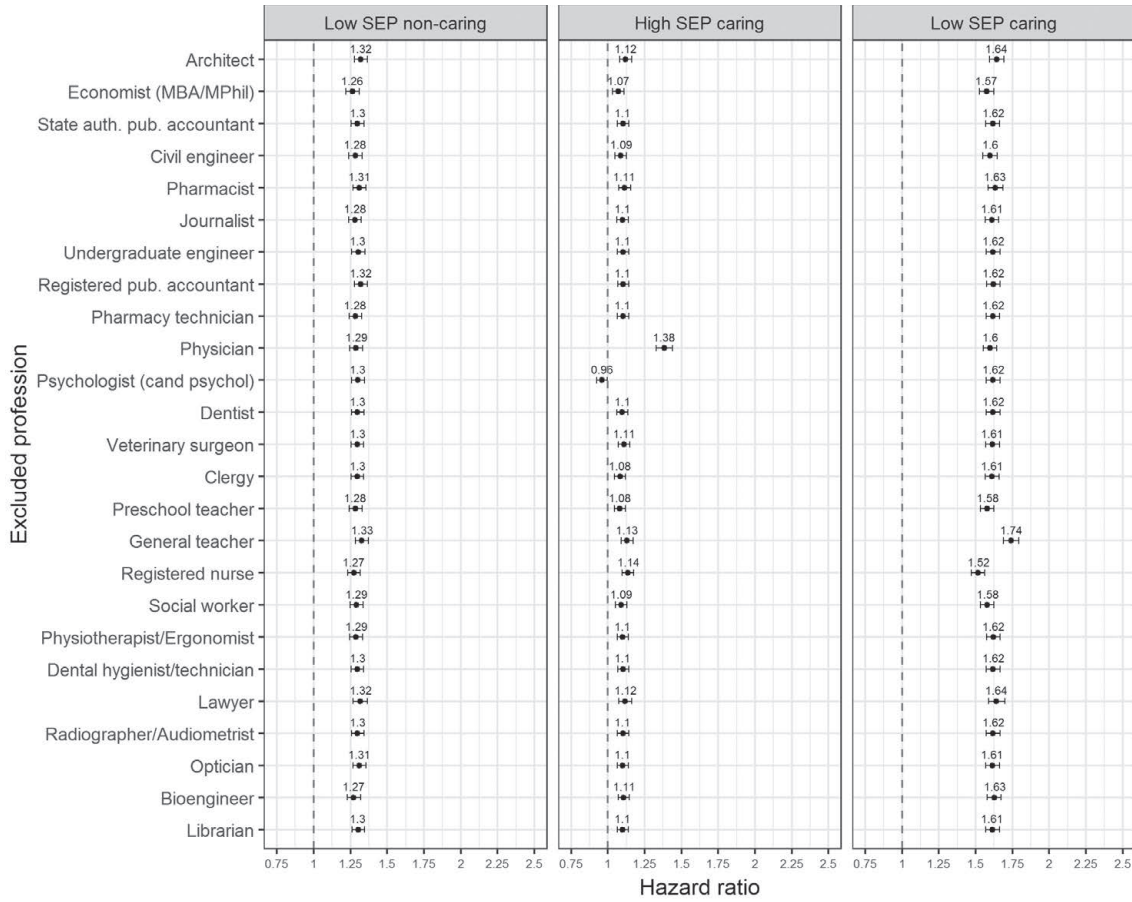
Figure A1. Relative risk (hazard ratio) of long-term sickness absence for men according to type of professional. Robustness check of impact of omitted professionals on estimate for type of profession.



Note: Reference category = High SEP non-caring professionals; adjusted for marital status, pregnancy, number of children under 18, immigration status, part-time work, income, sector, percent of women at workplace, centrality of workplace, prior sickness absence; year of birth fixed effects; stratified by order of events; Cox proportional regression model: Norway 2003-2013.

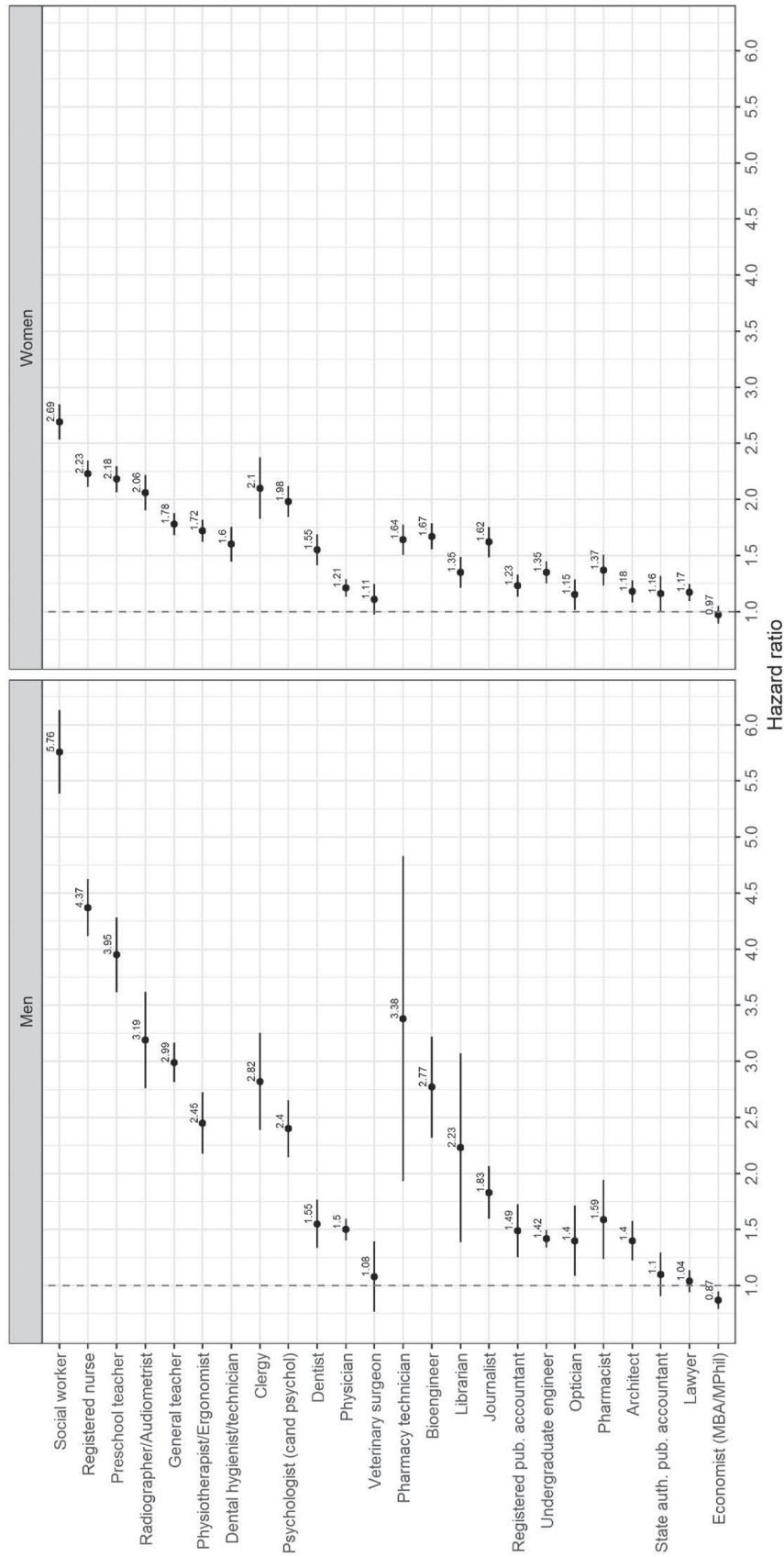


Figure A2. Relative risk (hazard ratio) of long-term sickness absence for women according to type of professional. Robustness check of impact of omitted professionals on estimate for type of profession.



Note: Reference category = High SEP non-caring professionals; adjusted for marital status, pregnancy, number of children under 18, immigration status, part-time work, income, sector; percent of women at workplace, centrality of workplace, prior sickness absence; year of birth fixed effects; stratified by order of events; Cox proportional regression model; Norway 2003-2013.

Figure A3. Unadjusted relative risk (hazard ratio) of long-term sickness absence among professionals, by gender.



Note: Reference category = civil engineer; stratified by order of events; Cox proportional regression model, Norway, 2003–2013, N = 2,274,229.

Article 2

Madsen, A.Å. and Røberg, K.I.K. (forthcoming). Education-occupation mismatch and long-term sickness absence: A longitudinal study of over- and under-education using Norwegian population data, 2003-2013. Submitted to *Journal of Education and Work*.

[Article not attached due to copyright]

Article 3

Madsen, A.Å., Brekke, I. and Fekjær, S.B. (forthcoming). Women's attrition from male-dominated workplaces. Submitted to *Work, Employment & Society*.

[Article not attached due to copyright]

Article 4

Madsen, A. Å. (2019). Return to work after first incidence of long-term sickness absence: A 10-year prospective follow-up study identifying labour market trajectories using sequence analysis. *Scandinavian Journal of Public Health*. Retrieved from

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ORIGINAL ARTICLE

Return to work after first incidence of long-term sickness absence: A 10-year prospective follow-up study identifying labour-market trajectories using sequence analysis

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Abstract

Aims: The study aim was to identify prototypical labour-market trajectories following a first incidence of long-term sickness absence (LTSA), and to assess whether baseline socio-demographic characteristics are associated with the return-to-work (RTW) process and labour-market attachment (LMA). **Methods:** This prospective study used Norwegian administrative registers with quarterly information on labour-market participation to follow all individuals born 1952–1978 who underwent a first LTSA during the first quarter of 2004 ($n = 9607$) over a 10-year period (2004–2013). Sequence analysis was used to identify prototypical labour-market trajectories and LMA; trajectory membership was examined with multinomial logistic regression. **Results:** Sequence analysis identified nine labour-market trajectories illustrating the complex RTW process, with multiple states and transitions. Among this sample, 68.2% had a successful return to full-time work, while the remaining trajectories consisted of part-time work, unemployment, recurrence of LTSA, rehabilitation and disability pension (DP). A higher odds ratio (OR) for membership to trajectories of weaker LMA was found for females and older participants, while being married/cohabitating, having children, working in the public sector, and having a higher education, income and occupational class were associated with a lower OR of recurrence, unemployment, rehabilitation and DP trajectories. These results are consistent with three LMA indicators. **Conclusions:** Sequence analysis revealed prototypical labour-market trajectories and provided a holistic overview of the heterogeneous RTW processes. While the most frequent outcome was successful RTW, several unfavourable labour-market trajectories were identified, with trajectory membership predicted by socio-demographic measures.

Keywords: Long-term sickness absence, return to work, labour market attachment, labour market careers, sequence analysis, socio-economic inequality in health

Introduction

Long-term sickness absence (LTSA) is a personal and public health problem with financial consequences for the employee, employer and society. Considering the multiple negative implications of ongoing absence due to sickness, knowledge about the return to work (RTW) process and factors associated with unsuccessful RTW is key to targeting interventions aimed at reducing work disability [1]. The RTW process can be complex and incompletely captured by static measures [2], while both outcome choices and follow-up times represent

methodological challenges [3]. Although RTW may signal a successful end to LTSA, the original condition can also cause subsequent absences [4]. Temporary labour-market exit can therefore also indicate weaker labour-market attachment (LMA), as LTSA is associated with future sick listing [5], disability pension (DP) [6] and unemployment [7]. LMA refers to whether individuals are employed continuously or experience temporary or permanent non-employment [8] and can indicate whether the RTW process is successful in the long term.

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 SAGE

Table I. Definition and ranking of labour-market states.

Ranking	State	Definition
1	LTSA	Long-term sickness absence benefit
2	Rehabilitation	Work assessment allowance, medical rehabilitation allowance, vocational rehabilitation allowance, time-limited disability pension, qualification benefit
3	Unemployment	Unemployment benefit
4	Disability pension	Disability pension, preliminary disability pension
5	Part-time work	≤ 30 hours a week
6	Full-time work	> 30 hours a week
7	Other	Student benefit, parental leave benefit, social assistance benefit, old-age pension

Recent research has implemented sequence analysis to account for the complexity of the RTW process [3, 9–11]. This method provides a holistic study of individual labour-market trajectories by considering the timing, duration and order of multiple events [12]. By focusing on the longitudinal sequencing of states, sequence analysis captures whole trajectories of LMA and supplements multi-state models [e.g. 13], which emphasize instantaneous transitions [14]. The previous studies of RTW using sequence analysis [3, 9–11] reveal how the careers of sick-listed individuals unfold according to intervention and diagnosis, however, a general assessment of the overall RTW process using this method is currently lacking. Following all individuals experiencing all-cause LTSA for an extended period provides an overview of labour-market careers and exploits the potential of sequence analysis to render individual trajectories comprehensible.

Therefore, the study aim was to investigate the RTW process and subsequent LMA using sequence analysis. The primary aim was to identify prototypical labour-market trajectories following RTW after a first incidence of LTSA. The secondary aim was to assess whether baseline socio-demographic factors were associated with LMA and trajectory membership. A recent review showed that higher socio-economic position (SEP) was associated with positive RTW outcomes, while older age and being female were associated with negative RTW outcomes [1]. Detection of prototypical trajectories following RTW and prediction of trajectory membership based on socio-demographic characteristics may help identify individuals with a weak LMA [15].

Data and methods

Data and design

This prospective, population-based cohort study included all Norwegians born 1952–1978 who had a first incidence of LTSA during the first quarter of 2004 (2004Q1). Statistics Norway provided detailed administrative register data [16] on income, employment,

welfare benefits (FD-Trygd), education (the Norwegian National Education Database), and demographics (the Central Population register). In previous studies of RTW using sequence analysis, register data has been linked to subsamples based on intervention [3, 9, 10] or region [11] with follow-up times of a few years. Here, individual's labour-market participation was followed from 2004Q1 to 2013Q4 (excluding those who are self-employed). A quarterly time-scale was used to facilitate the classification of trajectories, which can be complicated by long sequences [11, 17]. Individuals who died during the study period ($n = 198$) or who had missing baseline socio-demographic characteristics ($n = 1421$) were excluded. Women who gave birth during 2004 were excluded due to the high levels of sickness absence among pregnant workers ($n = 2356$) [18]. Individuals with missing labour-market information during at least 12 of the 40 quarters were also omitted ($n = 571$), because sequences with extensive ($\geq 30\%$) missing can affect sequence analysis results [19]. Thus, the final dataset included $n = 9607$ individuals. The results were robust across sample specifications (see online supplemental materials).

States

Table I shows the labour-market states. LTSA is physician-certified absence > 16 days lasting up to one year, separated into the first occurrence (starting 2004Q1), second, third and fourth or higher occurrence. Rehabilitation benefits are reserved for workers with impaired work abilities and a prospect of RTW. DP is granted to individuals with a permanent loss of work ability. Full-time and part-time employment were defined as work > 30 or ≤ 30 hours per week, respectively. Unemployment benefits are provided to individuals actively seeking employment; the remaining benefits constitute the 'other' state (e.g. parental leave benefit).

Because register data may contain overlaps between states, a ranking of simultaneous states was made [13]. Aggregating labour-market information from months to quarters generates further overlap.

To allow for more variability within labour-market trajectories, the rare and less stable states were prioritized according to the rankings in Table I. When aggregating from months to quarters, the modal state was preferred unless the numbers of states were equal, in which case the ranking was used to determine state.

Baseline socio-demographic characteristics

All baseline socio-demographic variables were measured during 2003. These include gender, age, marital status, number of children < 18 years old and sector. Education, income and occupational class were used to determine SEP. Education was operationalized as lower secondary, upper secondary, undergraduate and postgraduate degree. Yearly income was split into quartiles based on the income distribution of the full population during 2003. Occupational class was measured as manual workers, routine non-manuals, lower service class and higher service class [20]. Occupation during 2004 was used for individuals with no occupation during 2003.

Statistical analyses

Individuals' labour-market careers were analysed using sequence analysis. A sequence is a succession of observed states (e.g. labour-market states) per individual over time (e.g. 40 quarters). Optimal matching is used to measure the dissimilarity between individual sequences, in terms of operations required to transform one sequence into another [12]. Data-driven substitution costs were obtained by considering two states as similar if there was a high chance that both states would be followed by a common state one year (four quarters) later, while the costs of insertions/deletions were set to half the maximum substitution cost [21]. Ward's method, recommended for clustering in sequence analysis [19], was used to group similar sequences. Quality measures [22] and a substantive evaluation were used to determine the appropriate number of clusters (see online Supplemental Table S1). After considering a range of solutions, nine prototypical labour-market trajectories were selected. Prediction of membership to trajectories based on socio-demographic characteristics was based on multinomial logistic regression with odds ratios (OR) and 95% confidence intervals (CI).

Three measures of LMA were used. *Complexity* is a composite measure of career instability that captures the frequency of transitions, states and variations in the timing/duration of states [12]. A high career complexity reflects a turbulent career with

frequent state shifts. Based on previous RTW studies [3, 9], a *volatility indicator* and an *integration indicator* were implemented [23]. Volatility is the proportion of employment episodes in relation to total episodes. Integration refers to how quickly and the extent to which the individual re-entered employment and is assessed by adding the number of employment episodes weighted by their position within the career trajectory [23]. Higher values (range 0–1) of volatility and integration indicate a positive RTW outcome.

Results

Table II shows baseline (2003) descriptive statistics and associations (mean values) with the three LMA measures relating to complexity, volatility and integration (2004–2013). Women and younger individuals had less-stable trajectories, fewer periods of employment and re-entered employment more slowly. Being married and having children were associated with more stable trajectories and a higher RTW process quality. Working in the public sector suggested more complexity but a higher RTW process quality compared with the private sector. Higher education, income and occupational class were associated with an improved LMA on all three measures.

Figure 1 shows nine prototypical RTW trajectories. The state distribution plot displays the proportion of individuals in each state during each quarter per cluster. The first six clusters represent successful RTW, and the last three shows weak LMA. Within this sample: 6553 (68.2%) individuals returned to stable full-time work (cluster 1); 395 (4.1%) returned to part-time work before stepping up to full-time work (cluster 2); 321 (3.3%) returned to full-time work before stepping down to part-time work (cluster 3); 691 (7.1%) returned to stable part-time work (cluster 4); and 266 (2.7%) returned to (mainly) full-time work but had several periods of unemployment (cluster 5). Cluster 6 included a large number of individuals who experienced prolonged or repeated LTSA periods before entering rehabilitation; among these 242 (2.5%) individuals, rehabilitation led to successful return to full-time work. For the 543 (5.6%) individuals in cluster 7, return to full-time/part-time work included repeated LTSA periods before initiating rehabilitation and receiving DP. In cluster 8, 451 (4.7%) individuals entered rehabilitation shortly after LTSA and either remained in rehabilitation or shifted to DP during the study period. Finally, 145 (1.5%) individuals received DP during most of the study period (cluster 9).

Table II. Distribution of baseline socio-demographic characteristics and mean values of labour-market attachment (complexity, volatility indicator, integration indicator).

	Mean	<i>n</i>	Complexity		Volatility indicator		Integration indicator	
			Mean	SD	Mean	SD	Mean	SD
Gender								
Male	0.52	4952	7.33	4.07	0.78	0.25	0.77	0.24
Female	0.48	4655	9.31	4.48	0.71	0.27	0.69	0.26
Age								
25–30	0.24	2332	10.18	4.62	0.68	0.25	0.67	0.25
31–35	0.18	1697	8.53	4.41	0.75	0.25	0.73	0.25
36–40	0.18	1776	7.80	4.15	0.77	0.25	0.75	0.25
41–45	0.18	1736	7.37	3.98	0.78	0.26	0.77	0.25
46–51	0.22	2066	7.15	3.87	0.76	0.28	0.75	0.27
Marital status								
Single	0.53	5115	8.88	4.54	0.72	0.27	0.70	0.26
Married/cohabitating	0.47	4492	7.61	4.10	0.77	0.25	0.76	0.25
Number of children < 18 years								
No children	0.45	4336	8.81	4.50	0.72	0.26	0.71	0.26
1 child	0.22	2113	8.14	4.30	0.75	0.27	0.73	0.26
2 children	0.23	2241	7.59	4.16	0.78	0.25	0.76	0.25
3 or more children	0.10	917	7.88	4.29	0.75	0.27	0.74	0.26
Sector								
Private sector	0.58	5566	8.14	4.31	0.73	0.27	0.72	0.26
Public sector	0.42	4041	8.49	4.48	0.76	0.25	0.75	0.24
Education								
Lower secondary education	0.19	1783	8.89	4.29	0.64	0.32	0.64	0.31
Upper secondary education	0.46	4377	7.93	4.26	0.76	0.25	0.75	0.24
Undergraduate	0.28	2671	8.61	4.57	0.76	0.23	0.75	0.23
Postgraduate	0.08	776	7.81	4.47	0.80	0.21	0.78	0.21
Income								
Income quartile 1	0.03	308	10.49	4.36	0.41	0.33	0.40	0.31
Income quartile 2	0.25	2372	9.69	4.37	0.64	0.30	0.63	0.29
Income quartile 3	0.38	3683	8.37	4.39	0.76	0.24	0.75	0.23
Income quartile 4	0.34	3244	6.96	3.96	0.83	0.20	0.81	0.19
Occupational class								
Manual	0.32	3098	8.46	4.26	0.70	0.29	0.69	0.28
Routine non-manual	0.27	2566	8.84	4.45	0.71	0.28	0.70	0.27
Lower service class	0.29	2833	8.05	4.41	0.79	0.22	0.78	0.21
Higher service class	0.12	1110	7.14	4.28	0.82	0.20	0.80	0.20
Total		9607	8.29	4.39	0.74	0.26	0.73	0.26

Note: Socio-demographic variables measured during 2003. Complexity, volatility indicator and integration indicator measured from 2004Q1 until 2013Q4. SD = standard deviation.

Table III shows the ORs for cluster memberships (reference = cluster 1) based on baseline socio-demographic measures. Women had a higher OR of belonging to the clusters involving part-time work: cluster 2 (OR = 3.11), cluster 3 (OR = 3.57), and cluster 4 (OR = 5.23). They also had a higher OR of belonging to the two clusters that included rehabilitation: cluster 7 (OR = 1.70) and cluster 8 (OR = 1.60). Overall, increasing age was associated with higher OR of part-time (cluster 4) and DP (cluster 9). Individuals aged 46–51 years at baseline had a higher OR of belonging to late rehabilitation (cluster 7; OR = 1.76), prolonged rehabilitation (cluster 8; OR = 2.27), and especially early DP (cluster 9; OR = 29.84). Being married/cohabitating was associated with a higher

OR of return to full-time work via part-time work (cluster 2, OR = 1.47) and part-time work (cluster 4; OR = 1.45); this was also associated with a lower OR of returning to unemployment (cluster 5; OR = 0.71), successful rehabilitation (cluster 6; OR = 0.61), and DP (cluster 9; OR = 0.55). Having children was significantly associated with a lower OR of quickly shifting to DP (cluster 9). Working in the public sector indicated a higher OR of returning to full-time work via part-time work (cluster 2, OR = 1.66) and part-time work (cluster 4, OR = 1.50), and a lower OR of returning to unemployment (cluster 5; OR = 0.53) and successful rehabilitation (cluster 6; OR = 0.72). Overall, the three SEP indicators showed that higher SEP was associated with a more successful RTW.

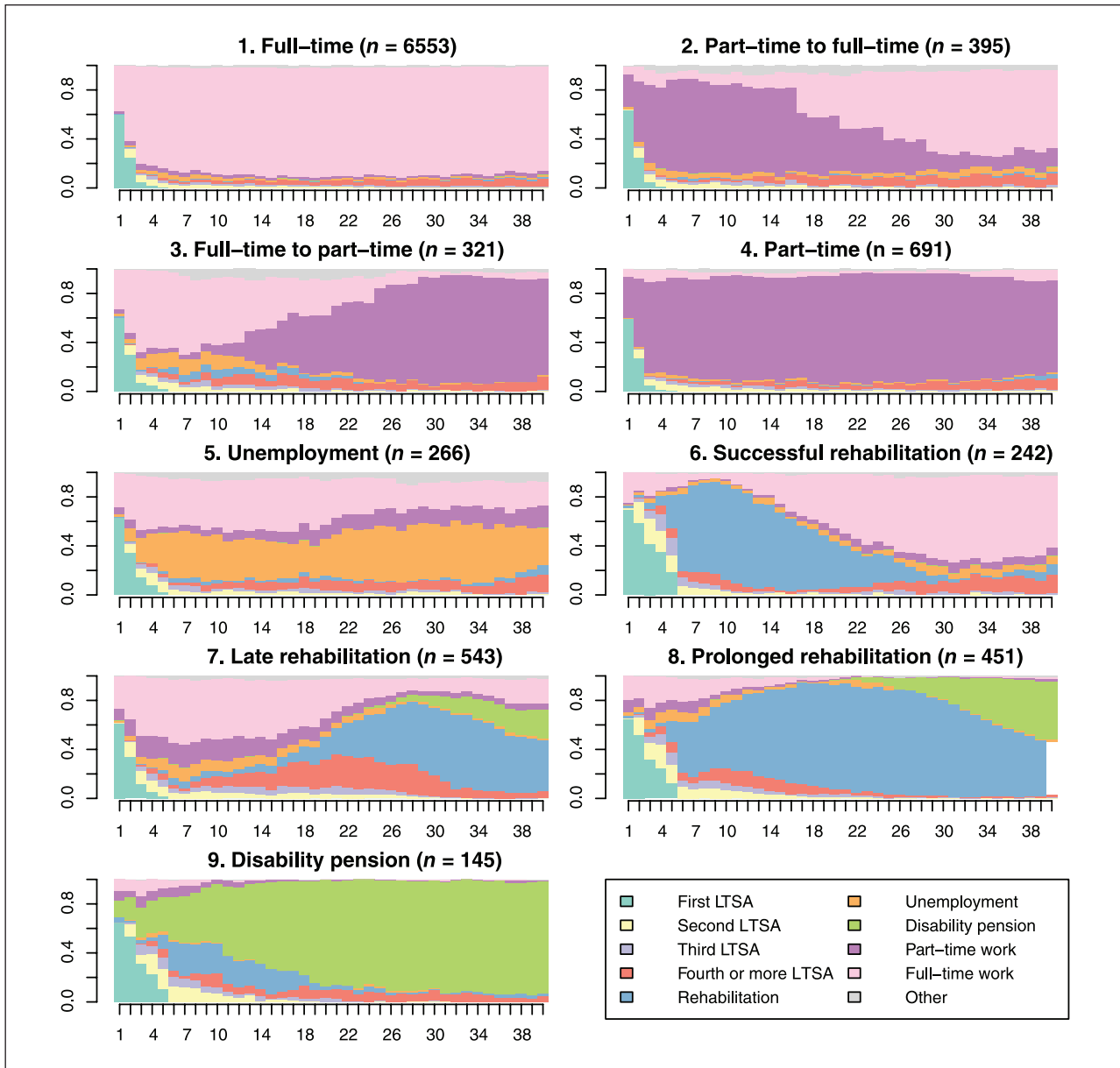


Figure 1. State distribution plot of labour-market trajectories after first incidence of long-term sickness absence in 2004Q1, Norway 2004–2013 ($n = 9607$).

Note: LTSA = Long-term sickness absence. Other = student benefit, parental leave benefit, social assistance benefit and old-age pension.

This was especially evident for income and education, but less so for occupational class. The ORs for belonging to clusters 7–9 decreased with increasing income and education, and there was a lower OR for membership the cluster of prolonged rehabilitation for the lower service class (cluster 8; OR = 0.46) and higher service class (cluster 8; OR = 0.32).

Discussion and conclusion

The aims of this study were to identify prototypical labour-market trajectories over a 10-year period

following a first incidence of LTSA, and to investigate the associations between the RTW process, LMA and baseline socio-demographic characteristics. Sequence analysis identified nine trajectories, illustrating the complex RTW process, with multiple states and transitions. Among this sample, 68.2% successfully returned to stable, full-time work – indicating strong LMA – while others were distributed across other prototypical trajectories, of which five (clusters 5–9) indicated weaker LMA. Several baseline factors were associated with a long-term RTW process. A higher OR of membership to trajectories with weaker LMA

Table III. Multinomial logistic regression (adjusted odds ratios and 95% confidence intervals) of socio-demographic characteristics regressed on membership to prototypical labour-market trajectories (clusters) with stable full-time work (cluster 1) as reference.

	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7	Cluster 8	Cluster 9
Gender (ref. = male)								
Female	3.11*** [2.35, 4.12]	3.57*** [2.67, 4.79]	5.23*** [3.97, 6.90]	1.20 [0.90, 1.59]	1.21 [0.90, 1.64]	1.70*** [1.38, 2.09]	1.60*** [1.26, 2.01]	0.81 [0.54, 1.21]
Age (ref. = 25–30)								
31–35	0.67* [0.47, 0.95]	1.11 [0.78, 1.56]	1.56** [1.12, 2.18]	0.95 [0.66, 1.37]	1.28 [0.88, 1.86]	1.22 [0.91, 1.62]	1.25 [0.89, 1.75]	1.12 [0.39, 3.25]
36–40	0.77 [0.54, 1.09]	0.79 [0.52, 1.20]	1.78*** [1.28, 2.49]	0.83 [0.55, 1.24]	1.05 [0.70, 1.59]	1.17 [0.86, 1.59]	1.35 [0.96, 1.90]	4.70*** [2.16, 10.26]
41–45	0.58** [0.40, 0.84]	0.97 [0.66, 1.43]	1.79*** [1.30, 2.48]	0.83 [0.54, 1.26]	0.91 [0.58, 1.43]	1.17 [0.86, 1.60]	1.40 [0.99, 1.97]	6.39*** [2.97, 13.77]
46–51	0.72 [0.51, 1.03]	0.92 [0.63, 1.34]	3.54*** [2.61, 4.79]	0.73 [0.47, 1.15]	0.85 [0.52, 1.36]	1.76*** [1.32, 2.35]	2.27*** [1.64, 3.13]	29.84*** [15.29, 58.22]
Marital status (ref. = single)								
Married/cohabitating	1.47** [1.14, 1.90]	1.09 [0.83, 1.43]	1.45*** [1.18, 1.78]	0.71* [0.52, 0.97]	0.61** [0.44, 0.83]	0.81 [0.66, 1.00]	0.94 [0.74, 1.18]	0.55** [0.38, 0.80]
Number of children <18 (ref. = no children)								
1 child	1.32 [0.98, 1.77]	0.84 [0.62, 1.14]	1.26 [1.00, 1.59]	1.16 [0.84, 1.60]	1.46* [1.03, 2.06]	0.86 [0.67, 1.09]	1.17 [0.90, 1.51]	0.59* [0.38, 0.94]
2 children	1.26 [0.93, 1.72]	0.66* [0.47, 0.93]	1.15 [0.89, 1.48]	0.69 [0.46, 1.01]	1.39 [0.96, 2.01]	0.82 [0.63, 1.06]	0.77 [0.57, 1.03]	0.57* [0.34, 0.95]
3 or more children	1.66* [1.11, 2.48]	0.52* [0.30, 0.91]	1.07 [0.76, 1.52]	0.97 [0.58, 1.62]	1.59 [0.96, 2.63]	1.08 [0.77, 1.53]	1.25 [0.87, 1.80]	0.22** [0.08, 0.64]
Sector (ref. = private sector)								
Public sector	1.36** [1.08, 1.70]	1.17 [0.91, 1.50]	1.50*** [1.24, 1.81]	0.53*** [0.39, 0.72]	0.72* [0.53, 0.98]	0.90 [0.74, 1.10]	0.87 [0.70, 1.08]	1.00 [0.69, 1.45]

Table III. (Continued)

	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7	Cluster 8	Cluster 9
Education (ref. = lower secondary)								
Upper secondary	1.01	0.81	1.01	0.51***	0.77	0.60***	0.48***	0.52**
	[0.75, 1.37]	[0.58, 1.13]	[0.81, 1.26]	[0.38, 0.70]	[0.56, 1.07]	[0.48, 0.75]	[0.38, 0.61]	[0.35, 0.77]
Undergraduate	1.43*	1.03	0.70*	0.70	0.71	0.60***	0.66**	0.44**
	[1.01, 2.05]	[0.70, 1.52]	[0.52, 0.95]	[0.47, 1.05]	[0.45, 1.12]	[0.45, 0.81]	[0.48, 0.90]	[0.24, 0.82]
Postgraduate	1.15	1.21	0.45**	0.91	0.88	0.46**	0.35**	0.30
	[0.65, 2.06]	[0.70, 2.10]	[0.24, 0.83]	[0.50, 1.69]	[0.46, 1.70]	[0.28, 0.75]	[0.18, 0.70]	[0.08, 1.07]
Income (ref. = income quartile 1)								
Income quartile 2	0.60*	0.73	1.16	0.37***	0.52*	0.42***	0.28***	0.10***
	[0.38, 0.96]	[0.38, 1.39]	[0.73, 1.85]	[0.22, 0.62]	[0.28, 0.97]	[0.28, 0.65]	[0.19, 0.41]	[0.06, 0.18]
Income quartile 3	0.13***	0.35**	0.14***	0.13***	0.25***	0.18***	0.08***	0.02***
	[0.08, 0.21]	[0.18, 0.67]	[0.08, 0.23]	[0.08, 0.22]	[0.14, 0.48]	[0.11, 0.27]	[0.05, 0.11]	[0.01, 0.03]
Income quartile 4	0.07***	0.24***	0.07***	0.09***	0.11***	0.11***	0.05***	0.01***
	[0.04, 0.13]	[0.12, 0.49]	[0.04, 0.12]	[0.05, 0.16]	[0.05, 0.22]	[0.07, 0.17]	[0.03, 0.08]	[0.00, 0.02]
Occupational class (ref. = manual)								
Routine non-manual	1.35*	1.24	1.27*	0.89	0.73	0.87	0.84	1.09
	[1.02, 1.77]	[0.90, 1.71]	[1.02, 1.58]	[0.65, 1.21]	[0.53, 1.02]	[0.70, 1.10]	[0.66, 1.07]	[0.72, 1.64]
Lower service class	0.85	0.91	0.96	0.62*	0.53**	0.60***	0.46***	0.54
	[0.60, 1.21]	[0.62, 1.32]	[0.71, 1.29]	[0.41, 0.92]	[0.34, 0.81]	[0.45, 0.80]	[0.33, 0.65]	[0.28, 1.03]
Higher service class	0.53*	0.70	0.66	0.39**	0.80	0.72	0.32***	0.63
	[0.28, 0.99]	[0.40, 1.23]	[0.37, 1.17]	[0.19, 0.77]	[0.45, 1.43]	[0.47, 1.09]	[0.17, 0.59]	[0.23, 1.70]
<i>n</i>	395	321	691	266	242	543	451	145

Note: Significance probabilities: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Covariates measured in 2003. Trajectories from 2004 to 2013. Cluster 1 = stable full-time work; cluster 2 = part-time to full-time work; cluster 3 = full-time to part-time work; cluster 4 = stable part-time work; cluster 5 = unemployment; cluster 6 = rehabilitation to full-time work; cluster 7 = full-time or part-time work to long-term sickness absence and rehabilitation; cluster 8 = prolonged rehabilitation; cluster 9 = disability pension.

was found for females and older participants, while being married/cohabitating, having children, working in the public sector, and having a higher education, income and occupational class were associated with a lower OR of membership to trajectories that included unemployment, rehabilitation and DP. These results were consistent with the three indicators of LMA relating to complexity, volatility and integration.

The present study is not directly comparable with previous studies of the RTW process that used sequence analysis [3, 9–11] because of differences in samples, follow-up times and diagnoses. However, consistent with the only other sick-leave study that examined all-cause morbidity [9], the most frequent trajectory was from LTSA to continuous work, indicating successful RTW. In that study, individuals with mental health reasons (compared with other health reasons) had a less successful RTW process. A rapid, successful RTW was also the most common trajectory in a study of workers with musculoskeletal disorders, with workers with back strains more likely to experience sustained RTW, while workers with fractures or dislocations were more likely to have prolonged sickness absence [11].

Transitions between states in RTW research have also been used in multistate models [e.g. 13] and trajectory analysis [e.g. 15], emphasizing RTW as a heterogeneous and long-term process. The advantage of methods allowing for complex pattern analysis is illustrated in the present study by the trajectories of delayed success (cluster 6), relapse (cluster 7) and stepwise exit (cluster 8). Consistent with a previous study [13], these data demonstrate the importance of discriminating between full-time and part-time work. The trajectory of stepping-up (cluster 2) shows that part-time work can function as a transition to full-time employment, underscoring the importance of a flexible and including work life that enables individuals with temporary low-work ability to engage in part-time work until fully recovered [24]. Moreover, stepping-down from full-time to part-time work (cluster 3) and stable part-time work (cluster 4) can be understood as successful RTW for individuals with restricted functional abilities [13].

In Norway, rehabilitation benefits provide a secure source of income for individuals with long-lasting impaired function who intend medical or vocational rehabilitation. These analyses show that while rehabilitation leads to successful RTW (cluster 6), it also works as a stepping-stone to permanent DP (clusters 7–9). Rehabilitation resulting in successful RTW has also been shown previously [13]. However, rehabilitation can also mean long-term labour-market detachment, which can make RTW challenging. One study found a rate of only 27% RTW following

rehabilitation benefits [25]. Accordingly, clusters 7–9 demonstrate that unsuccessful RTW is more common among individuals receiving rehabilitation benefits and, hence for some, rehabilitation postponed DP.

Prediction of trajectory membership found that high SEP was associated with positive RTW outcomes, while being older and female were associated with negative RTW, in accordance with a recent review [1]. Additionally, being married/cohabitating, having children and working in the public sector were also associated with positive RTW outcomes. Women were found to be at greater risk for trajectories of prolonged and repeated LTSA periods and rehabilitation, but not DP, which is consistent with previous research [26]. While both family and workplace characteristics have been suggested as possible explanations for these findings [26], the gender gap in sickness absence is still largely unexplained [27]. Public (as compared to private) sector workers had a lower OR of entering a trajectory of unemployment. One explanation could be that former sick-listed individuals are more vulnerable to downsizing and restructuring in the private sector [28]. The higher OR of belonging to trajectories of rehabilitation and DP for older workers may reflect worse prospects for rehabilitation and a preference for alternatives to re-employment, since they are less likely to RTW following vocational rehabilitation [29], and DP can act as a pathway to early retirement, since age is associated with a higher risk of DP [30]. Musculoskeletal diseases are presumably central to the socio-economic gradient in RTW, as socio-economic differences in sickness absence can be primarily attributed to physical working conditions [31]. While physical working conditions are the main explanatory factor for onset of sickness absence, the socio-economic gradient in unsuccessful RTW and trajectories of weaker LMA might be due to lower socio-economic groups having less access to health care, a higher prevalence of comorbid disorders, fewer material resources to cope with sickness, less social support, less control over work, poorer treatment compliance and greater treatment resistance [32].

Strengths and limitations

The primary strength of this study is the use of register data with full information on social benefits and several years of follow-up information on labour-market states, which is needed to obtain a sufficient overview of the RTW process [13]. Moreover, sequence analysis profits from the rich data and complements time-to-event analyses with a holistic description of labour-market trajectories. Additionally, population

data allow for the study of marginal groups. The majority of sick-listed individuals had a successful RTW; detection of alternative trajectories and the statistical power to assess predictors of trajectory membership [15] might not have been possible without complete registers.

One limitation of sequence analysis is that it is a descriptive and explorative method [3]. The combination of cluster analysis and inferential methods must be made with caution as the within-cluster heterogeneity are not reflected in the uncertainty of the parameter estimates of the multinomial logistic regression [22]. Furthermore, sequence analysis is also sensitive to choice of distance measure [21]. Another limitation is the lack of information on diagnoses and other explanatory variables. Two studies found that RTW trajectories varied based on diagnosis [9, 11]. Hence, reasons for LTSA might have provided valuable insight into the RTW process. While the present study included a number of socio-demographic variables, it lacks other variables such as work-related or personality factors that could elucidate why some people do not experience successful RTW. Moreover, future studies could also profit from information on short-term absence (≤ 16 days), which this study lacks. Finally, generalization may be restricted to Nordic countries, given that the large variation in social security systems between countries makes comparisons difficult. However, because the Nordic welfare states have comparable systems, these findings might be generalized to those countries [13].

Conclusions

This study identified nine prototypical labour-market trajectories following a first incidence of LTSA. The application of sequence analysis highlighted the heterogeneity of the RTW process, capturing trajectories of multiple states and transitions. While the majority of individuals in this sample had a successful RTW, the trajectories also showed patterns of unemployment, recurrence of LTSA, rehabilitation and DP. The study also investigated whether LMA and trajectory membership were associated with socio-demographic variables. Female gender and older age were associated with a worse RTW process and weaker LMA, while being married/cohabitating, having children, working in the public sector and having a higher education, income and occupational class contributed to a lower OR of belonging to adverse trajectories. These findings contribute to our knowledge about the RTW process, including identification of trajectories and groups at greatest risk of long-term labour-market

detachment. This insight may be important for targeting interventions aimed at reducing work disability and social insurance careers [25].

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Supplemental material

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Supplementary material for article 4

Online Supplementary Material

Cluster quality measures

Table S1 shows the proposed cluster solution in bold (nine clusters) and cluster quality measures for the sequence analysis. The sample comprised all individuals born 1952–1978 who experienced a first long-term sickness absence (LTSA) during 2004Q1, excluding individuals who died during the study period, women who gave birth during 2004, individuals missing baseline socio-demographic characteristic information, and individual sequences with $\geq 30\%$ missing. Those self-employed were excluded based on the lack of data.

Table S1. Measures of cluster partition quality. The chosen cluster solution is in bold.

	PBC	HG	HGSD	ASW	CH	R2	HC
2 clusters	0.635	0.765	0.765	0.473	2727.495	0.221	0.135
3 clusters	0.751	0.884	0.884	0.518	2202.578	0.314	0.063
4 clusters	0.768	0.899	0.899	0.517	1692.870	0.346	0.053
5 clusters	0.783	0.918	0.918	0.490	1431.822	0.374	0.043
6 clusters	0.788	0.926	0.926	0.476	1251.28	0.395	0.038
7 clusters	0.796	0.936	0.936	0.470	1104.157	0.408	0.032
8 clusters	0.797	0.938	0.938	0.466	1004.968	0.423	0.031
9 clusters	0.798	0.940	0.940	0.469	916.733	0.433	0.030
10 clusters	0.643	0.860	0.860	0.311	905.996	0.459	0.061
11 clusters	0.644	0.862	0.862	0.307	845.679	0.468	0.060
12 clusters	0.646	0.865	0.865	0.311	786.771	0.474	0.058
13 clusters	0.647	0.867	0.867	0.314	735.394	0.479	0.057
14 clusters	0.646	0.874	0.874	0.306	698.681	0.486	0.054
15 clusters	0.648	0.883	0.883	0.304	660.704	0.491	0.049

Note: PBC = Point Biserial Correlation; HG = Hubert's Gamma; HGSD = Hubert's Gamma Somers' D; ASW = Average Silhouette Width; CH = Calinski–Harabasz index; R2 = Pseudo R²; HC = Hubert's C.

Robustness checks of exclusion criteria

The proposed cluster solution might be sensitive to the exclusion criteria (see Methods section).

Table S2 shows the cluster quality of the proposed number of clusters for three samples.

Sample 1 includes all individuals born 1952–1978, excluding those who died during the study

period. Sample 2 is the same as sample 1, excluding individual sequences with $\geq 30\%$ missing.

Sample 3 is the same as sample 2, excluding women who gave birth during 2004.

Table S2. Proposed number of clusters and cluster quality measures using three samples.

Sample	N	Clusters	PBC	HG	HGSD	ASW	CH	R2	HC
1	13 955	9	0.750	0.905	0.905	0.338	1209.428	0.410	0.048
2	12 950	10	0.772	0.929	0.929	0.412	1059.033	0.424	0.034
3	10 763	10	0.774	0.925	0.925	0.443	952.108	0.443	0.036

Note: Sample 1: All individuals born 1952–1978 who experienced their first long-term sickness absence during 2004Q1, excluding individuals who died during the study period. Sample 2: sample 1, excluding individual sequences $\geq 30\%$ missingness. Sample 3: sample 2, excluding women who gave birth during 2004. PBC = Point Biserial Correlation; HG = Hubert's Gamma; HGSD = Hubert's Gamma Somers' D; ASW = Average Silhouette Width; CH = Calinski–Harabasz index; R2 = Pseudo R²; HC = Hubert's C.

Sample 1: Individuals born 1952–1978, excluding those who died during the study period

Figure S1 shows prototypical labour market trajectories for a sample consisting of all

individuals born 1952–1978 who experienced their first LTSA during 2004. Only individuals

who died during the study period were excluded. The state distribution plot is highly similar to

the plot presented in the primary analyses, underscoring the robustness of the cluster solution.

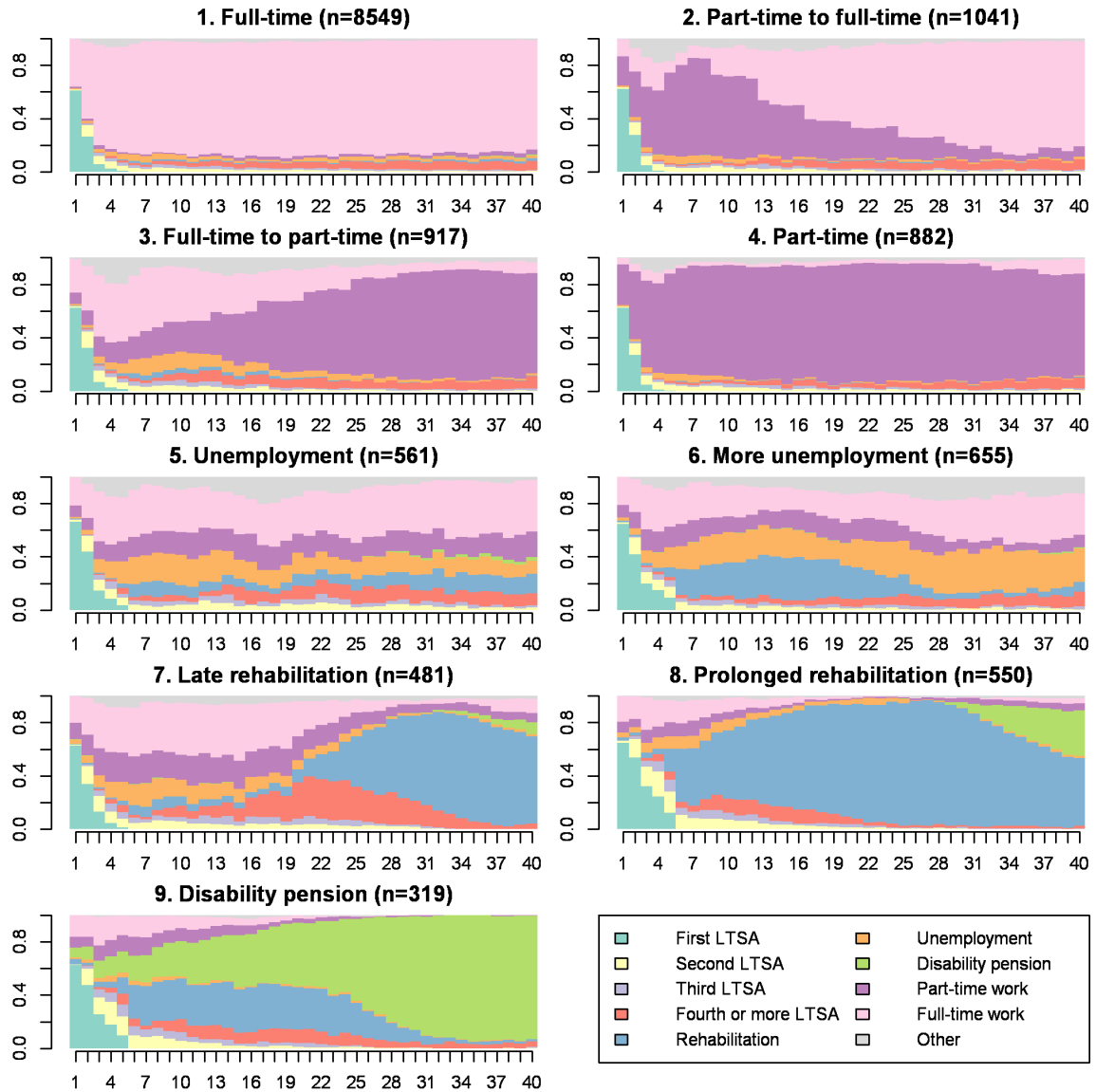
However, Table S2 shows that the cluster quality is lower compared with the study's solution

(AsW=0.34) and the trajectory of successful rehabilitation is missing (cluster 6, Figure 1).

Instead, cluster 6 is replaced by another cluster of unemployment (cluster 6, Figure S1). There

seems to be a poor separation between cluster 5 and cluster 6 in Figure S1.

Figure S1. State distribution plot of labour market trajectories according to sample 1.



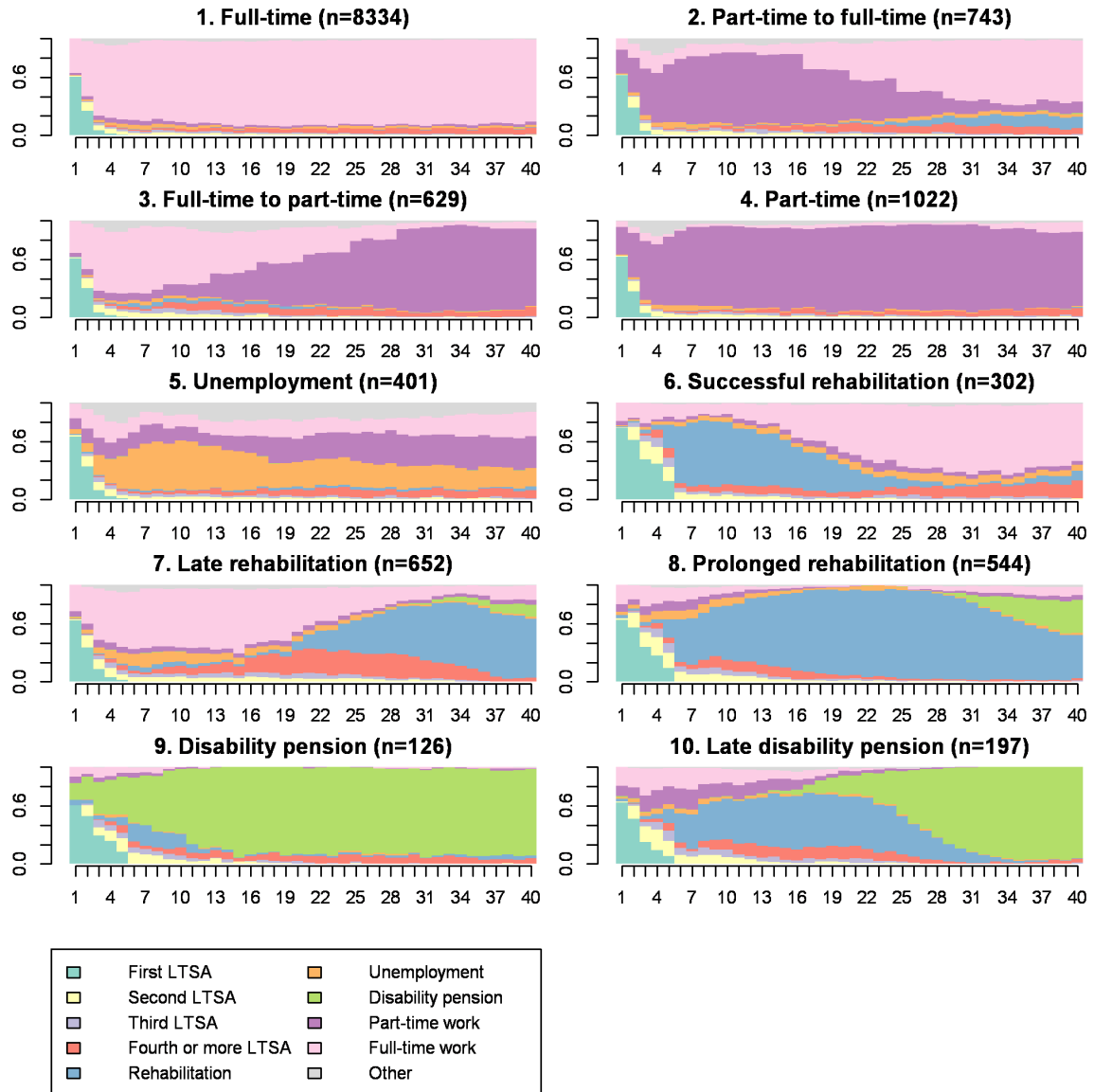
Note: LTSA = Long-term sickness absence. Other = includes student benefit, parental leave benefit, social assistance benefit and old-age pension. Includes all individuals born 1952–1978 experiencing their first LTSA in 2004Q1, excluding individuals who died during the study period. Norway, 2004–2013 (N = 13,955).

Sample 2: Excluding individual sequences with $\geq 30\%$ missingness

The low cluster quality and the deviant cluster in Figure S1 could be the result of including individuals with sequences with extensive missing. Simulations show that individual sequences with $\geq 30\%$ missing can derogate optimal matching, and the assignment of individuals to a cluster becomes arbitrary when missing elements in a sequence exceed a certain number [1].

This may be the reason for the low cluster quality of sample 1 and the poor separation between clusters 5 and 6 in Figure S1.

Figure S2. State distribution plot of labour market trajectories according to sample 2.



Note: LTSA = Long-term sickness absence. Other = includes student benefit, parental leave benefit, social assistance benefit, and old-age pension. Including all individuals born 1952–1978 who experienced their first LTSA during 2004Q1, excluding individuals who died during the study period, and individual sequences with $\geq 30\%$ missingness. Norway, 2004–2013 (N=12,950).

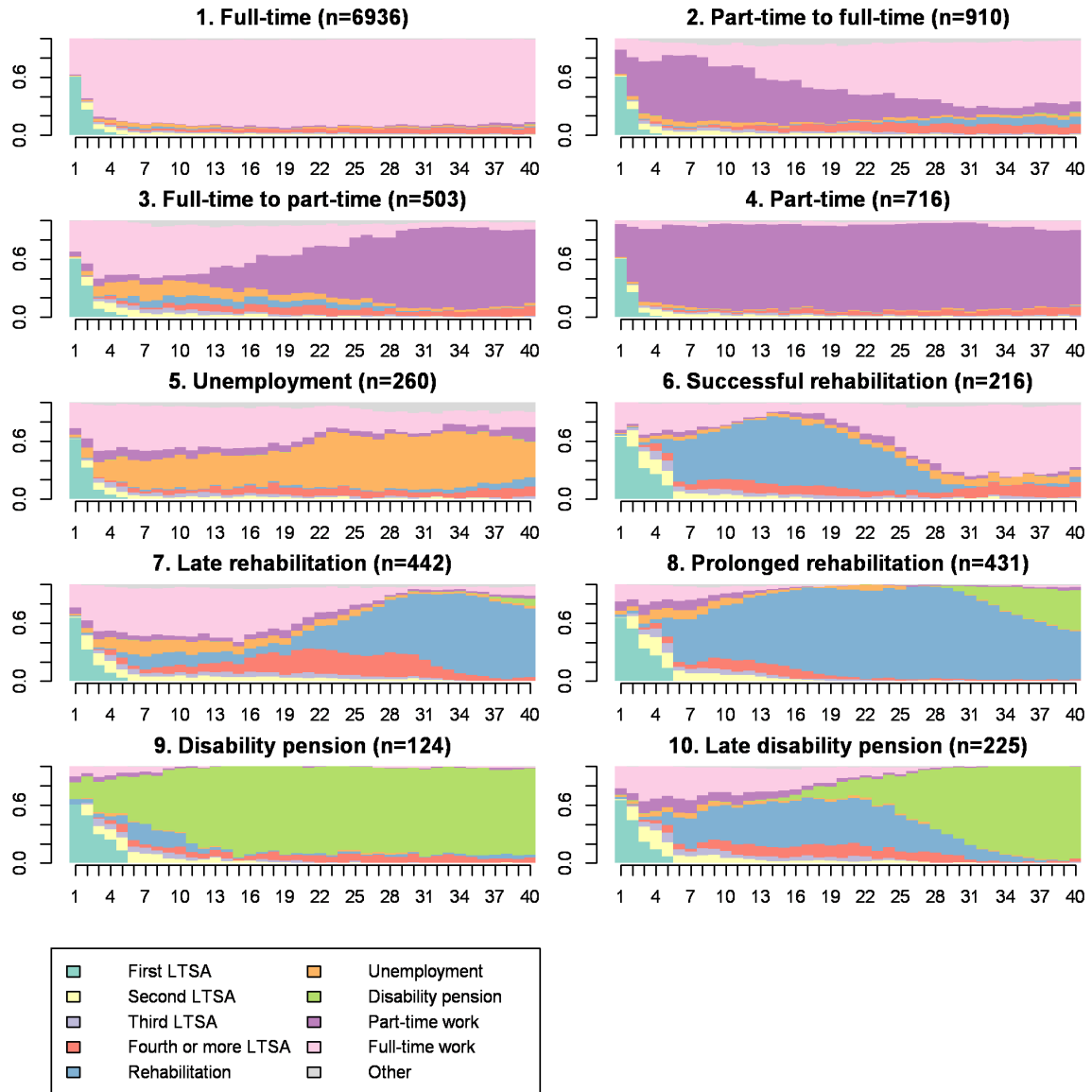
Sample 2 excludes individual sequences with $\geq 30\%$ missing and Figure S2 shows the labour market trajectories for this sample. Table S2 shows that the cluster quality is higher for sample 2 (AsW=0.41) and Figure S2 shows the same clusters as Figure 1. In addition, an

additional cluster (cluster 10, Figure S2) shows a separate path of rehabilitation to disability pension (DP) which is absent in the proposed study solution. The late DP cluster (cluster 10, Figure S2) is not separated into a distinct cluster but is distributed among clusters 7–9 in Figure 1 owing to sample differences.

Sample 3: Excluding women who gave birth during 2004

Sample 3 is the same as sample 2, excluding women who gave birth during 2004, due to the extremely high levels of sickness absence among pregnant workers [2]. The difference between sample 3 and the sample used in the study is that sample 3 included individuals with missing baseline socio-demographic information. As shown in Figure S3, exclusion of women who gave birth during 2004 does not alter the results shown in Figure S2. The only striking difference between Figures S2 and S3 is that the state “other” occurs less frequently in Figure S3, owing to fewer women receiving parental leave benefits. As for sample 2, sample 3 results in the same prototypical trajectories as presented in Figure 1. As in Figure S2, Figure S3 also has an additional cluster (cluster 10) with the nuanced transition from rehabilitation to DP.

Figure S3. State distribution plot of labour market trajectories according to sample 3.



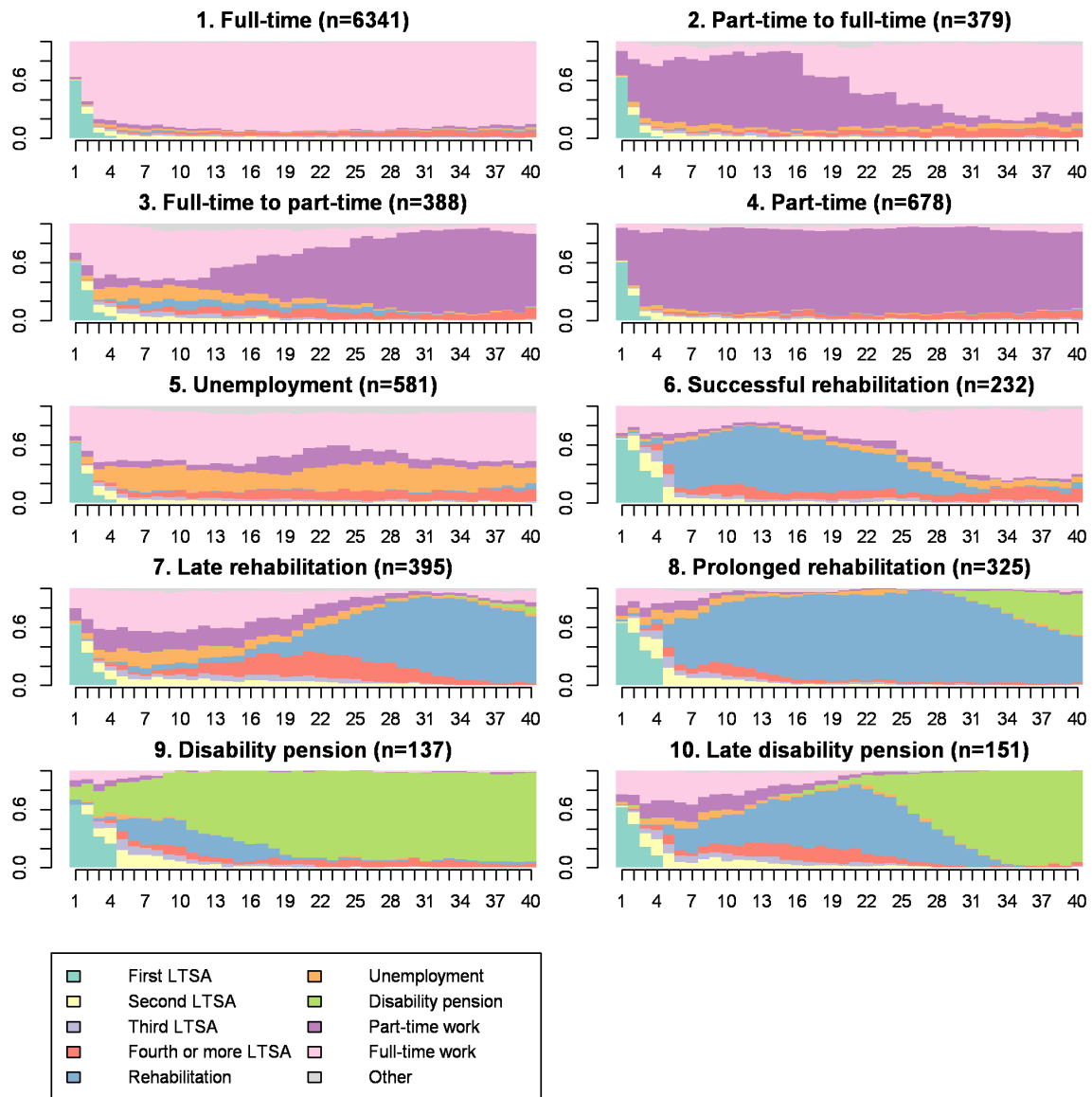
Note: LTSA = Long-term sickness absence. Other = includes student benefit, parental leave benefit, social assistance benefit, and old-age pension. Includes all individuals born 1952–1978 who experienced their first LTSA during 2004Q1, excluding individuals who died during the study period, individual sequences with $\geq 30\%$ missingness, and women who gave birth during 2004. Norway, 2004–2013 (N=10,763).

Imputing missing in individual sequences

Individual sequences with less than 30% missing were included in the main analysis. Here, missing was included as a special state when computing the pairwise distances [3]. Alternatively, one could impute the missing states. Halpin [4] has developed an approach for multiple imputation for categorical time series suitable for sequence analysis. Following this

approach, a simple predictive model included the last and next observed states, and the proportion of time spent in the various states before and after the gap (missing). 10 imputations were generated and the modal state for each quarter among the 10 dataset were chosen. Figure S4 shows the results of a sequence analysis of the same sample as the main analysis but with the missing states imputed.

Figure S4. State distribution plot of labour market trajectories with missing states imputed.



Note: LTSA = Long-term sickness absence. Other = includes student benefit, parental leave benefit, social assistance benefit, and old-age pension. Includes all individuals born 1952–1978 who experienced their first LTSA during 2004Q1, excluding individuals who died during the study period, individual sequences with $\geq 30\%$ missingness, women who gave birth during 2004, and individuals with missing information on baseline (2003) independent variables. Norway, 2004–2013 (N=9,607).

The results including imputed states are very similar to the main results (figure 1). The key difference is the emergence of an additional prototypical trajectory of late disability pension (cluster 10, figure S4), similar to figure S2 and figure S3. Hence, the prototypical trajectories seem robust. The analysis of imputed data further highlights the separation of trajectories of “prolonged rehabilitation” and “late disability pension” as the main varying factor across sample specifications.

Supplementary material references

- [1] Dlouhy K, Biemann T. Optimal matching analysis in career research: A review and some best-practice recommendations. *J Vocat Behav* 2015; 90: 163–173.
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- [3] Gabadinho A, Ritschard G, Studer M. Mining sequence data in R with the TraMineR package: A user’s guide. *Univ Geneva*, <http://mephisto.unige.ch/traminer> (2010).
- [4] Halpin B. Multiple imputation for categorical time series. *Stata J* 2016; 16: 590–612.

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