The Norwegian Agreement on a More Inclusive Working Life (IA Agreement) and its effects on sickness absence and work participation

A registry-based Norwegian cohort study

Rachel Louise Hasting

Institute of Health and Society

Faculty of Medicine, University of Oslo

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List of Publications

Paper I: Hasting RL, Merkus SL, Hanvold TN, Kristensen P, Gran JM, Mehlum IS. Impact of the Norwegian Agreement for a More Inclusive Working Life on diagnosis-specific sickness absence in young adults: a difference-in-difference analysis. BMC Public Health. 2022;22(1):235.

Paper II: Hasting RL, Mehlum IS, Undem K, Robroek SJW, Burdorf A, Gran JM, Merkus SL. The effects of a voluntary agreement for a more inclusive working life on work participation and repeated sickness absence: a cohort study in Norway. *Submitted.*

Paper III: Hasting RL, Hoff R, Merkus SL, Gran JM, Mehlum IS. Effect of the Norwegian Agreement on a More Inclusive Working Life on use of sick leave and pregnancy benefits among pregnant women: a cohort study. *Manuscript.*

Abbreviations

AAP	Work assessment allowance
AKU	Norwegian Labour Force Survey
CIF	Cumulative incidence function
DAG	Directed acyclic graph
DID	Difference-in-difference
DPIA	Data Protection Impact Assessment
ELOS	Expected length of stay
G	Basic amount for reimbursement; 111 477 NOK in 2022
GDPR	General Data Protection Regulation 2016/679
IA Agreement	Norwegian Agreement on a More Inclusive Working Life
ICPC-2	International Classification of Primary Care, Second Edition
MBRN	Medical Birth Registry of Norway
MoBa	Norwegian Mother, Father and Child Cohort Study
NAV	Norwegian Labour and Welfare Administration
NOU	Norwegian Official Report
NUDB	National Education Database
OCBE	Oslo Centre for Biostatistics and Epidemiology
REC	Regional Committee for Medical and Health Research Ethics
RTW	Return to work
SA	Sickness absence
SES	Socioeconomic status
sIPTW	Stabilised inverse probability of treatment weights
SSB	Statistics Norway
STAMI	National Institute for Occupational Health in Norway

English Summary

Background: Work participation is relatively high in Norway. However, so is sickness absence (SA), which can lead to a permanent withdrawal from working life. SA and work participation are influenced by various factors, including gender and industry worked in. The tripartite Norwegian Agreement on a More Inclusive Working Life (IA Agreement) was created in 2001 as a tool to reduce SA and increase work participation among the working-age population in Norway. The original national goals were: (1) reduce SA by 20% relative to the second quarter of 2001, (2) employ more individuals with reduced work capacity, and (3) increase the pension age. Companies could become IA companies by signing the IA Agreement on a local level with a Working Life Centre run by the Norwegian Labour and Welfare Administration (NAV), gaining access to IA-related measures to help them reach these goals. The few peer-reviewed studies into the IA Agreement have found either no effect or a small positive effect on both SA and work participation, but few of these have allowed for causal inference. This has led to a call for a more causal evaluation of the IA Agreement.

Aims: The three papers included in this thesis aimed to investigate effects of the IA Agreement on work participation and SA using causal methods for observational data. The specific research questions were: (1) does working in an IA company impact the prevalence and duration of SA (Paper I); (2) does working in an IA company affect work participation and reoccurrence of SA once an individual has returned from an SA episode (Paper II); and (3) does working in an IA company affect work participation and the use of SA and pregnancy benefits in pregnant women (Paper III)?

Methods: All three papers were based on linking various registries for a cohort of 626,928 individuals born in Norway between 1967 and 1976. The first paper used a difference-in-difference (DID) method to compare the prevalence and duration of SA in individuals working in companies with and without an IA Agreement, before (2000) and after (2005) its introduction. Analyses were stratified by gender and industry, and we included only individuals with either musculoskeletal or psychological SA. Paper II used stabilised inverse probability of treatment (sIPTW) weighted Cox regression models and weighted cumulative incidence functions to compare individuals with and without an IA Agreement

who returned from an SA episode between 01.01.2005 and 31.12.2010. We considered the probability of all-cause exit from work and the following cause-specific events: work, full SA, graded SA, unemployment/economic inactivity, education, disability pension, and death/emigration. Analyses were stratified by gender, and individuals returning from musculoskeletal- or psychological-related SA were analysed as subgroups. Paper III followed women who gave birth between 01.12.2003 and 01.12.2010 in weeks 6-37 of pregnancy. We used sIPTW weighted multistate models to compare probabilities of being in work, full SA, graded SA, pregnancy benefits, maternity leave, or other, in women with and without the IA Agreement. We computed the expected length of stay (ELOS) for each state during follow-up, along with the ELOS difference between IA and non-IA groups.

Results: The findings varied depending on gender, industry, SA diagnosis, and outcome, indicating that the mechanisms by which the IA Agreement works are complex. All studies also had small effect sizes, with the confidence intervals often including null. However, the overarching picture given by the papers in this thesis is that the IA Agreement does not necessarily prevent or reduce SA incidence, including repeated SA, but it can contribute to a shorter SA duration, especially for men and for musculoskeletal-related SA. Potential effects of the IA Agreement in pregnancy varied depending on the trimester. These findings further support the idea that IA measures are more useful for some groups and SA diagnoses than for others. Finally, the results indicate that individuals working in IA companies remain in work to a larger extent than those in non-IA companies, which can mean that the IA Agreement is succeeding in its goal of preventing withdrawal from work through other mechanisms than reducing SA.

Conclusions: Evaluating the IA Agreement is a complex task, but this thesis indicates that it may be beneficial for certain groups and for reducing SA duration, particularly in men. The IA Agreement may also aid in helping individuals remain in the labour market. Using causal inference methods has allowed us to evaluate the effect of working in a company that signed the IA Agreement, rather than studying associations. The small effect sizes on the individual level may contribute to a substantial effect on the population level. This thesis provides a foundation upon which research into more specific groups and occupations can be built.

Norwegian Summary (Norsk Sammendrag)

Bakgrunn: Arbeidsdeltakelsen er relativ høy i Norge. Samtidig er sykefraværet også høyt, noe som kan føre til permanent eksklusjon fra arbeidslivet. Sykefravær og arbeidsdeltakelse påvirkes av mange faktorer, blant annet kjønn og industri. Den norske Avtalen om et mer inkluderende arbeidsliv (IA-avtalen) ble opprettet i 2001 som et virkemiddel for å redusere sykefraværet og øke arbeidsdeltakelsen blant personer i yrkesaktiv alder i Norge. Opprinnelig hadde IA-avtalen tre mål: (1) redusere sykefraværet med minst 20% sammenlignet med andre kvartal i 2001, (2) sysselsette flere personer med redusert funksjonsevne og (3) øke pensjonsalderen. Bedrifter kunne bli IA-bedrifter ved å tegne avtale med det lokale NAV (Arbeids- og velferdsetaten) arbeidslivssenteret, og dermed få tilgang til IA-relaterte tiltak som kunne hjelpe dem å nå IA-målene. De få fagfellevurderte artiklene på IA-avtalen har enten funnet ingen effekt eller en liten positiv effekt på både sykefravær og arbeidsdeltakelse, men svært få har brukt kausale metoder. Dette har ført til etterspørsel om flere kausale studier som kan vurdere IA-avtalen.

Mål: De tre artiklene i avhandlingen skal vurdere effekter av IA-avtalen på sykefravær og arbeidsdeltakelse med bruk av kausale metoder for observasjonsdata. Forskningsspørsmålene var: (1) hvordan påvirker IA-avtalen prevalens og lengde på sykefravær (Paper I); (2) påvirker IA-avtalen arbeidsdeltakelse og gjentatte sykefravær når en person kommer tilbake fra et sykefravær (Paper II); og (3) påvirker IA-avtalen arbeidsdeltakelse og bruk av sykefravær og svangerskapspenger blant gravide kvinner (Paper III)?

Metode: Alle de tre artiklene baserte seg på en kohort med 626,928 personer født i Norge mellom 1967-1976, med kobling mellom flere registre. Den første artikkelen brukte metoden forskjell-i-forskjellen (DID) for å sammenligne sykefraværsprevalens og -lengde blant personer som jobbet i bedrifter med og uten IA-avtale før (2000) og etter (2005) IA-avtalen ble introdusert. Paper II brukte stabilisert invers sannsynlighetsvektede (sIPTW) Cox regresjonsmodeller og vektede kumulative insidensfunksjoner for å sammenligne personer med og uten IA-avtale som kom tilbake fra sykefravær mellom 01.01.2005-31.12.2010. Vi så på sannsynligheten for frafall uansett årsak og for følgende

tilstander: arbeid, fullt sykefravær, gradert sykefravær, arbeidsledighet/økonomisk inaktivitet, utdanning, uførepensjon og død/emigrasjon. Analysene ble stratifisert på kjønn og industri i Paper I, og inkluderte personer med sykefravær grunnet muskel- og skjelettplager og psykiske plager. Analysene i Paper II ble stratifisert på kjønn og sykefraværsårsak (muskel- og skjelettplager og psykiske plager). I Paper III ble gravide kvinner som fødte mellom 01.12.2003 og 01.12.2010 fulgt fra svangerskapsuke 6 til 37. Vi brukte sIPTW vektede multistatemodeller og sammenlignet sannsynlighetene for å være i arbeid, fullt sykefravær, gradert sykefravær, svangerskapspenger, fødselspermisjon og annet, for kvinner med og uten IA-avtale. Vi beregnet forventet oppholdslengde (ELOS) for hver tilstand i oppfølgingstiden, og forskjellen i ELOS mellom de med og uten IA-avtalen.

Resultater: Retningen i resultatene varierte mellom kjønn, industri, sykefraværsdiagnose og utfall (prevalens/lengde på SA, eller andre tilstander som arbeidsledighet). Dette tyder på at mekanismene i IA-avtalen er komplekse. Alle effektestimatene var små og konfidensintervallene inneholdt stort sett nullverdien. Likevel indikerer artiklene at IA-avtalen ikke nødvendigvis reduserer eller forhindrer sykefravær, inkludert gjentatte sykefravær, men at IA-avtalen kan bidra til redusert lengde av sykefravær. Dette gjelder særlig for menn og for de med muskel- og skjelettrelatert sykefravær. Mulige effekter av IA-avtalen blant gravide varierte, avhengig av trimester. Funnene støtter ideen om at IA-relaterte tiltak er mer nyttig for noen grupper enn for andre. Resultatene viser også at personer i IA-bedrifter oftere forblir i arbeid sammenlignet med de som jobber i bedrifter uten IA-avtale, som kan bety at IA-avtalen klarer å forebygge frafall fra arbeidslivet gjennom andre måter enn å redusere sykefraværet.

Konklusjoner: Det kan være vanskelig å evaluere IA-avtalen, men denne avhandlingen tyder på at IA-avtalen kan være nyttig for noen grupper og for å redusere lengde av sykefraværet, særlig blant menn. IA-avtalen kan også bidra til å beholde personer i arbeidslivet. Ved å bruke kausale metoder har vi kunnet ta steget bort fra assosiasjoner og studere effekten av å jobbe i en IA-bedrift. De små effektstørrelsene på individnivå kan utgjøre en stor effekt på populasjonsnivå. Avhandlingen gir et grunnlag som fremtidig forskning på spesifikke grupper og yrker kan bygge videre på.

1 Introduction

1.1 Work Participation in Norway

Norway has historically had a high participation rate in the labour market. Since the 2000s, consistently more than 74% of those aged 15-64, defined by the Organisation for Economic Co-operation and Development (OECD) as working age, were registered as being in paid employment (1). At the end of 2021, over 76% of individuals of working age in Norway were employed; this is much higher than the OECD average of around 68% (1). Of those in paid employment, 74% work full-time (2).

The largest industries (also known as economic activities) in Norway are health and social work, wholesale and retail, and construction (3). The majority of Norwegian companies are relatively small, with less than 50 employees; larger companies tend to be found in the public sector (4, 5). The proportion of individuals in employment has been steadily increasing since 2017, with the exception of special circumstances under the COVID-19 pandemic that resulted in a sharp temporary increase in unemployment (1, 6). The current unemployment rate (defined as those actively seeking employment) was 3.2% in October 2022, one of the lowest in the EU/EEA (7-9).

However, other measures of reduced work participation are considerably higher in Norway than in other countries. An example of this is time lost due to illness/injury, which has received a lot of political focus in many countries (10). Norway's current rate of physician-certified sickness absence (SA) is around 5.4% (11) and has been fairly stable since 2004 (6). Around a third of SA lasting longer than 14 days may be at least partly work-related (12, 13). Implementing measures to prevent and reduce SA, particularly work-related SA, can aid in reducing SA rates in Norway.

1.2 Road to the Norwegian Agreement on a More Inclusive Working Life

During the 1990s, there was a marked increase the number of individuals beginning to receive SA and disability pension (see Figure 1)(14, 15). This resulted in the establishment of the so-called Sandman committee (*Sandmanutvalget*) in 1999 (14). The committee received a mandate from the government to study these developments in more detail and suggest ways to reduce their impact on the labour market. In 2000, the committee delivered their Norwegian Official Report (NOU) with the recommendation that a holistic approach, including changing the structure of the health system, be taken to prevent and reduce SA and keep individuals in employment (14). The committee also emphasised the importance of including both the employer and employee in the process, along with the Norwegian Labour and Welfare Administration (NAV), the institution responsible for benefits and getting people into working life. The main area for improvement highlighted was communication between these different actors – that the sick employee is followed up by the employer, that the employer works together with the employee and NAV to develop a plan for getting the employee back to work, and that the individual's physician and the occupational health service at the workplace are also involved in the process.

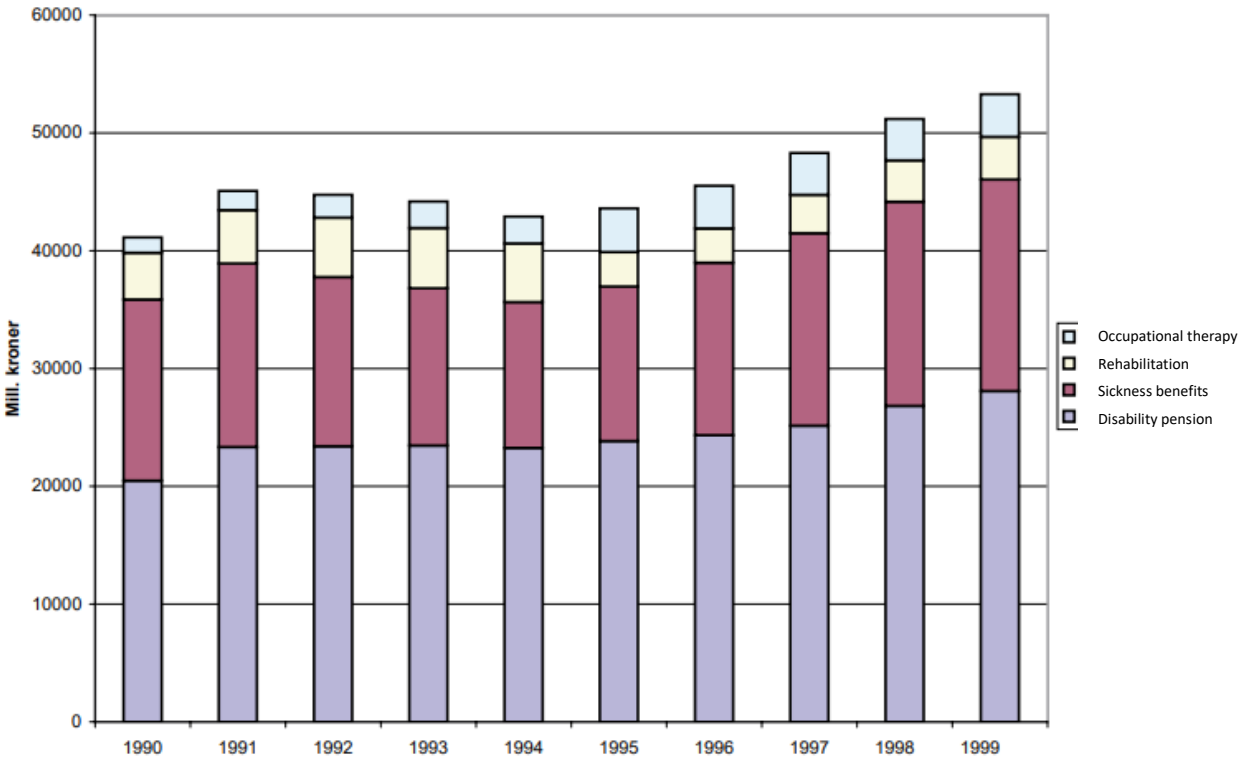

Figure 1. *Changes in the amount of disability pension, sickness benefits, rehabilitation and occupational therapy received between 1990-1999. Amounts in billion kroner. Taken from the Sandman report (14)*

1.2.1 Goals of the Norwegian Agreement on a More Inclusive Working Life

The results of the Sandman committee placed an increased focus on this cooperation between the different actors mentioned above. With the overarching goal of working together to reduce SA and increase work participation, the tripartite Norwegian Agreement on a More Inclusive Working Life (the IA Agreement) was created in 2001 (15). The IA Agreement is a cooperation between the Norwegian government and organisations representing employers and employees, respectively. The first IA Agreement began in October 2001 and ran until the end of 2005, with three main national goals (15):

1. Reduce SA by at least 20% relative to the SA rate in the second quarter of 2001 (just under 7% of working days lost)
2. Employ more individuals with reduced work capacity (e.g., those with disabilities)

3. Increase the mean pension age

Companies could voluntarily sign this IA Agreement with their local NAV centre, committing to work towards these goals. They would then gain access to IA-related measures (described below) to aid with this work. The IA Agreement has since been renewed four times, and the current IA Agreement covers the period 2019-2024 (extended from 2022 due to COVID-19)(16).

The overarching goal of the Agreement (to reduce SA and increase work participation) has remained the same, though the goals have changed somewhat. The main changes have concerned the second goal, to employ more individuals with reduced work capacity. Originally, the goal was defined as including those completely outside the labour market, such as those experiencing discrimination (17). From 2014, this was altered to explicitly include the prevention of withdrawal from the labour market for those who are already employed (18). In 2019, there was a further shift to solely preventing withdrawal of "working people [who] do not return to work after sick leave", rather than also including individuals outside the labour market (19). Several other large changes to the IA Agreement were introduced in 2019. The goal to increase the mean pension age was removed, and the goal for reducing SA was changed to a reduction of 10% compared to the 2018 average, which was around 6% of working days lost (19). Finally, instead of companies voluntarily agreeing to be part of the IA Agreement and signing the IA Agreement with their local NAV Working Life Centre, all companies automatically became part of the IA Agreement and were given access to IA-specific measures.

1.2.2 Measures offered by the IA Agreement

The original IA Agreement had broad, sweeping measures that focused mainly on SA and the workplace. These included the use of active sick leave (where the individual is in some kind of work-related activity during SA), money for adjusting workplaces and getting individuals back to work faster, and an extended period of self-certified SA (8 days before a note from the physician was required, instead of 3)(15). The other two goals had no measures specifically created to achieve them until partway through the second IA Agreement in 2006, when measures such as educational temporary positions for those struggling to access the job market and grants to assist those with milder psychological diagnoses and complex ailments were announced (20). Money was also made available

from 2010 for expenses related to using occupational health services, as long as it involved the prevention of SA or increasing return to work (RTW) of those on SA or otherwise outside of the labour market (21).

A central measure in the IA Agreement was the creation of Working Life Centres (*arbeidslivssentre*) under NAV (15). The Working Life Centres have a contact person for IA companies and offer advice, help with grant applications, and so on (17). These Working Life Centres have been essential for new pilot projects such as "Raskere Tilbake" ("Back [to work] Faster"), which was introduced in 2007 and used measures such as tailored care to get employees back to work faster after SA (22). There is also evidence that Working Life Centres may have contributed to a reduction of SA in IA companies (23).

In the third IA Agreement period (2010-2013) came an explicit focus on graded SA, as a measure to maintain contact with the workplace and increase overall health (21). Graded SA is not a measure reserved only for IA companies and had already been widely used since 2004 (see section on Graded SA below), but has been heavily emphasised in the IA Agreement since this third period (19).

1.2.3 Industries and the IA Agreement

A more industry-specific focus was also introduced in the third Agreement period (21). The level of SA, especially work-related SA, varies between the industries; they also differ in their changes in SA following the introduction of the IA Agreement (6, 13, 24, 25). There have also been large differences in the share of IA companies within industries since the IA Agreement was introduced, indicating a variation in the level of effort/knowledge different industries have had with regards to the IA Agreement (26). It may be the case that the IA measures are more effective in some industries than others; it can, for example, be easier to adjust work tasks for office workers than manual labourers (26). IA companies also likely invest in IA-related work to varying levels, highlighted by the fact that many employees in these companies, including union representatives, do not know the IA Agreement exists (27). This heterogeneity has led to an emphasis on "industry-focused measures" in the current IA Agreement, which has introduced "industry programmes" (19). This is where specific industries are prioritised, based on their potential for reducing and preventing SA and withdrawal from work

(28). Seven industries are currently part of this programme: hospitals, care homes, kindergartens, oil and gas, food product manufacturers, public transport, and construction. These industries receive focused tools to help them in their IA-related work; in hospitals, for example, a full digital program has been developed to aid with improving the workplace and preventing SA (29).

1.3 Sickness Absence in Norway

Norway has one of the highest SA rates in Europe (8); Figure 2 shows the percentage of employees aged 15-74 years in selected countries who were on SA during the reference week of the Norwegian Labour Force Survey (*Arbeidskraftsundersøkelsen*, AKU) between 1990 and 2019. It is clear from the figure that Norway has had a higher SA rate than the other countries since the mid-2000's. The rate of SA in Norway has remained consistently between 3-4% since 1996, with a rate of around 3.5% in 2019.

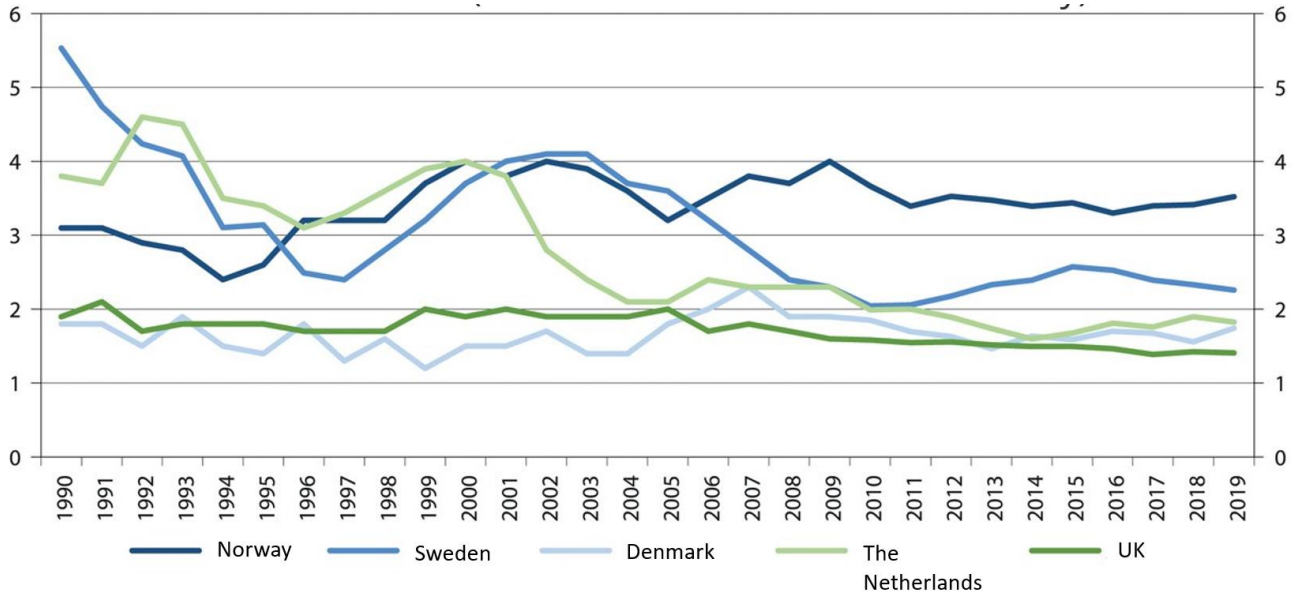

Figure 2. *Percentage of all employees aged 15-74 who were on sickness absence for entire reference week. Taken from the Labour Force Survey. (8)*

It is important to distinguish between short-term, "unavoidable" SA (e.g., due to colds and gastrointestinal issues), and longer-term SA that may be reduced or eliminated with workplace measures. In addition, it is the longer SA episodes that account for most working days lost; around

40% of physician-certified SA in 2020 was over 16 calendar days, but this accounted for over 80% of working days lost (6). This thesis only considers SA longer than 16 calendar days due to the nature of our data (see Methods section).

1.3.1 Repeated SA

Repeated SA - more than 1 SA episode a year - is fairly common when considering shorter SA spells (e.g., a few days) due to the common illnesses prevalent in the population, especially during winter. However, repeated SA can also be longer-term and significantly impact work participation. Around 60% of those with any SA in the course of a year have 2 or more spells (6). Further, those with 3+ spells account for over 65% of working time lost due to SA. Repeated SA is a risk factor for future SA, unemployment, disability pension, and mortality (30, 31). Preventing repeated SA is therefore beneficial for reducing overall SA rates and promoting a healthy working environment.

1.3.2 SA diagnoses

Figure 3 gives a visual overview of SA >16 calendar days in 2019, along with how it varies with regards to diagnosis, gender, age, and sector. Musculoskeletal- and psychological-related diagnoses are most common for physician-certified SA in developed countries (32, 33). Norway is no exception, with these two diagnoses accounting for 35% and 22% of all physician-certified SA in 2021, respectively (6, 34). There are some discrepancies between these rates and those reported in Figure 3; in the figure, the first 16 days are not included in the calculation of percentages.

There has been a reduction in the proportion of musculoskeletal SA from 2018 to 2021, but an increase in the proportion of psychological SA (6). Both diagnoses are more common in women compared to men (35-37). However, this may be because women are more likely to work in industries with a higher prevalence of these diagnoses e.g., the health and social sector (37, 38).

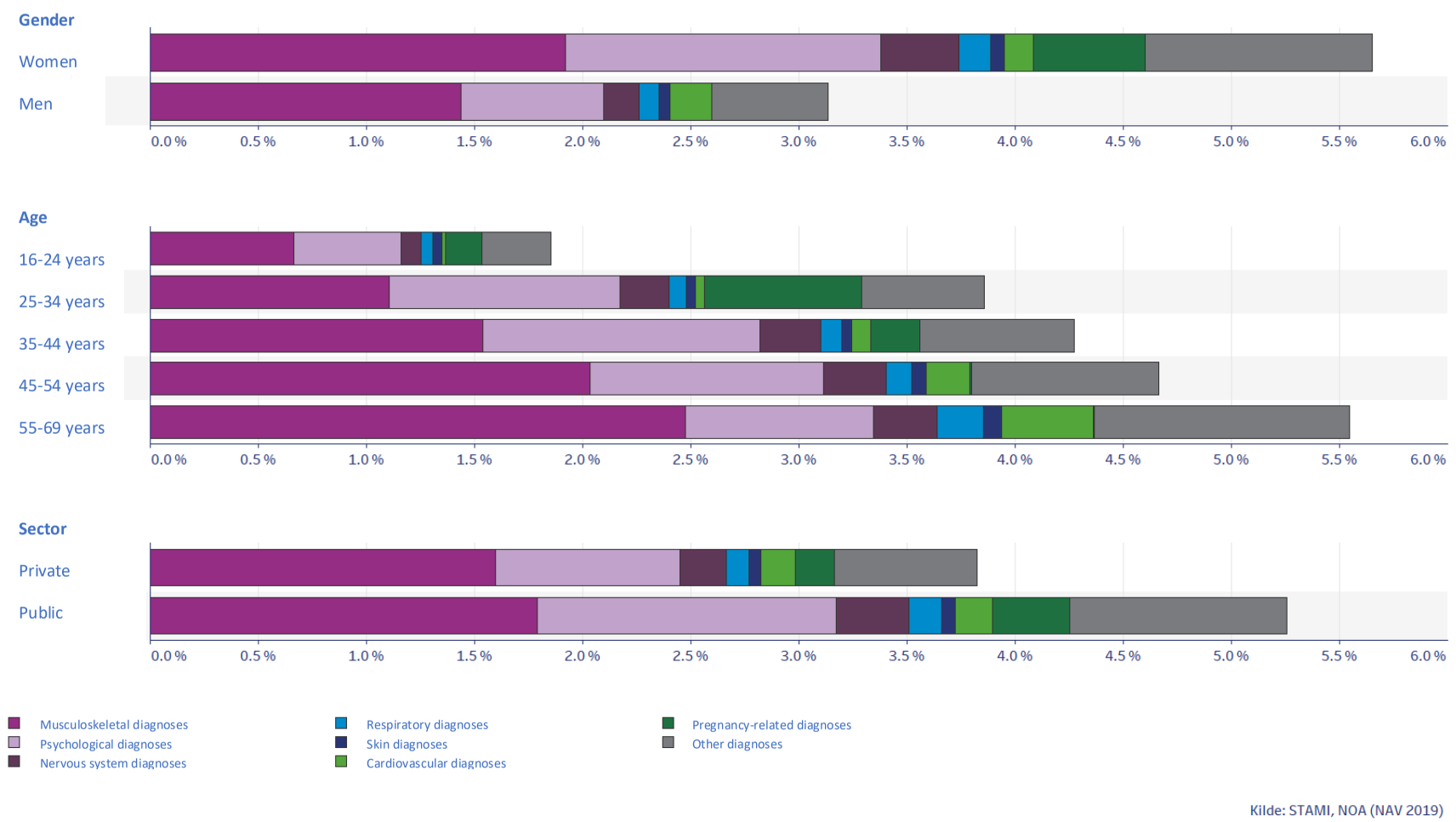

Figure 3. *Employees' sickness absence in 2019 that lasted more than 16 days, stratified by diagnosis, gender, age, and sector (39). Norwegian text translated by author.*

1.4 Factors influencing sickness absence and work participation

There are certain factors that influence both the risk of SA and participation in the labour market. This thesis will mainly focus on SA. Some of the most commonly studied factors that are relevant here are socioeconomic status (SES) in childhood and at working age, industry/work sector, and gender. These are expanded on in turn below. Lifestyle factors, such as smoking, weight, stress levels, and sleep can also increase the risk of SA and reduce work participation (40-42). Lifestyle factors are outside the scope of this thesis and will not be discussed.

1.4.1 Socioeconomic status

An individual's early life experiences can influence their risk of SA later in life, regardless of job choice. Parental SA and SES are associated with a higher risk of individual SA in adulthood (43, 44). Illness and chronic disease contracted early in life can also impact individuals' level of education and work participation (45, 46). SES at working age influences SA and work participation, whether measured by income, education, or occupation, with those in higher SES groups experiencing less SA and increased work participation (41, 47-49).

1.4.2 Industry/work sector

An individual's occupation can be seen as a proxy for work environment and can affect work participation, particularly SA. Those working in lower occupational groups may have a higher risk of SA (40, 47, 49, 50). A related aspect is the individuals' working conditions, for example the extent to which a job includes heavy lifting or whether the employee has control over how their working day looks. Higher exposure to physically demanding work, lower degree of job control and higher emotional/psychological demand increases SA risk and duration (22, 40, 41, 48, 51, 52). The relationship between occupation/work exposures and SA is also influenced by other factors, such as age and socioeconomic status measured by means other than occupation (48-50).

1.5 Gender differences in SA and work participation

There are obvious gender differences in labour market participation. At the end of 2022, 71% of men and 66% of women were registered as employed; the difference was largest in the older age groups (55-74 years of age), with a gap of 9-14 percentage points between the genders (53). There were also differences in the type of employment, with 88% of men working full-time whilst just 69% of women report working full-time (2). Men are more often employed in construction, whilst women are more often employed in health and social work (3).

The unemployment rate, on the other hand, is higher among men (3.4%) than women (3.1%)(9), which is the opposite of the general trend in the EU/EEA (7). This means that both the employment rate and the unemployment rate are lower among women. The AKU reports that 25% of men and 31% of women were non-employed in 2022, which could explain this finding (9).

Women have higher SA rates than men in most countries, and this "gender gap" has been increasing over time (54). This increase occurs even when the overall rate of SA is decreasing (38). Women are also more likely to receive disability pension (55) and work part time due to poor health (8, 56). The consistent increase in the gap over time suggests it is not solely due to biological differences in health and pregnancy-related SA, though these factors play a part (35, 57, 58). Markussen et al. found that the gender differences in SA remained even after controlling for a large number of covariates related to individual, workplace, and physician factors (59). Several biological and cultural explanations have been put forward for the gender gap; see Bekker et al (2009) for a comprehensive review (58). Some of the most common explanations are expanded on below.

1.5.1 Pregnancy

A significant amount, though not all, of the gender differences in SA can be explained by pregnancy-related SA (57). Pregnancy is a special situation when it comes to SA; the conditions experienced are often only for the length of the pregnancy and are not usually directly caused by the work tasks of the pregnant woman, though work can exacerbate the issues. Employers are required to assess to what extent the pregnant woman's work tasks can be adjusted to allow her to remain in work for as long as

possible during her pregnancy. Pregnant women's SA can be reduced by adjusting work tasks, though there is a lack of research on this topic (60, 61). However, workplace adjustment is not always possible, and this lack of adjustment can result in higher levels of SA among pregnant women compared to non-pregnant women (30). If the work is perceived as dangerous for either the woman or the foetus, and it is not possible to adjust work tasks, women can apply for pregnancy benefits even if they currently have no health problems (*svangerskapspenger*)(62). Pregnancy benefits are further described in section 1.7.6.

Another pregnancy-related explanation that can account for some of the growing gender gap in SA is the fact that women are waiting longer before they begin having children. The mean age at first birth increased from 27 years in 2000 to 30 years in 2022 (63). This means that women are generally older than before during pregnancy, which may result in more complications and therefore higher SA (64). However, research actually suggests that older pregnant women have less SA than younger pregnant women, with only part of this explained by differences in SES (64, 65).

1.5.2 Differences in working conditions and occupation

As previously mentioned, industries vary both with regards to their gender distribution and with regards to their SA rates. This could contribute to the gap, as traditionally male- and female-dominated industries have differing risks of SA (51, 58, 66). External factors such as financial crises can also affect male- and female-dominated occupations differently, with one study showing a larger SA reduction in male-dominated occupations during the financial crisis in 2009 (38). Studies investigating this labour segregation hypothesis have had mixed findings as to whether male- and female-dominated occupations affect the gender difference in SA and are often inconsistent between countries (38, 58, 66).

1.5.3 The "double burden" hypothesis

The "double burden" hypothesis, or "work-family burden", suggests that women experience a higher mental/physical load, and thus higher SA, due to having both workplace responsibilities and a tendency to do most of the house- and child-related work in addition (58, 67). However, studies

looking at family-related stressors suggest controlling for these have little effect on the observed gap (35, 51, 54). A 2017 review also found inconsistent evidence that this burden explained the differences in work participation between men and women (68).

1.5.4 Differences in help-seeking behaviour

Finally, it has been suggested that attitudes and norms towards SA may differ between men and women, and could be learned in adolescence (44). Women are argued to have a lower threshold for seeking help and for SA than men; however, this has not been supported by research (69). A related explanation is that due to men waiting longer for seeking help, they are sicker when they eventually end up on SA. This results in men having fewer SA episodes, but that their duration is longer. One study found that men had a higher risk of SA episodes lasting longer than 12 weeks compared to women (33), but this has been disputed in other studies (70).

Although the potential causes of the gender gap have been much discussed, both at a political level and in research, not many suggestions have been made in terms of what, if anything, can be done to reduce the gap. There is also the question of whether we should be trying to close the gap, and whether it is even possible. However, it could be that gender-targeted interventions may reduce SA in a more effective way due to these differences between men and women.

1.6 Is reducing SA always beneficial?

The debate surrounding SA is complex. On the one hand, it is beneficial for individuals to be able to take time off due to illness so they can recuperate. Not providing adequately paid sick leave for an individual can result in “presenteeism”, where employees are forced to stay in work even when sick (71). Presenteeism artificially reduces SA rates; however, individuals that remain at work whilst sick tend to be less productive and have a higher risk for SA and poorer general health in the future (71-73). The pressure to be in work despite being sick can disproportionately affect those with a lower education and lower socioeconomic status, who also tend to have a higher rate of SA (59). Studies have found that more generous sickness benefits may actually reduce the rate of SA in a population,

especially those with a lower SES (74). There are, therefore, benefits to providing paid sick leave and having a certain amount of SA in the working population.

In addition, research suggests an interplay between employment, unemployment, SA, and other measures of work participation (75, 76). It may be that the economic incentives and structure of the benefits system determine whether individuals are able to work or not, rather than their state of health (77). An increase in the number of recipients of SA and other welfare benefits is often seen as negative, since the ideal is to have as many individuals employed and productively working as possible. The political focus tends to be on reducing SA rather than increasing employment. This may be because SA is something tangible politicians and employers feel they can do something about, relative to unemployment rates which can be related to economic factors that are (mostly) out of their control. The "sausage model" developed by Wergeland, however, suggests that applying pressure to one part of the system, like pushing down on one end of a sausage, will result in more people appearing in other parts of the system, or the other end of the sausage (77). This is an important consideration when considering the "optimal" level of SA and setting goals for SA reduction, as making SA less attainable or economically unattractive may push more people towards unemployment/non-employment or disability pension. The interplay between these factors also means that it may be best to look at various outcomes simultaneously, to understand the mechanisms of SA and work participation.

This is not to say that the current level of SA in Norway is the optimal level; we do not know what this level is. We do, however, know that prolonged or high rates of SA can have negative impacts on an individual and a societal level. On an individual level, SA and a lack of work participation generally can lead to a loss of financial security and identity, along with mental health issues (78, 79). For companies, the time and cost spent training up an individual may be lost if they become too ill to work. A loss of workers due to SA also leads to a drop in productivity, in addition to being a burden on the welfare system. EU countries, for example, spent an average of 1.3% of their GDP on sickness benefits in 2020, equivalent to over €176,000 million (80). Norway spent a total of 2.1%, twice the EU average. This is largely due to the combination of the high SA rate and the generous structure of the

welfare system in Norway. The correct balance needs to be struck between a level of SA that both allows individuals to recuperate and has minimal costs on both the individual and societal level.

1.7 Sickness benefits and other health-related benefits

1.7.1 The Norwegian National Insurance Scheme

The Norwegian National Insurance Scheme (*Folketrygden*) is a public system funded by National Insurance contributions from the individual, employer contributions on behalf of the employee, and funds from the Norwegian government (81, 82). This covers individuals' loss of earnings in the case of absence from work due to illness, unemployment, and permanent disability, amongst other things.

The National Insurance Scheme began in 1967, but there had already been laws in place for several decades built on the Bismarck model of social welfare (81). SA benefits were first introduced for low-income workers in 1907 and were gradually expanded until all workers were covered in 1957. Meanwhile, unemployment benefits were introduced in 1939, and disability benefits came in 1961 (81).

It is important to note that the rules regarding access to the National Insurance Scheme differ for employed and self-employed individuals. For the purposes of this thesis we will focus only on employed individuals – that is, those with an employment contract.

1.7.2 Sickness benefits

Countries differ in how they handle employees that are absent due to illness. Some, like the USA, do not require companies to offer paid leave but instead have a requirement for unpaid leave depending on the circumstances (83). Others, such as Norway, have a public benefits system that covers loss of earnings during SA. The sickness benefits in Norway are considered generous; since 1978, employees with SA have had the right to 100% salary from the first day they are unable to work due to illness/injury, provided they have been employed in the 4 weeks prior (84). This is the case up to an amount equal to 6 times the "basic amount", often shortened to G, which is an amount set by the

Norwegian government to calculate pensions and benefits and amounted to 111 477 NOK in 2022 (85). After this amount is reached, it is at the employer's discretion whether they reimburse any lost income above this. The first 16 calendar days are reimbursed by the employer; individuals can self-certify their SA for a period of 3 days, though companies are now encouraged to expand this to 8 days if possible, with this increased time originating as one of the IA-related measures (15, 86). After this, individuals need to obtain a sickness certificate from their physician. Following the first 16 calendar days, NAV takes over reimbursement and the individual has access to SA for a total of 52 weeks (87).

1.7.2.1 Graded SA

During more long-term SA periods, both the employer and employee have certain requirements that must be met in order for the employee to continue receiving benefits. The employee has a duty to engage in work-related activity whilst on sick leave (*aktivitetsplikt*), unless there are medical grounds for exemption or the job role is not appropriate for this (88). Similarly, the employer has a duty to adapt work tasks to facilitate this work-related activity. This should be discussed by the employer and employee early on and a follow-up plan should be developed (89). The ability to adjust working tasks and the layout of one's working day may help individuals RTW faster (90). It is therefore actively encouraged to work alongside receiving sickness benefits where possible (87, 91, 92).

One way of keeping individuals in work-related activity is through graded SA, where the individual is partly on sickness benefits (from 20% to 99%) and partly at work (93). Graded SA was emphasised in the 2004 reforms for physician-certified sickness absence, which encouraged physicians to prioritise graded over full SA and required them to file a report explaining why employees were unable to be in work-related activity after 8 weeks of SA, if this was the case (94). This reform may have contributed to a reduction in full SA, both in terms of number of episodes and to an extent duration (59, 95, 96). In addition, one study noted that the number of graded SA episodes increased following the reform (96), supporting the idea that physicians were implementing it in their practices. There are differences between diagnosis groups, with musculoskeletal-related SA most likely to be graded (95).

Research into the effects of graded SA on health- and work-related outcomes is, however, mixed in terms of results. A 2008 review found that overall, individuals with graded SA did not return to work

faster than those on full SA, though results were not consistent and may have been due to selection effects between the groups (95). An updated 2018 review found, on the other hand, that graded SA resulted in shorter SA and increased work participation compared to full SA, though it did not contribute to a reduced occurrence of SA (97).

1.7.3 Work Assessment Allowance (AAP)

Following the 52 weeks of sickness benefits, the individual is hopefully back at work. If not, they transition to other health-related benefits. The most common is work assessment allowance (*arbeidsavklaringspenger*, AAP), with 4% of those aged 18-66 claiming AAP at the end of 2022 (98). Prior to 2010, when AAP was introduced, individuals instead received "recovery" benefit (*attføringspenger*). This was originally created in 1960 and aimed to prevent individuals from permanently withdrawing from the labour market with disability pension (99). In 1994, recovery benefit was split into two: medical rehabilitation and vocational rehabilitation. The idea was to distinguish medical treatment from more vocational measures (99). These benefits were recombined in 2010 to create AAP.

One main difference between sickness benefit and AAP is that AAP requires work ability to be reduced by at least 50% (30% for occupational illness), whereas this level is 20% for sickness benefit (87, 91). The amount individuals receive from AAP is also less than SA, just 66% of their income up to 6G (91). Individuals must also require help to come back to work or retrain for a different career, and it must be possible to return to work eventually (91). If an individual qualifies for AAP, it is possible to receive it for 3 years, or a maximum of 5 years with extensions.

1.7.4 Disability pension

If it is not possible for the individual to go back to work following SA/AAP, or they are permanently reduced in their work capacity, they can apply for disability benefits (*uføretrygd*) (92). Work capacity must be reduced by at least 50% for an individual to be eligible, and it is possible to combine disability benefit with work. Individuals can receive 66% of their income to the maximum limit of 6G, measured using the three years with highest income during the five years prior to illness. It is also possible for

individuals to receive a disability pension from their public or private occupation pension provider if they meet certain criteria and, in the case of the private sector, if their company offers it (100, 101). Just under 10.5% of those in Norway aged 18-67 received disability benefit in 2022, with more women on disability benefits than men (12.5% versus 8.5%)(102). 84% of these received full benefits (i.e., were not in employment at all). It is uncommon for individuals to return fully to work once they have begun receiving disability benefits or disability pension, though it is possible. As they are very similar, both benefits will be referred to as "disability pension" for the purposes of this thesis.

1.7.5 Unemployment/nonemployment

Unemployment is defined as not being employed and actively seeking employment (103). Individuals are entitled to receive unemployment benefits corresponding to 62.4% of their previous income if they meet certain criteria, including a minimum level of income in the past few years and membership in the National Insurance Scheme (104).

As discussed above, some individuals struggling with poor health do not necessarily exit work through SA and other health-related benefits. For example, a Norwegian survey in 2018 found 84% of those reporting they were unemployed cited health problems as the main reason for their unemployment (105). Studies have also indicated that prior SA, particularly long-term or repeated SA, is a risk factor for unemployment (106). This suggests that some individuals become unemployed because of their poor health and subsequently struggle to re-enter the labour market.

A related concept is nonemployment, or economic inactivity. This is defined as being neither employed nor unemployed, and in 2022 approximately 17% of those aged 20-64 in Norway were outside of the labour market (107). Individuals in nonemployment/economic inactivity are a very heterogenous group, as some will be stay at home parents or receiving an education, for example, whilst others may have health problems or lack of skills that prevent them from participating in the labour market (75).

1.7.6 Birth-related benefits

1.7.6.2 Pregnancy benefits

As mentioned, individuals can receive pregnancy benefits if their workplace is potentially dangerous for either the pregnant woman or the foetus (62). Pregnancy benefits cover loss of earnings up to 6G, can be full or graded, and can be started at any point during pregnancy until the start of maternity leave (62). To receive pregnancy benefits an application must be submitted with a form filled out by both the physician/midwife and the employer (62). This can be time-consuming and difficult for the pregnant woman, and takes a while to be granted, so it is probable that some women choose SA over the process of applying for pregnancy benefits. In contrast, research suggests that women who are not successful in their application for pregnancy benefits substitute them for SA (108).

1.7.6.3 Maternity leave

Women who give birth are required to begin maternity leave three weeks before their due date, and take a further six weeks of their total quota directly after birth (109). Individuals receive 100% of their usual salary up to 6G, calculated using the average of the 3 previous months prior to the start of maternity leave.

1.8 Effects of the IA Agreement on SA and work participation

The IA Agreement has now entered its 22nd year, and it is important to evaluate the progress made since 2001. During this period, SA has fallen from 7.2% to a level of 5.8% in 2021, a reduction of around 19% (or 1.4 percentage points)(6). Figure 4 illustrates the changes in SA during the IA Agreement period.

The first goal (to reduce SA by 20% from the 2001 level, and from 2019 to reduce SA by 10% from the 2018 average) has not been reached. The proportion of individuals in work has, however, steadily increased since 2001, though it has fluctuated with the financial crisis and the recent COVID-19 epidemic (6). The second goal (previously to include individuals with reduced work capacity, from 2019 to prevent withdrawal from work) has also not been reached. The percentage of individuals

receiving disability benefits has been fairly stable throughout the IA period, fluctuating between 10% to 10.5% (102). The number of individuals with reduced work capacity that are registered as employed has also been stable during this period (110). This suggests that there is still some work to do to reach both the goals in the current IA Agreement, and that it is important to ensure the measures included in the current IA Agreement are those which are best tailored to meet these goals.

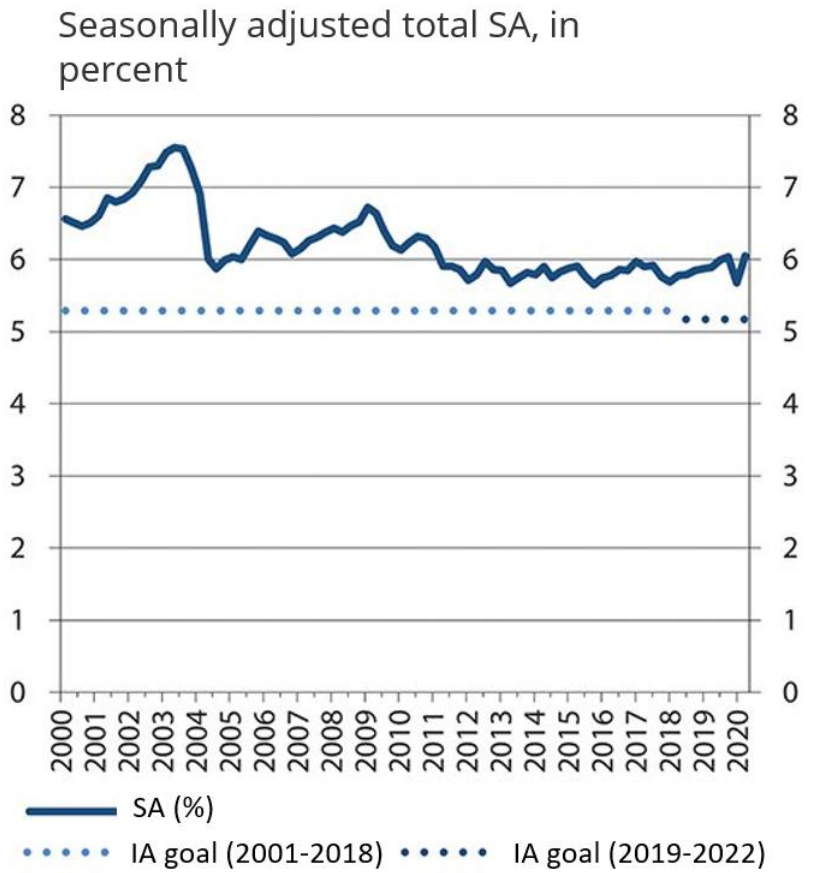

Figure 4. *Seasonally adjusted total SA in percent, with dotted lines showing the IA goals prior to 2019 and following the latest IA Agreement 2019-2024. Text translated by author. Taken from the Official Norwegian Report on competence, activity and security of income (8)*

It is also unclear whether the trends in SA are due to the IA Agreement or unrelated other changes. SA dropped quite rapidly in 2003-2004, which was also the year sweeping reforms to SA certification by physicians were announced and implemented, including the introduction of the work-related activity requirement outlined previously (111). Isolating the potential contributions of the IA Agreement is important when evaluating its effectiveness on work participation and SA, as well as identifying how to better target IA measures to certain groups. This has been difficult to achieve on a general level,

with a 2018 summary of knowledge on the area emphasising that the studies that exist investigate separate aspects of the IA Agreement and miss a more holistic view that takes into account the interaction between the goals (23).

1.8.1 Causal studies into the IA Agreement

The knowledge summary also indicated a gap in terms of causal studies that could infer effects of the IA Agreement, rather than associations (23). This has been emphasised by the Research Group for the IA Agreement, who publish yearly reports on the status of the agreement (112). Some causal peer-reviewed studies have been carried out into the IA Agreement, but are mainly based on specific IA-related measures or one occupational group (often the physicians certifying SA)(23). One master thesis evaluated the effect of the IA Agreement on SA, in the setting of cooperation with the NAV Working Life Centres (113), and found that IA companies on average reduced their SA by 2.5% with support from the Working Life Centres. However, the thesis did not distinguish between full and graded SA, nor between men and women. It is important to build upon this knowledge using similar causal methods. In order to identify a causal effect from a non-randomised intervention like the IA Agreement, three conditions generally need to hold: consistency (a well-defined intervention), exchangeability (similar distribution of confounding factors in the IA and non-IA populations), and positivity (all combinations of these confounding factors have a treatment probability greater than zero)(114). The usage of causal methods developed in the field allows us to satisfy these assumptions to a certain extent (see Discussion) and infer effects of the IA Agreement. Thus, the call for causal methods led to the establishment of the larger project this thesis is based in, which aims to use novel statistical methods on large registry datasets to identify effects of the IA Agreement and its related measures on SA and work participation (115). During the course of this thesis, two other papers have been published to attempt to identify effects of the IA Agreement through this project, and have suggested a positive effect of the IA Agreement on SA and work participation, especially in certain subgroups (24, 25). The papers in this thesis complement prior research by giving a broader idea of what having access to the IA Agreement means for SA and work participation.

2 Aims of the thesis

The aims of this thesis were therefore to look closer at the overall impact of the IA Agreement and its effects on SA and work participation. As previously mentioned, it is important to look at SA in a broader context with other outcomes in order to understand the wider picture of work participation. By using causal models, we can go somewhat beyond pure associations and say something about the effect of working in a company that has voluntarily signed the IA Agreement.

The overarching research questions were as follows:

1. Does working in an IA company impact the prevalence and duration of SA? (Paper I)
2. Does working in an IA company affect reoccurrence of SA and work participation once an individual has returned from an SA episode? (Paper II)
3. Does working in an IA company affect the use of SA and pregnancy benefits or work participation in pregnant women? (Paper III)

Due to the gender differences explained above, men and women were studied separately in Papers I and II (only women were included in Paper III). Analyses were also conducted on musculoskeletal- and psychological-related SA subgroups in Papers I and II. Based on prior research, we expected to find either a beneficial effect or no overall effect of the IA Agreement on both SA and work participation.

3 Methods

3.1 Study Design

All three studies used registry-based observational data. For Paper I, a quasi-experimental DID design was used to compare the periods before and after the introduction of the IA Agreement (116), whilst a prospective cohort design was used for Papers II and III to follow individuals with/without the IA Agreement over time (117).

3.1.1 DID design

DID is most commonly used in economic studies today. However, it has strong roots in epidemiology; many will recognise it from the cholera study conducted by John Snow, commonly regarded as one of the founders of modern epidemiology (118-120). A DID design is a form of natural experiment whereby an outcome is compared in a group that has received a treatment or intervention (in our case, the IA Agreement) and a control group. The difference in the outcome variable is compared between the two groups before and after the intervention, and the change in this difference (difference in the difference) indicates the effect of the intervention.

Generally, with continuous/discrete outcomes, a standard linear regression is used for two groups and two time periods:

$$Y_{gt} = \beta_0 + \beta_1 T_g + \beta_2 P_t + \beta_3 (T_g \times P_t) + \epsilon_{gt}$$

Adapted from Wing, Simon & Bello-Gomez (2018) (116)

where the dummy variables T_g = group (intervention or control) and P_t = time period (before or after intervention).

The DID coefficient is then the interaction effect between the intervention group and the time period (β_3). This can more intuitively be interpreted as the difference between the actual observed outcome of the intervention group and what the outcome would have been without the intervention. A visual representation of this is found in Figure 5.

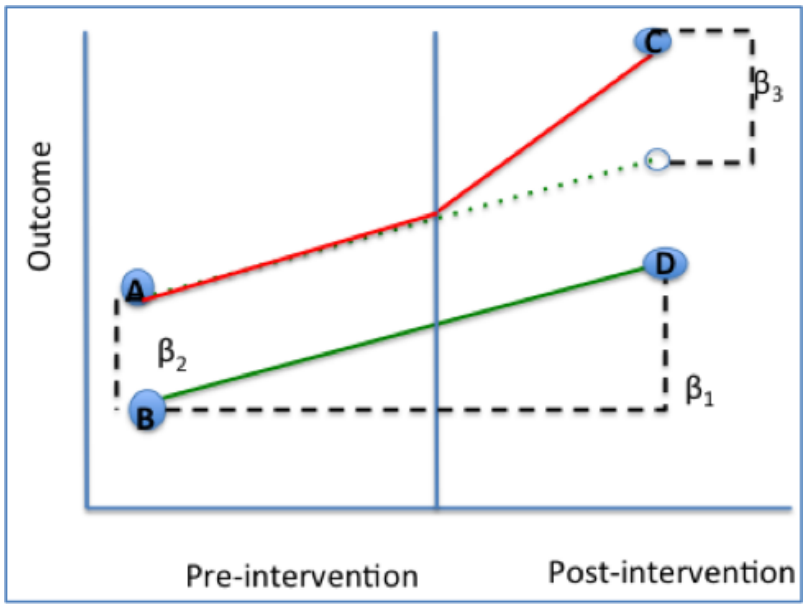

Figure 5. *Graphic representation of the difference-in-difference design. Taken from Columbia University Mailman School of Public Health (121)*

3.1.2 Prospective cohort design

For Papers II and III, a prospective cohort design was used (122). Individuals were split into IA and non-IA groups, measured at baseline, and were followed over a specific length of time (1 year in Paper II, and from 6-37 weeks of pregnancy in Paper III).

3.2 Study Population and Data Sources

The data used in this thesis came from a cohort of individuals live-born in Norway between 1967 and 1976 (N=626,928), which was established at STAMI in 2002 (123). Data are now available from 1990 until 2022. However, at the time of writing the papers included in this thesis, data which could be connected with reliable data on IA status (whether the company the individual worked for had signed the IA Agreement or not) were only available until 2014. The cohort is comprised of data obtained through national administrative registries covering the entire Norwegian population, with no possibility for the individual to request they not be included (see section on "Ethical Considerations")(124). For the purposes of this thesis, data were obtained from Statistics Norway (SSB), NAV, and the Medical Birth Registry of Norway (MBRN) through the Norwegian Mother,

Father and Child Cohort Study (MoBa). These registries were linked using the unique personal identification number given to individuals living legally in Norway, and SSB pseudonymised the data before we received it. We also received pseudonymised company numbers, which were used to connect together company-specific information such as industry and IA status. Figure 6 shows a flowchart of the number of subjects included in the three papers.

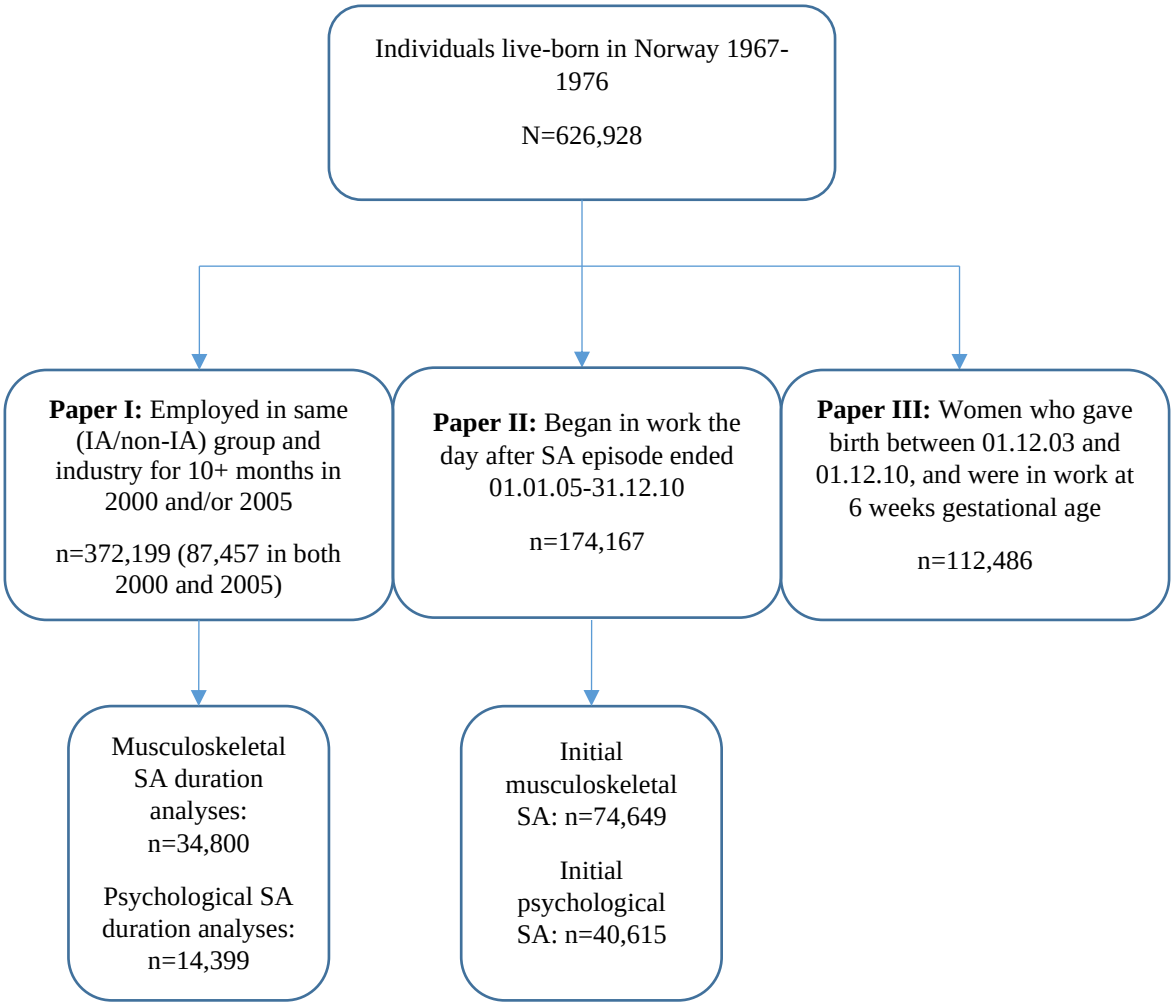

Figure 6. *Flowchart showing the study populations in the three papers.*

3.2.1 SSB Registries

SSB maintains various administrative registries which can be used for research. The most diverse of these is the events database called "Forløpsdatabasen Trygd" (FD-Trygd), which is updated daily and includes information from NAV and other administrative data sources collected by SSB (125). FD-Trygd tracks individuals over time and records changes in variables such as benefits received,

demographic information, and changes in company industry. In this thesis, FD-Trygd was used for background characteristics for both individuals and companies, as well as daily information on work and/or the receipt of benefits and pensions (126). Other SSB maintained registries used in this thesis included the National Education Database (NUDB), which is updated yearly and was used for education information in Papers II and III (127), and the Central Register of Establishments and Enterprises which is also updated yearly and provided additional information for companies, such as industry and company size (128). This additional company information could then be linked to individuals' information and employment histories through the company number.

Not all of the information for self-employed individuals is found in SSB's registries, which is another reason why we restricted our analyses to only employed individuals.

3.2.2 NAV Registries

Companies' IA status, including when they entered the IA Agreement and changes to their agreement status, was recorded yearly and obtained from NAV. We also received SA diagnoses from NAV.

3.2.3 MoBa

In Paper III, we also included data on gestational age at birth from MBRN, through MoBa (129). MBRN is a national health registry containing information about all births in Norway. MoBa is a population-based pregnancy cohort study conducted by the Norwegian Institute of Public Health. Participants were recruited from all over Norway from 1999-2008. The women consented to participation in 41% of the pregnancies. The cohort includes approximately 114,500 children, 95,200 mothers and 75,200 fathers. The study conducted in Paper III is based on version 6 of the quality-assured data files released for research in 2011. Of the 112,486 pregnancies in Paper III, 28,659 had data available in MoBa.

3.3 Intervention

The intervention of interest in all papers was the IA Agreement, previously outlined in the Introduction. The IA Agreement was voluntarily signed by companies, meaning the intervention and

control groups are not randomised. In Paper I, the first IA Agreement period was the focus (2001-2005), to be able to capture the before and after time periods required by the DID design. Paper II focused on the end of the first period, the second period (2006-2009) and the beginning of the third period (2010-2013), whilst in Paper III the first period through to the beginning of the third IA Agreement period was included. Figure 7 shows a visual representation of the IA Agreement periods and the three study periods.

Individuals in Papers I and II were required to have worked only in either IA or non-IA companies during the study period. This means that individuals that switched group, or that worked in both IA and non-IA companies simultaneously, were excluded from the studies. In Paper III we used IA status at baseline ("intention to treat"). If an individual worked in both an IA and non-IA company at baseline, they were categorised as having IA as they were exposed to the IA Agreement to some extent.

We did not have information on to what extent companies implemented the IA Agreement or how much they used the various benefits the IA Agreement afforded them. Some companies have likely used IA-related measures more than other companies, making it difficult to infer the effects of utilising IA-related measures using our data. Therefore, the exposure denoted only whether the company in question had signed the IA Agreement or not and thus whether individuals had access to IA-related measures, rather than their utilisation.

In all three papers, individuals were required to be in work in order to be exposed (or not exposed) to the IA Agreement. In Paper I, they were required to be in work for at least 10 months during the year in question (2000 and/or 2005), whilst in Papers II and III they were required to be in work at baseline.

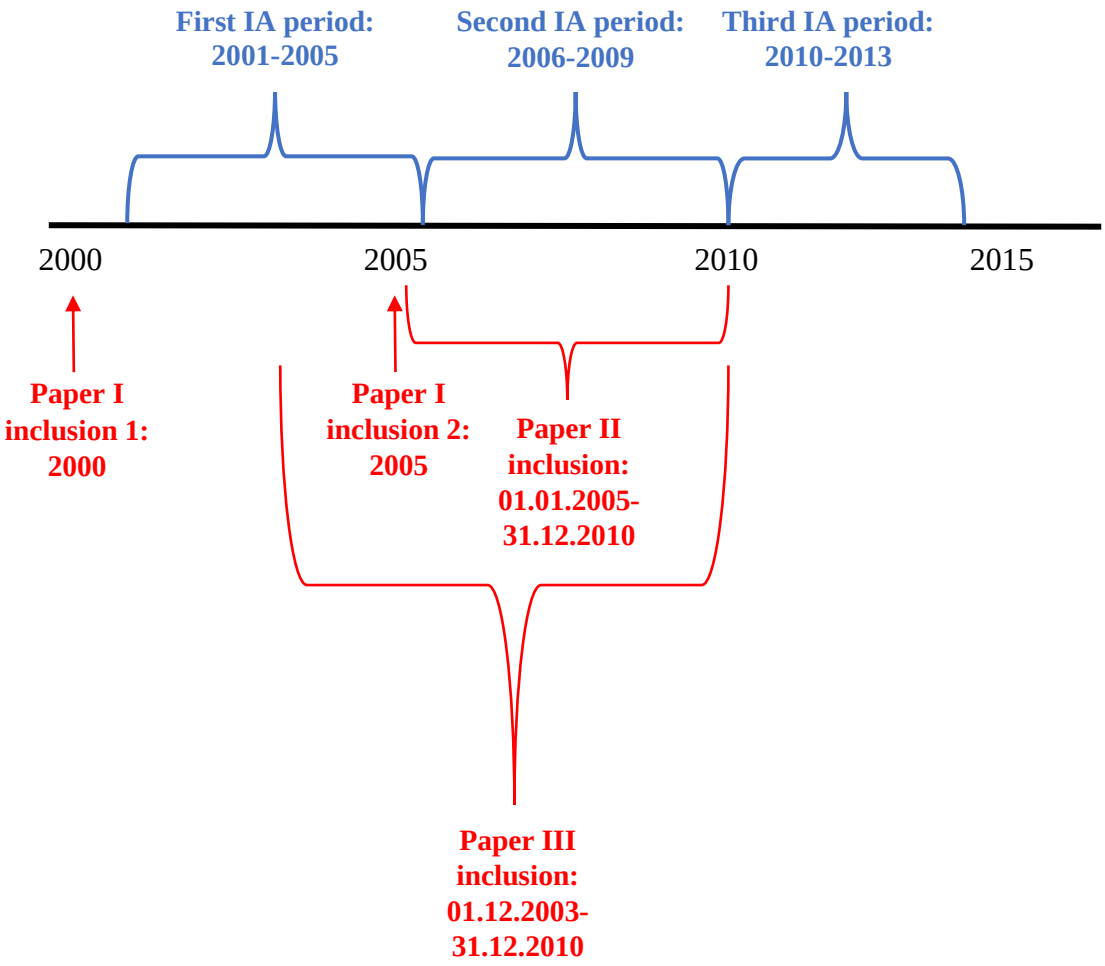

Figure 7. *Visual representation of the IA Agreement periods and inclusion periods for the three papers.*

3.4 Study Outcomes

In all three papers, the main outcome of interest was SA. We could only include SA >16 calendar days because it is only after this that the responsibility for reimbursement passes from the employer to NAV and the episode is registered in the databases. However, the specific study outcomes varied for each paper.

In Paper I, the study outcomes were:

1. The prevalence of SA (at least one SA episode in the observation period)
2. The duration of first SA episode in the observation period

These outcomes were studied according to two diagnosis groups: those with musculoskeletal diagnoses and those with psychological diagnoses. Diagnoses were coded according to the International Classification of Primary Care, Second Edition (ICPC-2) (130).

In Paper II, the study outcomes were:

1. all-cause exit from work
2. full and graded SA, as well as the following other cause-specific events; (remaining in) employment, education, unemployment/economic inactivity, disability pension, and death/emigration

Analyses were conducted on those returning from an SA episode. The main analysis concerned those returning from SA regardless of diagnosis. Secondary analyses were conducted on subgroups returning from SA with the same diagnosis groups as Paper I (musculoskeletal and psychological diagnoses, that were coded in the same way as Paper I).

In Paper III, the study outcomes were:

1. Receipt of SA benefits during pregnancy
2. Receipt of pregnancy benefit during pregnancy

All SA was considered in this paper, with a sensitivity analysis conducted on the subgroup with additional data from MoBa.

3.5 Other study variables

3.5.1 Stratification Variables

We studied men and women separately in all analyses. This is because men and women vary in their patterns of SA, their employment attributes (industry, full/part time work, etc.), and their reaction to workplace interventions (6, 131). We also specifically studied the two most common SA diagnoses in Norway, which are musculoskeletal and psychological diagnoses, in Paper I and part of Paper II (6).

3.5.2 Covariates

We used directed acyclic graphs (DAGs) to define the covariates that would be included in each study (see example below in Figure 8). All three papers included age, number of employees in the company at baseline, and company industry. Papers II and III also included calendar year, civil status, and education level. Paper II additionally included company region, length of initial SA, and grade of initial SA.

All covariates were measured at baseline in the respective papers.

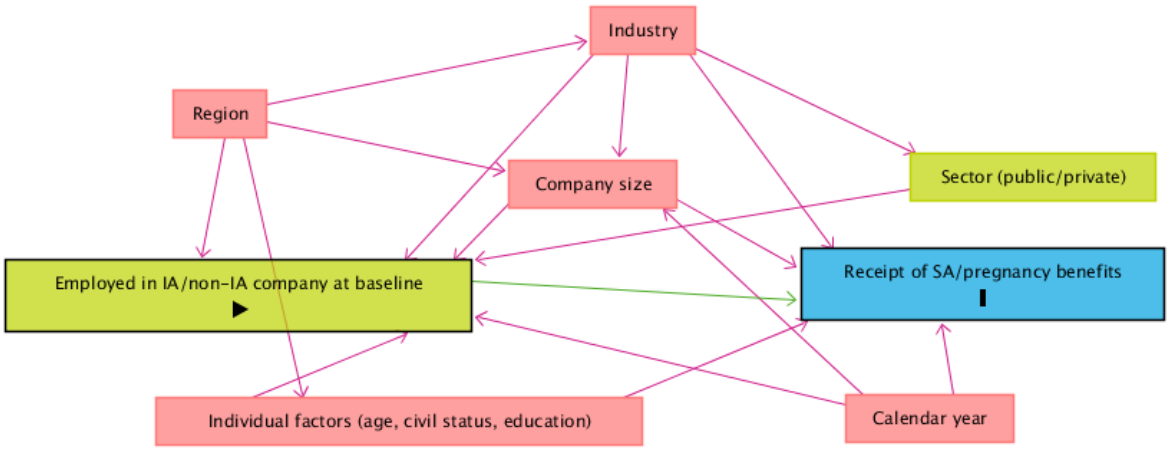

Figure 8. *Directed acyclical graph (DAG) for Paper III, created using Dagitty version 3.0 (132)*

3.5.3 Stabilised inverse probability of treatment weights (sIPTW)

We used stabilised inverse probability of treatment weights (sIPTW) in Papers II and III. As discussed previously, the IA Agreement is not randomly assigned to individuals. Certain characteristics (both on the individual and the company level) may make it more likely for an individual to be in the IA (or non-IA) intervention group. For example, the share of companies with an IA Agreement varies across industries (6). Someone working in manufacturing will therefore have a different likelihood of working in an IA company compared to someone working in education. It is possible to add these characteristics in as covariates when performing analyses to remove some of this confounding bias. Another method that removes confounder bias is the use of IPTW. IPTW aim to create a "pseudo-population" where the two groups have been randomised with respect to the confounders included in

the analysis. This is done by weighting each individual by their inverse probability of being in the group they are in given their values of the confounders (133). The weights are stabilised by using the probability of being in the observed group as the numerator instead of simply using the value of 1. This aims to reduce the number of extreme weights and give better statistical estimates (114, 134). We used sIPTW in Papers II and III, and the weights were calculated with the use of logistic regression with IA status as the dependent variable and all covariates as independent variables.

3.6 Statistical analyses

Data preparation and analysis were conducted in Stata version 15.1 for Paper I (135) and version 16.1 for Paper II (136). For Paper III, data were prepared in Stata 16.1 and analyses were conducted in R version 3.6.2 (137). All three papers used the STROBE checklist for observational studies to ensure all relevant information was included (138).

3.6.1 DID analysis

For Paper I, a DID analysis was conducted. A two group, two time period design was used, with the "before" period measured during 2000 and the "after" period measured during 2005. Linear probability models were used to analyse the impact of the IA Agreement on the prevalence of SA, whilst negative binomial models were used for the duration of SA; these were chosen based on the Akaike information criterion (AIC) value. The average marginal change (the DID coefficient) was then calculated using the "margins" command in Stata. A negative coefficient indicates that the difference between the intervention and control group has reduced over time, whilst a positive coefficient indicates that the difference has increased over time. The DID estimate does not give information on how the two groups have changed in relation to each other. If the control group had a higher incidence of SA than the intervention group, for example, a positive DID coefficient could indicate either that incidence has increased in the control group or that it has decreased in the intervention group. It may also be the case that both situations happened at the same time.

3.6.2 Competing risks

In Paper II we used a time-to-event approach that incorporates competing risks. The competing risks approach is a form of survival analysis that takes into account the fact that other events can affect individuals' probability of experiencing the event of interest (139). Cox proportional hazard models were used to analyse all-cause exit from work for men and women; this was followed up by a competing risks analysis whereby we calculated the cumulative incidence function (CIF) for the following events: full SA, graded SA, unemployment/economic inactivity, education, disability pension, and death/emigration. CIF measures the marginal probability for each event; that is, the probability of experiencing that event given that the individual is still at risk at that particular timepoint (140). This approach takes into account both the hazard of experiencing the event of interest and the hazard of experiencing a competing event, rather than censoring competing risk events, and is seen as more appropriate than traditional survival analysis methods when competing risks are present (141). The CIFs were computed for each group separately (in our case those with and without an IA Agreement), and differences between the resulting graphs were compared in a new graph with the differences in cumulative incidence between the groups over the time period, calculated by subtracting non-IA from IA. If the difference was larger than 0, the event was more likely to occur at that time point in the IA group; if the difference was smaller than 0, the event was less likely to occur in the IA group. Individuals were weighted using sIPTW to ensure the IA and non-IA groups were balanced with respect to the covariates.

3.6.3 Multistate modelling

In Paper III a multistate design was used. Multistate modelling tracks individuals over time and allows for transitions between defined "states" (142). In Paper III, the defined states were employment, full SA, graded SA, pregnancy benefits, maternity leave and an "other" state that contained all other registrations, or where the individual had no registrations in the dataset (see Figure 9). The use of multistate models is a more dynamic method than survival analysis, as it allows us to observe multiple transitions (events) for the same individual.

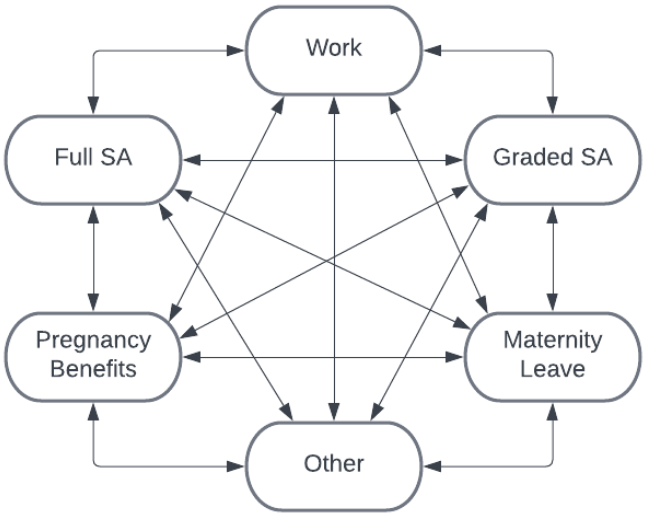

Figure 9. *Graphical representation of the multistate model used in Paper III.*

Individuals were included if they were in work at the beginning of follow-up (at 6 weeks of pregnancy). They were then followed up to 37 weeks of pregnancy, when the majority began maternity leave. Individuals could move freely between the different states until they entered maternity leave. This was defined as an absorbing state, meaning individuals remained in this state until the end of follow-up if they entered it, because very few return to work after beginning their maternity leave.

Individuals were weighted using sIPTW to ensure the IA and non-IA groups were balanced with respect to their probability of working in an IA company given their covariates. Individuals' transition intensities (the probability of going from one state to another, adjusted for covariates) were modelled using weighted Aalen additive hazard models (143), calculated separately for the IA and non-IA groups. These intensities were then used to calculate state probabilities using the Aalen-Johansen estimator (143). The state probabilities and differences in state probabilities (non-IA minus IA) were depicted in graphs. The ELOS was also calculated for each state over the follow-up period by summing up the area under the curve for each of the state probabilities (25). ELOS differences were calculated by subtracting non-IA from IA.

3.7 Ethical considerations

The project this PhD is based in (*Effects of workplace initiatives on sick leave and work participation – new statistical and causal models to utilise population registries*)(115) is a collaboration between STAMI and Oslo Centre for Biostatistics and Epidemiology (OCBE) and has been approved by the South-East A Regional Committee for Medical and Health Research Ethics (REC; case number 17344). The establishment of MoBa and initial data collection was based on a license from the Norwegian Data Protection Agency and approval from REC. The MoBa cohort is currently regulated by the Norwegian Health Registry Act.

The project uses only registry data. The main ethical considerations when using large registries are the lack of informed consent and the presence of sensitive personal information.

3.7.1 Informed consent

Informed consent is required in the Declaration of Helsinki (Articles 25-32) and is defined as being "adequately informed of the aims, methods, sources of funding, any possible conflicts of interest, institutional affiliations of the researcher, the anticipated benefits and potential risks of the study and the discomfort it may entail, post-study provisions and any other relevant aspects of the study. The potential subject must be informed of the right to refuse to participate in the study or to withdraw consent to participate at any time without reprisal." (144) As the registries used cover the entire population of Norway, and are primarily for administrative and not research purposes, it is not possible for us as researchers to obtain full informed consent from each individual. According to the General Data Protection Regulation 2016/679 (GDPR), informed consent is not necessary where it is deemed to be impossible or a "disproportionate effort", especially in research situations (Chapter 3, Article 14, paragraph 5b)(145). Related to informed consent is the ability to opt out of research after consenting (withdrawing consent). This is detailed both in the Declaration of Helsinki (Article 26) and in GDPR (Chapter 3, Article 17) (144, 145). However, individuals are not allowed to opt out from the registers that we use and are thus not able to opt out from our project. This is because GDPR regulations allow for exceptions to this requirement for the "right of erasure" where the information is

to be used for scientific research or statistical purposes that are in the public interest (Chapter 3, Articles 14 and 17)(145).

3.7.2 Sensitive Information

Another consideration involves anonymity and the use of sensitive personal data. The cohort used in this thesis is comprised of data connected together from different national registries using individuals' unique personal identity number. SSB pseudonymised the data before they were sent to us, but it is still theoretically possible to identify individuals based on the information provided in the registries (reverse identification). Many of the variables used involve sensitive data (e.g. health diagnoses) and are thus subject to data protection regulations regarding the handling of such data (GDPR Chapter 2, Article 9)(145). The GDPR explicitly state that it is permissible to process personal sensitive data if "processing is necessary for archiving purposes in the public interest, scientific or historical research purposes or statistical purposes…" (Chapter 2, Article 9, paragraph 2j)(145).

This PhD and the overarching project belong in turn to an umbrella project titled "*Working conditions, work participation and work-related health*". The umbrella project has a Data Protection Impact Assessment (DPIA) as required by GDPR to ensure that the data are stored and used in a way that does not violate the right of the individual to privacy (Chapter 4, Article 35)(145). The data are stored on a secure server with two-factor authentication. We have also applied to and obtained the necessary permissions from REC to work with the data, and we present only anonymised results (i.e. of large groups and not individuals). Finally, in order to ensure that the project complies with GDPR and data minimisation principles (Chapter 2, Article 5, paragraph 1c)(145), we have ensured that I have only had access to the data required to write this thesis.

4 Summary of Results

4.1 Paper I - Impact of the Norwegian Agreement for a More Inclusive Working Life on diagnosis-specific sickness absence in young adults: a difference-in-difference analysis

The aims of this paper were to assess the impacts of the IA Agreement on prevalence and duration of SA. We considered men and women separately, and focused on two major diagnosis groups; those with musculoskeletal and those with psychological SA.

We compared employees with the IA Agreement and those without the IA Agreement using the DID method. We analysed both overall differences in men and women, and stratified analyses by industry. Covariates we controlled for were industry (when not stratified) and mean company size. We also looked at full and graded SA separately.

The final population consisted of 372,199 individuals. The main finding was that the DID estimates for both SA prevalence and duration varied between genders, diagnosis groups and industries. The IA Agreement seemed to be associated with a reduced SA duration more than a reduced SA prevalence, especially for full SA. The IA Agreement seemed to have more of an impact on men than women, especially for musculoskeletal SA. IA companies tended to have a higher usage of graded SA than controls. This paper indicated that any effects of the IA Agreement are likely to be very heterogenous and that specific groups/industries may benefit more than others. However, the IA Agreement seems to be beneficial in reducing SA duration.

4.2 Paper II - The effects of a voluntary agreement for a more inclusive working life on work participation and repeated sickness absence: a cohort study in Norway

With the findings of the first paper in mind, this paper aimed to investigate the effects of the IA Agreement on the likelihood of remaining in work and repeated SA once an individual had returned to work from an SA episode.

Men and women were studied separately, and we also analysed subgroups with individuals returning from a musculoskeletal-related and a psychological-related SA, respectively. Cox proportional hazard models were used to calculate the overall risk of exit from work over a 500-day follow-up from the day the individual began work again after SA. Cumulative incidence differences between IA and non-IA groups were then calculated for the following competing events: full SA, graded SA, non-employment/economic inactivity, education, disability pension, and death/emigration.

In the population of 79,253 men and 94,914 women, we found that both men and women were more likely to remain in work if they worked in an IA company following SA, with the exception of men returning from psychological-related SA (Figure 10). Individuals working in IA companies had a higher likelihood of repeated SA, both full and graded, but a lower likelihood of becoming unemployed/economically inactive than individuals in non-IA companies. Men returning from psychological-related SA were less likely to remain in work if they were working in IA companies and had a higher risk of SA, but still had a lower likelihood of becoming unemployed/economically inactive compared to men in non-IA companies. The results from this paper indicate that the IA Agreement is keeping individuals in work, but that this may be through reducing unemployment/economic inactivity rather than by the reduction of SA (incidence). For men with a psychological diagnosis, the higher likelihood of not being in work was likely related to a higher risk of SA.

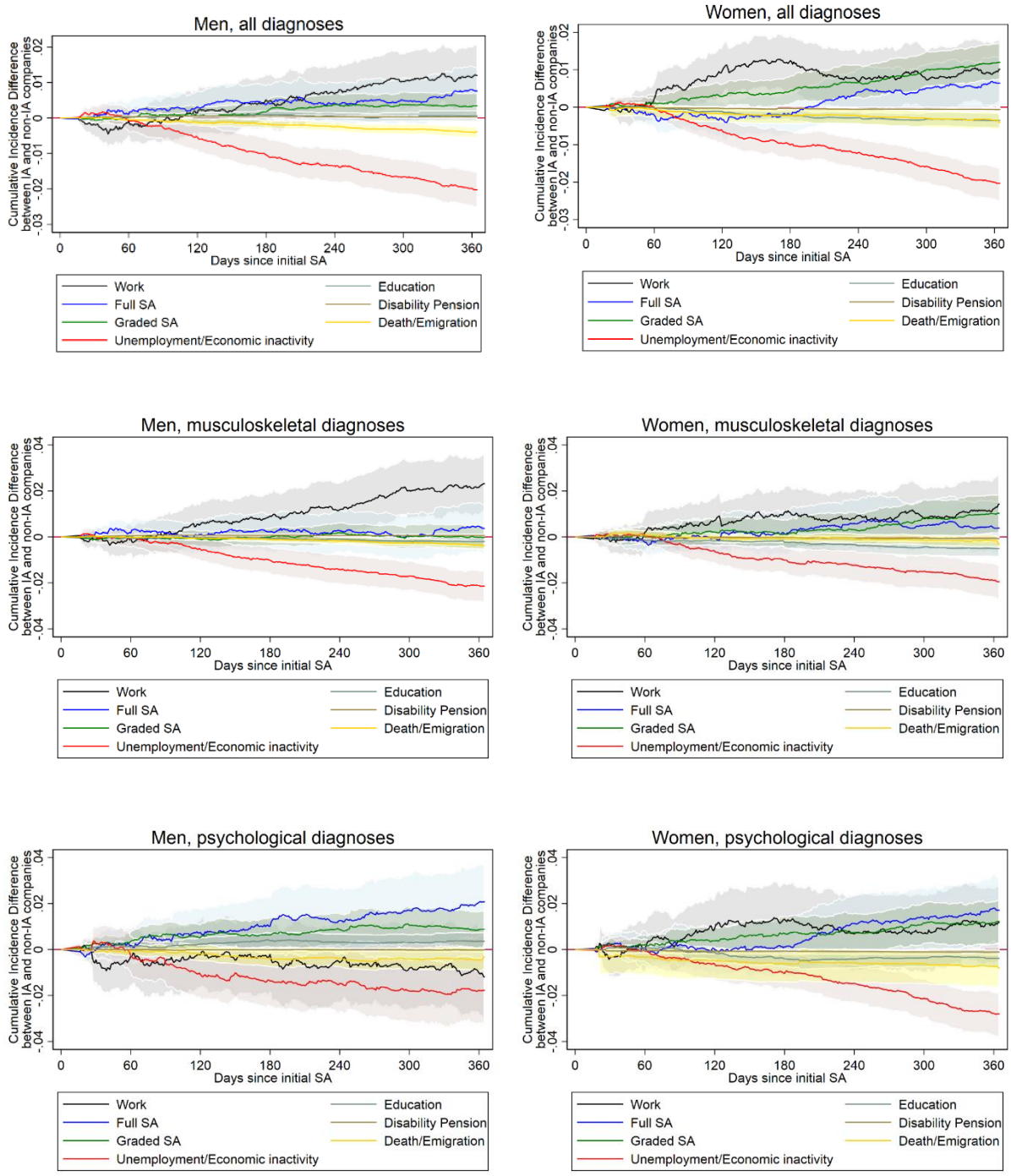

Figure 10. *Difference in cumulative incidence for employees in IA companies compared to those in non-IA companies, for the following states: work, full sickness absence, graded sickness absence, unemployment/economic activity, education, disability pension, and death/emigration. Stratified by gender and diagnosis. 95% confidence intervals calculated using 1,000 bootstrap samples. Taken from Paper II.*

4.3 Paper III - Effect of the Norwegian Agreement on a More Inclusive Working Life on use of sick leave and pregnancy benefits among pregnant women: a cohort study

The third paper looked solely at pregnant women and aimed to investigate the use of SA and pregnancy benefits during pregnancy, comparing those working in IA companies with those working in non-IA companies.

A multistate model was used to calculate the transition probabilities and expected length of stay (ELOS) in the following states: work, full SA, graded SA, pregnancy benefits, maternity leave, and "other" (all other registrations or no registration). Follow-up began at 6 weeks of pregnancy and ended 3 weeks prior to the woman's due date. Our study period was 2003-2010.

We followed 112,486 pregnancies in the course of our follow-up period. We found that the difference in probability of being on full SA varied across the course of the pregnancy, with women in IA companies less likely to be in full SA during the second trimester compared to women in non-IA companies, but more likely to be in full SA during the first and third trimesters (Figure 11). The probability of being in graded SA and on pregnancy benefits was not markedly different in IA and non-IA companies, though women in IA companies were slightly more likely to utilise graded SA and slightly less likely to utilise pregnancy benefits compared with women in non-IA companies. This suggests that the effectiveness of IA measures on SA may vary depending on the conditions experienced during pregnancy. Women in IA companies spent on average half a day more in full and graded SA, respectively, but also spent half a day more in work. This can indicate that the IA Agreement assists pregnant women with remaining at work during their pregnancy, despite their higher usage of SA.

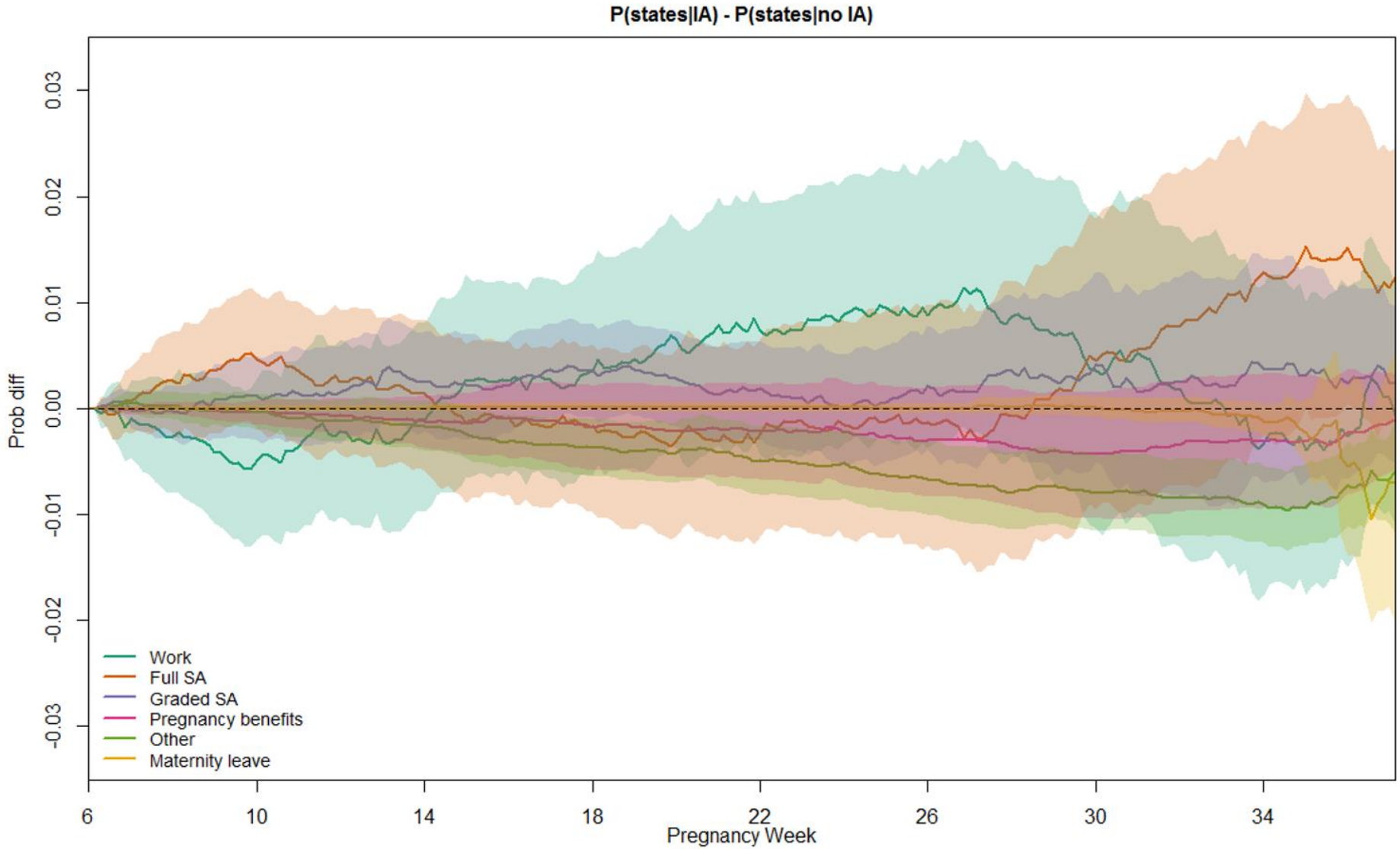

Figure 11. *Difference in state probabilities for pregnant women in IA companies compared to those in non-IA companies. 95% confidence intervals calculated using 1,000 bootstrap samples. Taken from Paper III.*

5 Discussion

6.1 Main results

This thesis has investigated the average effects of working in a company with the IA Agreement on SA and other measures of work participation. The findings varied depending on gender, SA diagnosis, industry, and outcome (both the different SA outcomes and whether we consider SA or more general work participation). This variation indicates that the mechanisms by which the IA Agreement works are complex. However, all the effect sizes found in the three studies were small, and the confidence intervals often included the null value. The small effect estimates indicate that the individual average effect of the IA Agreement is not very large, though on the population level this could translate to a larger effect. Nevertheless, the overarching picture given by the papers in this thesis is that the IA Agreement does not necessarily prevent or reduce the incidence of SA, including repeated SA after RTW, but may contribute to a shorter SA duration, especially for men and for musculoskeletal-related SA. A shorter SA duration will result in a lower SA rate measured by working days lost, meaning the IA Agreement is contributing towards its first goal of reducing SA. When looking at the special case of pregnancy, potential effects of the IA Agreement on both SA and work participation varied depending on the trimester. These findings further support the idea that IA measures are more useful for some groups and SA diagnoses than for others. Finally, the results indicate that individuals working in IA companies remain in work to a larger extent than those in non-IA companies, which can mean that the IA Agreement is succeeding in its second goal of preventing withdrawal from work, though through other mechanisms than reducing SA.

6.2 Methodological Considerations

6.2.1 Strengths of registry-based data

A cohort consisting of all individuals live-born in Norway from 1967-1976 was used in this thesis, with linkage of several large registries including exact dates for the different events of interest

(employment, SA, maternity leave, etc.)(123). There are several strengths to using registry data. Data are available for many years and have already been collected by the registry owners, which reduces expenses and allows for a longer follow-up period than would be possible were data collected by the research group. The use of registries also allows us to follow many more individuals than would be possible through manual data collection, meaning we have large sample sizes that increase analysis power. It is not possible for individuals to opt out of these registers (124), meaning that we do not have missing data on if or when individuals had SA over 16 calendar days, or if they were employed during our study period. This also means that our data are not subject to selection bias due to nonresponse or drop-out. Data are also collected objectively and are not subject to recall bias or differential misclassification (146). The wide variety of information available also means that we can adjust for many of the covariates we believe are relevant for our analyses, and the exact dates given for employment/SA episodes increase the precision of our analyses. However, there are also problems with using only registry data, which will be expanded on in the following sections.

6.2.2 Weaknesses of registry-based data

6.2.2.1 Obtaining and updating registry data

One issue with using registry data in Norway is the often long process of obtaining and updating data, which can be affected by delays. This thesis focuses on 2000-2010 for this reason, as the delays experienced in updating data made it impossible for us to study more recent periods. This is one of the biggest weaknesses in this thesis due to the changing nature of the IA Agreement over time, and especially the increased focus on graded SA and more industry-specific measures from 2010 onwards which we were not able to study (21). We also experienced data delays with a different, larger cohort also established at STAMI, which includes all individuals born between 1930-1992 who have lived or worked in Norway (N=6,423,192). Relevant data for this cohort were finally received in autumn 2022, just a few months before the end of the PhD period. This meant that we were not able to use this cohort in our analyses, which would have increased the generalisability of our results to different population groups. Further, these delays in receiving data also led to a change of research question in

Paper III, which further highlights the issues arising with data delays. Such delays are not always easy to foresee and are a common problem when conducting registry-based studies.

6.2.2.2 Information bias

Data from registries are not collected primarily for research purposes, meaning we are limited to using the variables and depth of information those collecting the data deem necessary for administrative purposes (146). We are therefore lacking variables that could have been important for our analyses, including unmeasured confounders. For example, we had no information on companies' actual use of measures offered through the IA Agreement, or their contact with NAV Working Life Centres; both have been suggested to influence the benefits gained from signing an IA Agreement on a local level (113). We have used DAGs when designing each of the three studies and included variables that would account for some of this residual confounding from "missing" variables, but it is possible (and probable) that some is still present.

One of the strengths mentioned above is that it is possible to use exact dates for the different outcomes we are interested in. The quality of these registries has not been independently evaluated, and evaluation is difficult (146). It is theoretically possible that there are episodes that are missing or incorrectly registered. However, most of the data come from administrative registries that are used to track and register benefit payments, and are assumed to be complete, so the chance that episodes are missing is very small (147). They are also updated and corrected regularly (148). One exception to this is the variables related to IA status, obtained from NAV. The IA status data used in this thesis was only systematically documented by NAV from 2010 onwards, with dates recorded retrospectively from 2003, and has no documentation or metadata available. It is possible that information on IA status is therefore wrongly recorded, or that some IA companies were not included in the data received from NAV if they ceased to exist before 2010. If this is the case, it is most likely that a number of IA companies are wrongly categorised as non-IA companies, which would underestimate the effects of the IA Agreement. It is in addition difficult to verify the quality of the IA data, as there are no other databases with similar information available for comparison. We have, however, checked the coverage of IA on a company- and individual-level prior to 2010 and compared it with both a report published

in 2009 and NAV data suggesting around 56% of all employees worked in IA companies at this time, and around 23% of companies had signed the IA Agreement (149, 150). A similar distribution is seen among our cohort, even though it is a small section of the Norwegian labour market, which suggests we can rely on these data.

6.2.3 Study population

6.2.3.1 Age restrictions

As previously mentioned, the cohort used in this thesis includes individuals that were born between 1967-1976. This means that in 2005, roughly the middle of our study period, these individuals were aged between 28-38 years old. Our study population was therefore relatively young, restricting generalisability of our results to older workers that may have a different pattern of work participation. However, this age range nevertheless interesting as it is here the gender gap in SA is largest (151). In Paper III we experienced the opposite issue, with a lack of information on younger rather than older participants. Here, the age range over the study period was 26-43. The mean age of women giving birth in Norway was around 30 in our study period (152), meaning our results for this paper are generalisable to the working population despite a probable underrepresentation of younger mothers, who have been suggested to have more pregnancy-related illness than older mothers even after taking SES into account (65).

6.2.3.2 Lack of information on immigrants

The cohort used consists solely of individuals who were born in Norway, and therefore does not contain information on immigrants. This means we can only generalise our findings to the native Norwegian working population. Immigrants may be more likely to have higher SA and work disability rates and are also more likely to be unemployed or non-employed than native Norwegians (6, 153, 154) and could potentially benefit more than Norwegians from IA-related measures.

6.2.4 Sources of bias

6.2.4.1 Misspecified follow-up

In Paper III, we aimed to follow pregnancies from 6 weeks gestational age. However, as mentioned previously, we did not have due dates for all pregnancies in our population. This meant we assumed those who did not have due date information gave birth at full term (40 weeks). It is highly unlikely that all these women gave birth on their due date (155), meaning that actual follow-up start likely varied between individuals. Some of the babies will also have been born prematurely (i.e., before 37 weeks), meaning we may have begun following some individuals before pregnancy. This is most likely non-differential misclassification, which would lead to an underestimation of the effects of the IA Agreement.

Related to this is the problem that we do not know if all companies registered as signing the IA Agreement in 2003 became IA companies in 2003, or if they were already IA companies prior to this. However, this will not have a large impact on our results; the follow-up periods for Papers II and III are from 2003 onwards, and in Paper I we stipulate only that the company must have signed the IA Agreement prior to 1st January 2004 to ensure the implementation period occurred before the "after" period in 2005. It could, however, be possible that IA companies signed the IA Agreement earlier or later than assumed, as IA status is only recorded on a yearly basis (in March). This exposure misclassification is assumed to be nondifferential, and would therefore lead to an underestimation of the effects of the IA Agreement. Furthermore, it may take some time between signing the IA Agreement and implementing any IA-related measures; this would also lead to an underestimation of the effects of the IA Agreement. In Paper I we tried to account for these issues by only including companies that had signed the IA Agreement prior to 2004, so they would have time to implement measures before follow-up in 2005. However, we did not have any way of accounting for this in Papers II and III.

6.2.4.2 Selection bias

Even though the registries in themselves are not prone to selection bias, the inclusion criteria used in the three papers can result in selection bias. One of the largest sources of selection bias in Papers I and

II comes from excluding individuals who did not work solely in IA or non-IA companies during follow-up, to ensure the intervention was as well-defined as possible and allow for causal inference (see section 6.2.3). This leads to the exclusion of individuals who do not have long-term stable jobs, or who may have multiple jobs with a mix of IA and non-IA companies. This group could include younger individuals just beginning their career, workers with more precarious employment, or those with several jobs to ensure more financial stability. Excluding individuals without long-term, stable employment may lead to an underestimation of the effects of the IA Agreement if it does contribute to keeping people in work longer, as suggested by the results of this thesis. Alternately, the effects of the IA Agreement may be overestimated if those who are excluded yet have a much higher risk of SA and reduced work participation work more in IA companies than in non-IA companies.

In Paper III we followed the concept of "intention to treat", which is a slightly different strategy where individuals are assigned to the IA/non-IA groups according to their status at baseline (114). This means that if an individual changed IA status during follow-up, they were still categorised as being in the same group they were in at baseline. Further, if an individual had multiple jobs with a mix of IA/non-IA at baseline, they were categorised in the IA group as we considered them as still being "exposed" to the IA Agreement and its related measures. When combined with the sIPTWs, using the intention to treat strategy allows us to compute the average effect of working in a company with the IA Agreement at baseline, which is similar to an RCT using intention to treat with non-adherence or missing data (114, 156). This approach may, therefore, be more suited to studying the effect of the IA Agreement than the approach taken in Papers I and II where the exclusion of vulnerable subgroups is higher and thus the selection bias is likely larger.

A separate source of selection bias in these studies is the fact that the IA Agreement is a voluntary intervention, and therefore there are likely differences between IA and non-IA companies that result in the former signing an IA Agreement. It has been well-documented that many IA companies sign the IA Agreement because they already have a high rate of SA they want to reduce (27, 149, 157). In Paper I the study design is assumed to account for these between-groups variations as long as they would have remained constant over time had the intervention group not received the intervention

(116), and in Papers II and III we used sIPTW to try and combat this problem. However, we cannot exclude the possibility that this type of selection bias also influenced our results.

6.2.3 Causality

In this thesis we have tried to identify the average effect of having an IA Agreement on SA and work participation. The use of the word "effect" implies that we are attempting to study a causal relationship. The field of causal inference and its application to observational data, including registry studies, has expanded greatly over the past few decades (114, 158, 159). The new methods that resulted from this make it possible to infer effects from non-randomised studies as long as certain conditions are met (114). This is a major strength of the analyses in this thesis. The following section will discuss the assumptions for causality in more detail and reflect on whether the three studies contained in this thesis satisfy the requirements for causal inference: namely consistency, exchangeability, and positivity.

6.2.3.1 Consistency

One of the requirements for drawing causal conclusions from observational data is that the intervention is well-defined (also known as the assumption of consistency)(114). This is an obvious issue with regards to the IA Agreement, which has changed regularly since 2001 and has not been implemented in a consistent manner over time, across regions, or between companies. An added level of complexity comes from the uneven implementation of certain IA-related measures across companies, and the fact that some "IA measures" were available to the whole labour market in our study period, such as graded SA. We have tried to mediate this by defining our intervention as "having signed an IA Agreement at the local level" and comparing the use of graded SA by IA and non-IA companies, rather than incorporating graded SA as an aspect of the intervention. We believe this is sufficient for evaluating the average effect working in a company with an IA Agreement. However, the lack of a well-defined intervention and the ability of non-IA companies to use some of the same measures means that it is difficult to say what specific part of the IA Agreement contributed to the results found in the papers.

The fact that the IA Agreement was gradually implemented and is not so well-defined resulted in a discussion of trends rather than effects in Paper I. This is because DID requires a well-defined intervention and a clear timepoint of implementation (116). We combatted the former requirement by defining our intervention as having an IA Agreement more generally, but the gradual nature of uptake by companies weakened the ability to infer causation by this method. Although the DID model is still a useful method to use in IA-related research, and has indeed been used in other research papers investigating various aspects of the IA Agreement (23, 24), it is perhaps more appropriate to use causal inference methods that do not require such a sharp before and after contrast when studying the IA Agreement on a general level.

6.2.3.2 Exchangeability

Another assumption that needs to be satisfied to infer causality from our data is exchangeability; that those in non-IA companies would have had the same average outcome as those who work in IA companies if they had worked in an IA company themselves (114). Another way of saying this is that the distribution of confounders between individuals in IA and non-IA companies is equal, so the only difference between them is the presence or absence of the IA Agreement. This concept is also one of the central aspects in the DID design and is known as the common trends assumption; that the outcome in the intervention and control groups would have been the same had the intervention group not received the intervention (116). We tried to assess this in Paper I by studying the trend in SA over time in the IA and non-IA groups, but due to the young nature of our sample it was difficult to thoroughly check that the trends before 2001 were similar between the groups and could only be done using total SA. This was another reason why we were careful when interpreting our results in a causal manner.

In Papers II and III we used the method of sIPTW weighting to weight our population according to their likelihood of working in an IA company given their confounder values. Using this method means we can assume the condition of exchangeability is satisfied, but only if there is no residual confounding (133). As previously mentioned, we did not have information on some potential confounders, such as the level of effort IA companies have invested in their implementation of the IA

Agreement, which may result in some residual confounding. However, we assume that the amount of residual confounding still present is minimal, following specification of causal pathways in DAGs and adjustment for variables we believe cover bias due to confounding.

6.2.3.3 Positivity

The final assumption that needs to be satisfied to be able to draw causal conclusions from our data is that of positivity; that all combinations of confounder values have a treatment probability greater than zero (114). In practice, this means that there needs to be at least one individual with each combination of possible confounders in the IA group. We checked this in each paper and this assumption was satisfied.

6.3 Discussion of results

6.3.1 Causal effect studies into the IA Agreement

The Research Group for the IA Agreement and other actors have repeatedly expressed a wish for more causal effect studies evaluating the IA Agreement (23, 112). This thesis aims to contribute towards filling this gap. It is not possible from the papers in this thesis to study specific aspects of the IA Agreement that may result in a higher prevalence or a shorter duration. However, this thesis gives a broader idea of whether the IA Agreement as a whole achieves its aims of reducing SA and increasing work participation. Our results are conflicting and dependent on the outcome as well as the population studied, be that gender, diagnosis, or industry group. Most effect sizes are also very small and generally not statistically significant, with confidence intervals including the null. The few other peer-reviewed studies attempting to identify causal effects of the IA Agreement have not been as broad, instead looking more in-depth at specific measures or characteristics of IA companies rather than at the overall Agreement itself, and often evaluating specific IA-related programs (23). Two exceptions to this are studies conducted on the same data source as in this thesis, from the same project group, which have shown a beneficial effect of the IA Agreement, particularly for certain subgroups (24, 25).

However, one of these studies also used the DID method and suffers from the same limitations due to this as Paper I.

The causal studies indicate that some aspects of the IA Agreement have been useful in reducing SA and increasing work participation, such as cooperation with NAV Working Life Centres, whilst others have had less of an effect, such as interventions focused on extended use of self-reported SA (23, 25). This variation in the effect of IA-related measures can help explain the conflicting results in this thesis, suggesting the IA Agreement is difficult to study on a macro level and that one has to focus in on specific IA-related measures or groups to see a clearer effect. Achieving a reduction in SA and increase in work participation also requires effort to be put in by the company, and a whole process of discussion and implementation within each company; this is difficult to capture on a macro level. Nevertheless, the results of this thesis suggest that simply having access to IA measures is not enough on its own to reduce SA prevalence but might aid in increasing work participation. A combination of registry-based studies with more in-depth quantitative and/or qualitative information on what kind of measures are used by companies (both IA and non-IA), using similar causal inference methods, may therefore be better for considering which aspects of the IA Agreement have an effect on SA. The following discussion highlights some interesting patterns that could inform further research into the IA Agreement.

6.3.2 SA prevalence versus duration

Our results indicate that the IA Agreement may be better at reducing SA duration rather than SA prevalence. The reduction in SA duration was seen in both genders for both musculoskeletal and psychological SA (Paper I), with the exception of men with graded psychological SA. One other study has indicated a reduced duration in SA, similar to our findings, following the introduction of a compulsory dialogue meeting after the employee has been on 6 months of SA (160). This meeting was, however, introduced in 2007, which is after the timeframe of our first study (2000-2005) and around the middle of our second and third studies (2003-2010). It is also not a measure solely used by IA companies. This means that the effect of the dialogue meeting cannot be a viable explanation for the findings in Paper I and are at best a partial explanation for the findings of Papers II and III.

However, the maintained connection to the workplace, which was also emphasised by the IA Agreement prior to the introduction of the dialogue meetings, may be a contributory factor to reducing SA duration as individuals feel better supported to RTW. The ability to apply for grants to adjust workplaces for IA companies may also have enabled individuals to spend a shorter period of time on SA.

6.3.3 Sickness absence versus work participation

Perhaps one of the most important findings in this thesis is that IA companies tend to have a higher usage of both full and graded SA, but also a higher rate of work participation (i.e., being registered as in employment), as shown in Papers II and III. This "non-employment/other" state is not well-defined in the papers; it includes unemployment and non-employment, but can also include education (in Paper III), for example. We cannot therefore say with certainty from our results that the IA Agreement prevents individuals from being excluded from the labour market. That said, it is positive that the same trend was observed in both women and men and in all diagnosis groups. It may be the case that industries with a higher share of IA companies, such as the health and social care industry, are also better at retaining their employees. Industries such as health and social care typically require higher education and skills that are specific to that industry, and suffer from staffing shortages, which in turn motivates companies to retain staff (161). The "sausage model" also comes into play here, as these industries also tend to have the highest rates of SA which means they may be reducing unemployment through increasing SA (6, 77). The effect seen on work participation would then be partly due to working in industries with a large share of IA companies. We have tried to combat the variation in proportion of IA companies with the use of sIPTW weights. However, it is not possible to include companies' motivations in these weights, so it is possible that some of the effect observed is due to differences between industries and their level of effort in implementing the IA Agreement. Nevertheless, if the IA Agreement is indeed managing to prevent withdrawal from the labour market, this would mean it is achieving its current second goal (19). This fits with other studies on the IA Agreement which suggest IA companies are good at adjusting the working environment for employees who require this, whether they are on SA or have a reduced work capacity (162). This is a very

positive contribution from the IA Agreement that would be missed if we focused only on SA and disability pension, rather than considering the whole picture, including work participation.

6.3.4 SA as a means of maintaining connection to working life

However, the question remains as to where these individuals that would ordinarily have withdrawn from the labour market have instead moved to; are they remaining in work, or are they the reason for the increased rate of SA observed in IA companies? Is higher SA a positive outcome? Wergeland's "sausage model" would suggest that a certain level of SA is beneficial and necessary so individuals can keep working without being pushed out of employment due to poor health (77). As employees on SA are still followed up closely by their employers, one can argue that even those on full SA are maintaining a connection to their workplace and have a higher potential to return to work than those who withdraw (8). Graded SA has an even stronger effect on the employee's connection to the workplace and subsequent return to work (111). As mentioned in the introduction, employment is seen as beneficial for individuals' mental health, financial situation, and general health (163). Seen in this light, the finding that the IA Agreement may be keeping individuals in work (albeit with a higher SA rate) is positive. However, there may also be some negative sides to keeping individuals connected to the labour market through SA, mainly for the employer. Firstly, the employer compensates the first 16 days of employees' SA in the Norwegian SA system (87); though it is possible for them to apply for a refund in the case of chronically ill or pregnant individuals (164), it is not certain that all repeated SA falls under this category. In addition, it might be difficult to find cover for employees that are sick, especially if they have a particular skill set. This will lead to a loss of productivity for the employer, plus potential doubled costs related to paying a temporary replacement during the first 16 days of SA. This highlights the fact that increased SA has both positive and negative sides, but that increased SA can nevertheless contribute to keeping people from withdrawing from the labour market completely. The benefits of remaining in work for the employee and for society as a whole could be argued to outweigh the costs to the employer, but there is in any case a balance to be struck.

6.3.5 Use of graded SA

The use of both graded and full SA were for the most part higher in IA companies. As IA companies are more likely to have higher rates of SA than non-IA companies to begin with (27), it is possible that some of the higher use of graded SA is due to substitution. This would mean in practice that IA companies are using graded SA in the place of full SA, and consequently the rate of full SA is lower than it would have been otherwise in IA companies. Graded SA is seen as more positive than full SA, both for reducing SA duration and increasing the likelihood of subsequent employment (97, 111, 165-167). Substitution of full SA with graded SA would therefore be a positive finding for the IA Agreement. However, graded SA has always been available to all companies regardless of IA status, and the use of graded SA was not emphasised in the IA Agreement specifically until 2010, after our study period (21). Furthermore, in Paper I the prevalence of graded SA was actually lower than the prevalence of full SA for musculoskeletal SA in IA companies, which does not support this explanation. In Paper II, the likelihood of using full SA relative to graded SA varied depending on gender and diagnosis, with women and individuals returning from psychological diagnoses in IA companies overall more likely to use graded SA than those in non-IA companies. The results are therefore inconclusive and suggest that the use of graded SA, like much of the IA Agreement, is dependent on the context and subgroup studied, but it is not possible to draw stronger conclusions based on the findings included in this thesis alone. A 2018 review indicated the lack of causal studies investigating the effects of graded SA on SA and work participation generally (97), meaning this is an area that would benefit from further study using the methods in this thesis.

6.3.5 Gender differences in effects of the IA Agreement

As alluded to in the above paragraphs, any effects of the IA Agreement on SA appear to be modified by gender. This relationship is further complicated by variations due to diagnosis, outcome studied, and industry. In Paper I, men in IA companies had a higher prevalence of musculoskeletal SA over time than men in non-IA companies, but over 16 days shorter duration. Women, on the other hand, had a lower prevalence of musculoskeletal SA and 4 days reduced duration. When considering all SA diagnoses in Paper II, men in IA companies had a higher likelihood of full SA than women, whilst

women were more likely to have graded SA than men (compared to their respective non-IA counterparts). This difference was smaller when considering only men and women returning from musculoskeletal diagnoses. The finding fits with previous research indicating women are more likely to use graded SA than men (165). However, a study on the same cohort used in this thesis did not find a gender difference in use of graded SA in IA companies (25). Furthermore, the risk of all-cause re-exit from work (including SA) was not very different between men and women in IA companies, compared to those in non-IA companies (Paper II). These findings indicate that the varying effects of the IA Agreement on men and women may be dependent on SA diagnosis and the outcome studied, and that the IA Agreement may be more beneficial for reducing SA duration in men compared to women. Other studies have found that the IA Agreement and related workplace interventions have a larger effect on men than women (25, 168), though in one study it is unclear whether the intervention group consisted solely of IA companies or not (168). The stronger reductions in SA duration for men with musculoskeletal SA suggest the IA Agreement may be particularly useful for adjusting work tasks in male-dominated occupations and industries. This can be supported by Paper I, as the results described above were not consistent across industries, particularly for SA prevalence, and by other studies that also suggest that some of the gender differences in SA observed can be due to the industries and occupations within industries that men and women traditionally work in, and their ability to implement interventions (51, 58, 168).

6.3.6 The interesting case of men with psychological diagnoses

Men with psychological diagnoses seem to have a slightly different pattern to the other groups. Men working in IA companies had a stable prevalence of psychological SA between 2000-2005, whilst the prevalence increased in men working in non-IA companies (Paper I). Men also had a shorter duration of psychological SA if they worked in IA companies, relative to men working in non-IA companies. This may indicate that IA companies are better at adjusting workplaces and allowing for men to remain in work longer with a psychological diagnosis. However, men in IA companies who returned from psychological SA were less likely to remain in work and more likely to experience repeated SA (Paper II), though they were also less likely to withdraw from work completely (i.e., to

"unemployment/economically inactive"). This could be because IA companies are better at retaining men with psychological illnesses, albeit with a high rate of SA, as argued above with the sausage model (77). This pattern is an interesting variation to the other groups we have studied and could be a target group for IA-focused work.

6.3.7 Effects of the IA Agreement on pregnancy

When conducting analyses for Paper II, we noticed that the results for men and women were more similar when we excluded pregnancy-related diagnoses. This gave us the idea to look at pregnant women in Paper III. We found very small effects of the IA Agreement on use of either SA or pregnancy benefits among pregnant women, with confidence intervals including the null value. This indicates that pregnancy-related conditions are not very amenable to reduction through IA-related measures, which is perhaps not surprising given that some conditions are not related to the workplace at all, e.g., nausea or pelvic girdle pain. However, we did see some trends towards a higher likelihood of being in work during the second trimester for those in IA companies. The second trimester is when nausea and tiredness are less common, whilst musculoskeletal conditions, such as lower back pain, begin to increase (169). It may be easier to adjust for these conditions using IA-related measures than for nausea and tiredness, or late-stage pregnancy conditions such as pre-eclampsia and risk of preterm birth, leading to the trend we see in our paper. Indeed, previous research indicates work adjustments can reduce the SA rate in pregnancy, particularly preventive measures (60, 170, 171). Other research has indicated that the attitudes of the pregnant woman and her perception of the employer's attitudes towards SA in pregnancy may have a large impact on the rate of SA (172). One would hope that IA companies have a more positive attitude towards SA in pregnancy, and the concept of having a company policy for pregnant individuals is likely on the agenda for IA companies (173). However, no research exists on this topic, and it was not possible to investigate this with our data. Nevertheless, the trends indicate again that the IA Agreement may have the largest impact when physical adjustments to the workplace can aid with keeping individuals in work.

6 Conclusions and future implications

This thesis aimed to look at effects of having access to the IA Agreement on SA and work participation. The effects we found were small and dependent on other factors such as gender, industry, and outcome. However, our results indicate that the IA Agreement may on average contribute towards a shorter SA duration and increased work participation, especially among men.

The results of this thesis were mixed but generally fit with other research in the field indicating a small positive effect (24, 25, 112, 157, 174) or no effect (26, 175, 176) of the IA Agreement on SA and work participation. It is important to emphasise that we have evaluated the effect of having access to IA-related measures through working in a company that has signed the IA Agreement. This is not the same as actively using IA-related measures, and we did not have data on the effort IA companies put into achieving IA-related goals. However, the more general results found in this thesis, plus the ability to look at several outcomes simultaneously, indicates that the IA Agreement does indeed work in some groups. There is also evidence that some industries experience a larger effect of the IA Agreement than others, which supports the industry-specific focus in the current IA Agreement (19).

In this thesis, we found that the IA Agreement may be successful in reducing withdrawal from work following an SA episode and during pregnancy; however, we did not have a well-defined "other" state, so we do not know if this reduction is due to fewer becoming unemployed or if there are other reasons behind this. Further studying those who do not remain in work, and whether their work trajectories are similar or different, would thus be of interest. Using similar methods as used in this thesis with more detailed information on the use of IA-related measures, or another proxy for companies' effort levels in achieving IA-related goals, would also be beneficial for evaluating both SA and work participation more generally and giving more concrete recommendations to policymakers regarding which IA-related measures seem to work best in which population and diagnosis groups. Further investigating the subgroup of men with psychological diagnoses would also contribute to understanding why this group has a slightly different pattern to other subgroups in this thesis, along with a better understanding of how psychological SA in general can be better targeted by the IA

Agreement. Finally, studying effects of the IA Agreement on an occupational level can give more information on whether industries, and the gender variation within them, explain as much of the variation found in our results as we suspect. Studying occupations can also further inform the targeting of IA-related measures to specific groups, both to reduce SA and to reduce withdrawal from work.

The first IA Agreement began in 2001, and 22 years later it still has a way to go before it reaches the national goals set. However, the requirement for evaluation and renewal every few years keeps these ambitious goals and the work that has to be done to achieve them at the forefront of politicians', employers', and employees' minds. One of the real strengths of the IA Agreement is this cooperation between these different actors, both nationally and locally. This leads to a more co-operative and steered effort, which means the IA Agreement is more realistic and balanced than it may have been otherwise. With further research informing the way the IA Agreement works and the measures included, I believe it can become an even more useful tool to achieve a better and more inclusive working life for employees in Norway.

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RESEARCH

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Impact of the Norwegian Agreement for a More Inclusive Working Life on diagnosis-specific sickness absence in young adults: a difference-in-difference analysis

Rachel L. Hasting[1*], Suzanne L. Merkus[1], Therese N. Hanvold[1,2], Petter Kristensen[1], Jon Michael Gran[3,4] and Ingrid S. Mehlum[1,5]

Abstract

Background: The Norwegian Agreement for a More Inclusive Working Life (the IA Agreement) aims to reduce sickness absence (SA) and increase work participation. Potential impacts of the IA Agreement have not been thoroughly evaluated. The study aimed to estimate the impact of the IA Agreement on musculoskeletal and psychological SA prevalence and duration among young adult men and women, and to identify whether the impact was modified by economic activity or SA grade.

Methods: Data from national registries were combined for 372,199 individuals born in Norway 1967–1976. ICPC-2 codes identified musculoskeletal (L) and psychological (P) diagnoses. A difference-in-difference method compared prevalence and mean duration of first SA > 16 days between 2000 and 2005 separately for men and women working in IA companies relative to non-IA companies. Analyses were adjusted for mean company size and stratified by economic activity and SA grade (full/graded). Average marginal change was calculated with 95% confidence intervals (CI).

Results: The impacts of the IA Agreement on SA prevalence were mixed as the direction and size of marginal changes varied according to diagnosis, gender, and economic activity. However, there was a general tendency towards reduced mean SA duration for both diagnosis groups, and in particular men with musculoskeletal SA (− 16.6 days, 95% CI -25.3, − 7.9). Individuals with full SA in IA companies had greater reductions in mean SA duration. Only the wholesale and retail economic activity indicated a beneficial contribution of the IA Agreement for both SA prevalence and duration, in both diagnoses and genders.

Conclusions: Potential impacts of the IA Agreement on SA in young men and women varied according to diagnosis and economic activity. However, results indicated that the IA Agreement could reduce SA duration. Further research should identify reasons for gender and economic activity differences.

Keywords: Cohort study, Difference-in-difference, Gender, Mental health, Musculoskeletal diagnosis, Musculoskeletal disorder, Policy interventions, Psychological diagnosis, Register-based study, Sick leave

*Correspondence: rachel.hasting@stami.no
[1] Department of Occupational Medicine and Epidemiology, National Institute of Occupational Health, PB 5330 Majorstuen, 0304 Oslo, Norway
Full list of author information is available at the end of the article

Background

Absence from work due to illness has a financial and social impact on multiple levels of society. For individuals, frequent and/or long sickness absence (SA) episodes

can contribute to an inability to continue in employment [1], a loss of social interaction with colleagues, and a lower income. Nationally, high costs and productivity losses are associated with SA; in 2018, European Union states combined spent 1% (roughly €160 billion) of their GDP on sickness benefits [2]. These challenges have resulted in an increased focus on measures to prevent and reduce SA in the working population.

In Norway, an increasing number of individuals received SA and other benefits during the latter half of the 1990s [3]. Due to this, the Agreement for a More Inclusive Working Life (the IA Agreement) was developed in 2001 by the Government and organisations representing employers and employees. The aim was to, over a period of 4 years, reduce SA by 20% from the 2001 level and increase work participation [3]. Companies who signed the IA Agreement (so-called IA companies) gained access to different resources, including measures to prevent SA (e.g. workplace risk assessment training) and to aid in faster return to work (e.g. grants to help modify the workplace) [3]. See Fig. 1 for more details. Though not an IA Agreement measure, utilising graded SA instead of full SA has also been a main focus; it involves working part-time whilst on SA, and thus aids faster return to work [4]. In 2018, around 30% of companies were IA companies, covering almost 60% of the Norwegian working population [5]. The IA Agreement is now in its fifth term (2019–2022), where it has been extended to include all Norwegian companies [6].

During the IA Agreement period 2001–2018, the percentage of available working time lost to SA in the Norwegian working population dropped from 6.6 to 5.8%, a relative reduction of 12.4% [4]. To what degree this reduction can be explained by implementation of the IA Agreement, or measures such as graded SA, remains unclear. Few peer-reviewed studies have evaluated it, and results have been mixed [7–9]. Furthermore, the reduction in SA varied according to gender and economic activity. During the first 10 years of the IA Agreement, women's SA decreased to a smaller extent than men's, widening the existing gender gap [5]. SA was also reduced in some economic activities more than in others from 2001 to 2018, from a 36% reduction in the hotels and restaurants economic activity to less than 10% in education [4]. Recent studies have indicated the IA Agreement may play a role in these variations, and that any impacts may also differ between genders within an economic activity [7, 9, 10]. As the most recent version of the IA Agreement includes an economic activity-specific focus [11], understanding these differences will aid implementation and future evaluation of the IA Agreement. It could also provide

Aims:

1. To reduce sickness absence (SA) by at least 20% over the IA Agreement period, with reference to the level of SA in the second quarter of 2001 (%).
2. To employ more individuals with a reduced functional ability that limits their capacity to work than at the beginning of the period.
3. To increase the mean pension age.

Measures:

1. Opportunity to use active sickness benefits without prior approval from the Norwegian Welfare and Labour Administration (NAV). Active sickness benefit is where an individual returns to work to carry out modified tasks whilst NAV pays the sickness benefit to the employer.
2. Own contact person in NAV who can assist in following up those on SA.
3. The occupational health services in an IA company can apply for refunds for work done in helping those on long-term SA or disability benefits to return to work.
4. Employees in an IA company can self-report SA for up to 8 calendar days, rather than 3.
5. If it is not possible for an employee to return to their original position, the employer, in cooperation with NAV and other government bodies, must assist in retraining so the employee can continue to work in the company.

The IA Agreement was implemented similarly across all economic activities in all regions of Norway on a national level. All firms had access to exactly the same measures during the period under study, regardless of economic activity.

[1]Based on the Norwegian description of the first IA Agreement period (3)

Fig. 1 Characteristics of the first IA Agreement period, 2001–2004[1]

valuable information for other countries looking to implement national interventions to reduce SA.

The IA Agreement's effect on SA in young adults is of particular importance, as experiencing SA early in the working career can contribute to increased SA and lower income later in life [12]. Younger adults also show a larger gender gap in SA than other ages (e.g. over 3 percentage points (PP) in those aged 30–34, compared to 2 PP in those aged 45–49) [13]. This is partially, but not wholly, explained by pregnancy-related SA [13, 14]. Exploring the impact of the IA Agreement on younger adults will thus provide further insight into how the related measures work in this vital population.

The most common cause of SA in Europe is musculoskeletal disorders [15], which, along with psychological diagnoses, are receiving an increasing level of attention due to their consequences for individual wellbeing, work productivity, and costs [16]. These are also the two largest diagnosis groups in Norway, accounting for over 50% of SA in 2019 [17]. They respond differently to workplace interventions [18]; accordingly, grants and measures included in the IA Agreement will likely be utilised differently depending on the diagnosis. Thus, it is beneficial to study the diagnoses groups separately.

This paper aimed to estimate whether the IA Agreement had an impact on musculoskeletal and psychological SA in young adults. Two main research questions were addressed: 1) What is the impact of the IA Agreement on the prevalence and duration of musculoskeletal and psychological SA separately for men and women, and 2) To what extent is any impact modified by economic activity and grade of SA (full/graded)?

Methods

Data sources

The project group established a birth cohort in 2002 that is comprised of all individuals live-born in Norway in the period 1967–1976 ($n=626{,}928$) [19]. Data from this cohort was used by linking different registries using the unique individual identification number. Information on gender, SA and economic activity were obtained from "FD-Trygd", an events database on employment and welfare maintained by Statistics Norway (SSB) [20]. Data on company size (number of employees) were obtained from the Central Register of Establishments and Enterprises, also maintained by SSB [21]. Data on if/when companies entered into the IA Agreement, any changes to their agreement status, and SA diagnoses were obtained from the Norwegian Labour and Welfare Administration (NAV). Ethical approval was obtained from the South-East A Regional Committee for Medical and Health Research Ethics (case number 17344).

Study design

A difference-in-difference (DID) method was used. We compared individuals working in companies with the IA Agreement (intervention) with those without the IA Agreement (controls), before implementation (2000) and after the first IA term (2005).

The DID method uses observational data to infer effects of quasi-experiments by comparing the outcome variable of the intervention group with a control group. A key assumption is that the intervention and control groups would have had the same trend over time for the outcome if there had been no intervention (the "common trends" assumption) [22]. This is usually tested by comparing the trend in outcome prior to the study period for each group. In the years prior to 2000, only a few of our young and healthy study population were diagnosed with musculoskeletal or psychological disorders. Therefore, we checked the trends in SA regardless of diagnosis (see Supplementary Fig. 1 and 2). The change over time for the intervention and control groups, in men and women respectively, appeared to be similar. Another key assumption is that the allocation of the intervention does not depend on the outcome pre-intervention [22]. The outcome in this study was SA at an individual level, and there is little to suggest that individuals select companies/jobs based on IA status [23]. IA was also allocated at a company level. Therefore, we consider this assumption to be reasonable. DID does not require that the individuals in each group are the same over time, but that the group characteristics are the same [24]. We checked the composition of the intervention and control groups respectively with regards to gender composition, age, company size, and economic activity, and they appear to be similar in 2000 and 2005 (Table 1). If these assumptions are fulfilled, DID can be used as an alternative where a randomised controlled trial (RCT) is not possible, allowing for the discussion of intervention effects [22].

The intervention effect is captured using an interaction term between group (intervention/control) and time period (before/after intervention) in a regression model. A positive estimate indicates an increase in the outcome due to the intervention (relative to controls), whilst a negative estimate indicates a decrease in the outcome due to the intervention.

Study population

The initial population consisted of 529,767 individuals, who were registered as employed in Norway on 1st January 2000 and/or 1st January 2005 (Fig. 2). Individuals were excluded in 2000 and/or 2005 if they worked for a company that signed the IA Agreement after 1st January 2004. This was to ensure that the intervention was

Table 1 Descriptive statistics for employees in the intervention group (IA) and control group (non-IA) in 2000 and 2005 ($N = 372,199$)

	Intervention						**Control**					
	2000 ***N*** **= 39,762 (20%)**			**2005** ***N*** **= 71,699 (27%)**			**2000** ***N*** **= 156,464 (80%)**			**2005** ***N*** **= 191,731 (73%)**		
	N	**%**	***Quartiles***	***N***	**%**	***Quartiles***	***N***	**%**	***Quartiles***	***N***	**%**	***Quartiles***
Year of birth			1969–1971-1976			1969–1971-1976			1969–1972-1976			1969–1971-1976
Female	25,265	64		40,390	56		68,137	44		73,584	38	
Company size			45–135-549			42–121-521			8–24-100			8–21-69
Economic activity												
Agriculture/forestry/fishing	97	< 1		130	< 1		4012	3		2802	1	
Mining/quarrying	508	1		1254	2		1562	1		4437	2	
Manufacturing	5066	13		11,041	15		20,072	13		25,474	13	
Electricity/gas/water supply	196	< 1		460	1		719	< 1		1008	1	
Construction	1276	3		2920	4		12,022	8		18,283	10	
Wholesale/retail	1442	4		2882	4		36,216	23		46,615	24	
Hotels/restaurants	695	2		585	1		9850	6		5196	3	
Transport/storage	2195	6		3504	5		14,510	9		15,276	8	
Financial/real estate	1901	5		4107	6		27,218	17		35,824	19	
Public administration	3760	9		7723	11		7167	5		6266	3	
Education	5577	14		10,881	15		2886	2		5305	3	
Health/social	15,887	40		24,860	35		11,864	8		17,216	9	
Other	1162	3		1352	2		8366	5		8029	4	

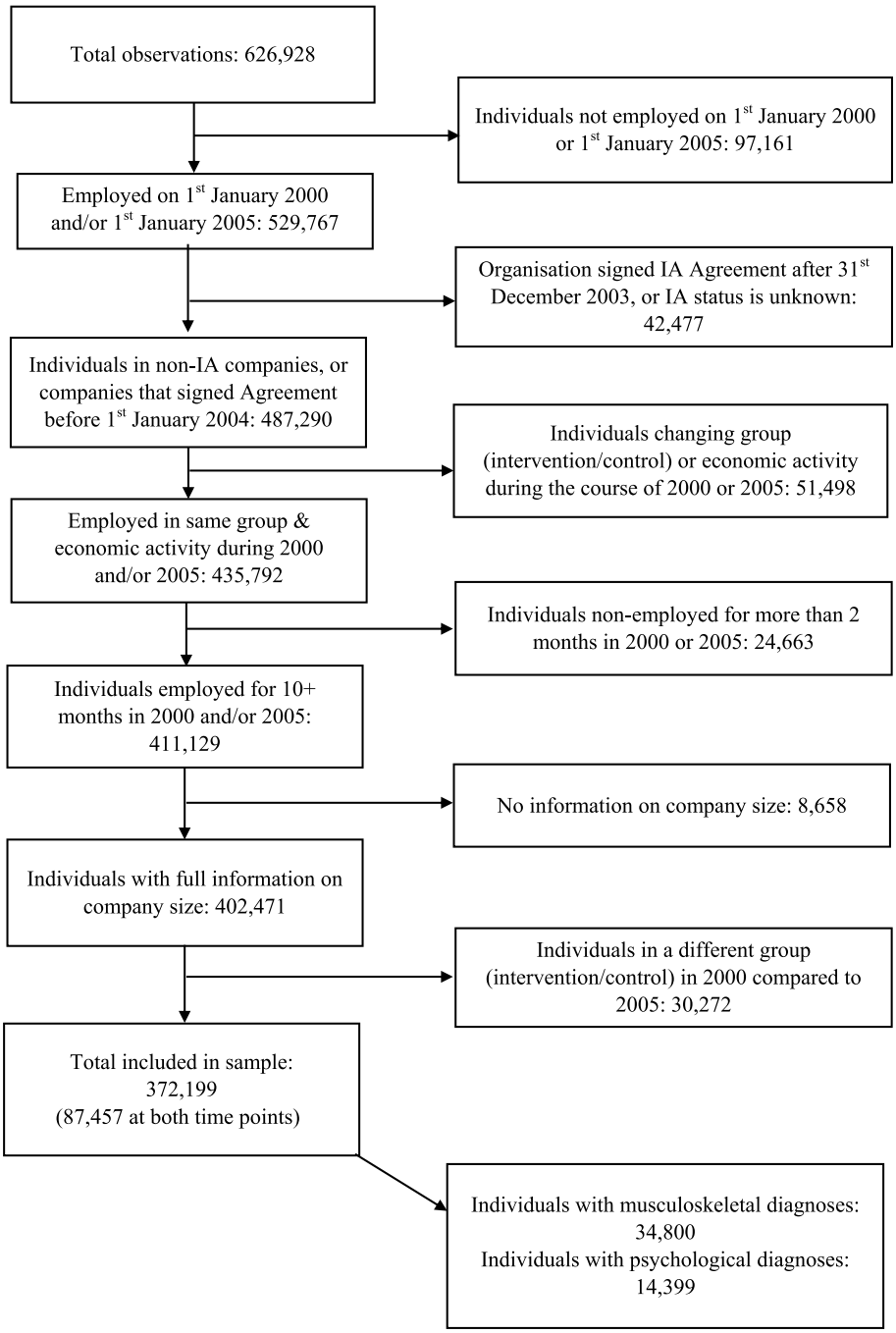

Fig. 2 Flowchart of study population

implemented at approximately the same time. Individuals were also excluded if they or the company changed group (intervention/control) or economic activity during the course of 2000 or 2005, were non-employed for more than 2 months of the year, or had missing information on company size. Finally, for those present in both years, individuals were excluded if they were in a different group (intervention/control) in 2005 compared to 2000. In total, 157,568 individuals (30%) of the initial population were excluded.

Study outcomes

In Norway, sickness benefits are covered by the employer for the first 16 calendar days of SA. After this, the

responsibility is passed on to NAV and the entire episode is registered in the sickness benefits database. This information is passed on to SSB and incorporated in the FD-Trygd database, from which we obtained SA data. Thus, only absences >16 days are included to ensure records are complete. Individuals must obtain a sickness certificate from their physician, with a diagnosis denoted by an International Classification of Primary Care (ICPC-2) code [25].

The two main study outcomes were one-year SA prevalence (at least one SA episode >16 days) and the duration of the first SA episode for those with SA >16 days during 2000 and 2005, respectively. The outcomes were studied separately for musculoskeletal diagnoses (ICPC-2 code L) and psychological diagnoses (ICPC-2 code P), and for men and women. We first analysed both full (100%) and graded (<100%) SA together, before analysing them separately and comparing the results with our main analyses to identify whether the IA Agreement influenced the implementation of graded SA. For SA episodes that began in the previous year (i.e. 1999 or 2004) or continued further into the following year, the duration of the entire SA episode was used, including days beyond 2000 or 2005.

Covariates

Covariates included in this study were gender, economic activity, and mean company size. The economic activity variable was coded according to the Standard Industrial Classification 2002 [26], based on the Statistical Classification of Economic Activities in the European Community (NACE) Revision 1.1, and included 13 different economic activity categories (see Table 1). Some economic activities were grouped together in categories in order to increase sample size for analyses; these were agriculture/forestry/fishing (categories A and B), financial/real estate (J and K), and other (O, P, and Q). As some individuals worked at multiple companies during the year, the mean company size was calculated for each individual.

Statistical analyses

All analyses were carried out in Stata, version 15.1 [27].

Linear probability models were used to calculate the average marginal change in the one-year prevalence of SA (measured in percentage point (PP) change). Due to the skewed nature of the data, negative binomial regression models were used to calculate the average marginal change in the duration of first SA episode (measured in days). When the number of individuals in the stratified economic activities exceeded 500 both in 2000 and 2005, we ran economic activity-specific models. Full/graded SA analyses were carried out on the same economic activities, even when sample size <500. The "margins" command in Stata was used to calculate average marginal change. 95% confidence intervals (CI) were calculated using clustered standard errors at the individual level, to account for correlation between individuals present at both time points.

Results

The final study population comprised 372,199 individuals (70% of the initial employed population), of whom 87,457 were present at both time points (Fig. 2). For the purposes of studying SA duration, only those with SA episodes (all-cause) were included; this resulted in two subpopulations of 34,800 for musculoskeletal SA and 14,399 for psychological SA.

Table 1 shows the background characteristics for the intervention (IA) and control (non-IA) groups in the main population (see Supplementary Table 1 for the subpopulations). There was a higher proportion of individuals in the control group both in 2000 and 2005 (80 and 73%, respectively); women were more likely to be in the intervention group at both time points (64 and 56%, respectively). The median company size was well over 100 employees in both years for those in the intervention group, and below 25 employees for the control group. Individuals in IA companies were more likely to work in the health and social economic activity (40% in 2000; 35% in 2005) and education economic activity (14% in 2000; 15% in 2005), whilst individuals in non-IA companies were more likely to be in wholesale/retail (23% in 2000; 24% in 2005) and financial/real estate (17% in 2000; 19% in 2005) economic activities. For a more detailed breakdown of the distribution of gender and diagnoses within economic activities, see Supplementary Tables 4 and 5.

In our total sample in 2000, the prevalence of musculoskeletal SA was 7.5% for men and 10.0% for women, whilst for psychological SA the prevalence was 2.1 and 3.5%, respectively. The mean duration (days) of musculoskeletal SA in 2000 for men was 102 (standard deviation (SD) 101, interquartile range (IQR) 30–56-133) and for women was 106 (SD 95, IQR 36–71-140). For psychological SA, this was 125 (SD 115, IQR 34–74-189) days for men, and 124 (SD 115, IQR 34–73-176) days for women.

Main analyses

Musculoskeletal diagnoses

Musculoskeletal SA prevalence was lower in 2005 than in 2000, in both genders and both groups (intervention/control) (Table 2). The negative DID estimate for women indicates that the decrease occurred to a larger extent in the intervention group than in the control group. For men, the positive DID estimate indicates that a decrease

Table 2 Prevalence and duration of musculoskeletal and psychological SA for male and female employees in the intervention group (IA) and control group (non-IA) in 2000 and 2005, the change over time, and difference-in-difference (DID) estimates (N = 372,199)

	Intervention								**Control**									
	2000 *N* = 39,762 (20%)			**2005 *N* = 71,699 (27%)**			**Change 2000–2005**		**2000 *N* = 156,464 (80%)**			**2005 *N* = 156,464 (80%)**			**Change 2000–2005**		**DID Estimate[a]**	
	N (%)	***Mean (SD)***	***Median (IQR)***	***N (%)***	***Mean (SD)***	***Median (IQR)***	***PP***	***Days[b]***	***N (%)***	***Mean (SD)***	***Median (IQR)***	***N (%)***	***Mean (SD)***	***Median (IQR)***	***PP***	***Days[b]***	***Marginal Change***	***95% CI***
Musculoskeletal (code L)																		
Prevalence																		
Men	1033 (7.1)			2014 (6.4)			−0.7		6626 (7.5)			7895 (6.7)			−0.8		0.3	− 0.2, 0.9
Women	2543 (10.1)			3383 (8.4)			−1.7		6380 (9.4)			6061 (8.2)			−1.2		−0.4	− 0.9, 0.1
Duration (days)																		
Men		98 (102)	54 (28–128)		93 (100)	48 (27–115)		−5		102 (101)	57 (30–134)		115 (113)	62 (32–157)		13	**−16.6**	**−25.3, −7.9**
Women		98 (89)	67 (34–128)		113 (113)	62 (31–156)		15		109 (96)	73 (37–146)		129 (120)	74 (34–195)		20	−4.3	−10.9, 2.3
Psychological (code P)																		
Prevalence																		
Men	337 (2.3)			708 (2.3)			0.0		1801 (2.0)			2602 (2.2)			0.2		−0.1	−0.4, 0.3
Women	914 (3.6)			2184 (5.4)			1.8		2313 (3.4)			3741 (5.1)			1.7		0.2	−0.2, 0.6
Duration (days)																		
Men		114 (112)	59 (30–162)		108 (109)	58 (29–145)		−6		127 (116)	76 (34–193)		129 (121)	73 (33–199)		2	−6.1	−22.2, 10.0
Women		111 (109)	62 (31–157)		125 (118)	74 (32–190)		14		128 (117)	77 (35–190)		142 (125)	87 (36–240)		14	−1.4	−12.3, 9.5

[a] Analyses adjusted for economic activity (13 categories) and mean company size. Bold font indicates estimates are statistically significant at the 5% level

[b] Calculated using mean days

SA sickness absence, *IQR* interquartile range, *CI* confidence interval, *SD* standard deviation, *PP* percentage points

occurred to a lesser extent in the intervention group compared to the control group.

Median SA duration for musculoskeletal SA was lower in the intervention groups in 2005 compared to 2000, but higher in the control groups, for both men and women. The negative DID estimate for women indicates that the intervention group increased to a lesser extent than the control group. In men, the negative DID estimate reflects the decrease in SA duration in the intervention group relative to the increase in the control group (−16.6 days, 95% CI -25.3, −7.9; see Table 2).

Stratification on grade of SA showed larger negative DID estimates for full SA than for graded SA for prevalence in women and for duration in both genders (Table 3). The change in DID estimates was particularly prominent for SA duration in women, where the difference in full SA was almost 5 days larger compared to the original estimate. However, for prevalence in men, there was a slightly larger positive DID estimate for full SA, compared to the original estimate, and a weak negative estimate for graded SA.

Psychological diagnoses

For psychological SA, men in both groups had a lower median duration in 2005 compared to 2000, whilst women had a higher median duration in both groups (Table 2). The negative DID estimates indicate that the mean duration in men decreased more in the intervention group than in the control group, whilst for women, mean duration increased less in the intervention group than in the control group.

For both genders, the trends in prevalence persisted regardless of grade of SA (Table 3). For SA duration, both genders had larger negative DID estimates with full SA, compared to the original analysis. Men in the intervention group showed an increase in duration of graded SA, compared to the original analyses.

Economic activity-specific analyses

Musculoskeletal diagnoses

The direction of the DID estimates for the prevalence of musculoskeletal diagnoses varied between the economic activities (Table 4). Regarding mean duration within the economic activities, the intervention group generally showed a larger decrease between 2000 and 2005 compared to the control group, especially in men. The DID estimates for prevalence and mean duration generally tended to have the same direction within economic activity for each gender, with some exceptions (e.g. men in the transport/storage, financial/real estate, and health/social economic activities). However, the estimates generally varied between genders within an economic activity. Only the wholesale/retail economic activity showed consistent negative DID estimates across outcomes and genders.

For both genders, the DID estimates for the intervention group were generally larger for negative estimates and smaller for positive estimates when considering SA duration in full SA, compared to the original estimates.

Table 3 DID estimates for SA prevalence and duration in those with graded (< 100%) SA and those with full (100%) SA, compared to original analysis[a]

	Original Analysis		**< 100% SA**		**100% SA**	
	Marginal Change	***95% CI***	***Marginal Change***	***95% CI***	***Marginal Change***	***95% CI***
Musculoskeletal (code L)						
Prevalence (PP)						
Men	0.3	−0.2, 0.9	−0.2	−0.5, 0.1	0.5	−0.0, 1.0
Women	−0.4	−0.9, 0.1	−0.1	−0.4, 0.3	−0.4	−0.8, 0.1
Duration (days)						
Men	**−16.6**	**−25.3, −7.9**	−12.2	−32.8, 8.4	**−17.7**	**−27.3, −8.1**
Women	−4.3	−10.9, 2.3	−2.7	−13.9, 8.5	**−9.1**	**−17.4, −0.8**
Psychological (code P)						
Prevalence (PP)						
Men	−0.1	−0.4, 0.3	0.0	−0.1, 0.2	−0.1	−0.4, 0.2
Women	0.2	−0.2, 0.6	0.2	−0.1, 0.4	0.1	−0.2, 0.4
Duration (days)						
Men	−6.1	−22.2, 10.0	22.3	−9.2, 53.9	−13.2	−31.7, 5.3
Women	−1.4	−12.3, 9.5	−3.1	−22.2, 16.1	−5.4	−19.0, 8.2

[a] Analyses adjusted for economic activity (13 categories) and mean company size. Bold font indicates estimates are statistically significant at the 5% level

PP percentage points, *CI* confidence interval

Table 4 Results of the difference-in-difference (DID) analyses for musculoskeletal- and psychological-related prevalence and duration, when stratifying by economic activity and gender[a]

	Musculoskeletal (code L)				Psychological (code P)			
	Prevalence (PP)		Duration (days)		Prevalence (PP)		Duration (days)	
	Marginal Change	*95% CI*	*Marginal Change*	*95% CI*	*Marginal Change*	*95% CI*	*Marginal Change*	*95% CI*
Manufacturing								
Men	−0.9	−2.3, 0.4	**−19.5**	**−34.1, −4.9**	−0.4	− 1.1, 0.3	−8.5	− 42.6, 25.6
Women	1.0	−1.3, 3.4	4.3	−18.8, 27.4	−0.4	− 1.8, 1.0	18.8	−25.0, 62.7
Construction								
Men	−1.4	−3.8, 1.1	−21.5	−44.2, 1.2	0.0	−1.0, 1.1	−32.2	−93.7, 29.3
Wholesale/retail								
Men	−0.3	−2.5, 1.8	−10.1	−44.7, 24.4	**−1.6**	**−3.1, − 0.1**	−11.0	−65.3, 43.4
Women	−2.7	−5.8, 0.3	−18.2	− 51.6, 15.1	− 0.9	−2.6, 0.7	−31.4	−94.1, 31.4
Transport/storage								
Men	1.2	−1.0, 3.4	−4.1	−29.5, 21.4	−0.5	−1.8, 0.8	**45.7**	**4.6, 86.7**
Women	1.3	−1.7, 4.3	22.7	−4.5, 49.9	0.9	−1.1, 2.9	0.3	−50.3, 50.8
Financial/real estate								
Men	0.5	−1.1, 2.0	−9.9	−65.2, 45.3	0.1	−0.9, 1.1	**55.6**	**4.8, 106.3**
Women	−1.4	−3.6, 0.9	−5.0	−34.0, 23.9	0.2	−1.4, 1.7	−30.5	−81.9, 20.8
Public administration								
Men	1.0	−0.4, 2.5	23.8	−10.1, 57.7	0.8	−0.1, 1.7	−9.0	− 75.6, 57.6
Women	−1.1	−3.1, 0.9	0.1	−30.5, 30.7	−0.5	−2.0, 0.9	1.7	−47.8, 51.2
Education								
Men	−0.1	−1.8, 1.5	−19.9	−69.7, 29.9	0.2	−1.2, 1.6	−38.6	− 102.6, 25.4
Women	0.4	−1.3, 2.0	−16.5	−44.2, 11.2	−0.1	− 1.5, 1.3	20.9	− 18.2, 60.0
Health/social								
Men	0.3	−1.4, 2.1	−26.4	−59.4, 6.6	1.2	−0.2, 2.5	−22.3	−70.8, 26.2
Women	−0.1	−1.1, 0.9	−4.5	−15.0, 6.0	0.1	−0.7, 0.8	− 7.1	−23.9, 9.7

[a] Analyses adjusted for mean company size. Bold font indicates estimates are statistically significant at the 5% level. *PP* percentage points, *CI* confidence interval

In contrast, estimates were smaller for negative estimates and larger for positive estimates when considering both SA prevalence and duration in graded SA, compared to the original estimates (Supplementary Table 2).

Psychological diagnoses

There were no clear trends for the direction of economic activity-specific DID estimates for psychological diagnoses, neither within outcome nor for each respective gender (Table 4). Men in the intervention group showed a significantly larger increase in SA duration than the control group in the transport/storage (45.7 days, 95% CI 4.6, 86.7) and financial/real estate (55.6 days, 95% CI 4.8, 106.3) economic activities. Similar to the results for musculoskeletal diagnoses, in the wholesale and retail economic activities, the IA Agreement was consistently associated with a smaller increase in both outcomes in the intervention group compared to the control group. This was significant for SA prevalence in men (− 1.6 PP, 95% CI -3.1, − 0.2).

There were no clear trends in the direction of DID estimates for full or graded SA on psychological related SA prevalence or mean duration across economic activities (Supplementary Table 3).

Discussion

This study used a difference-in-difference method to investigate the impact of the IA Agreement on the prevalence and mean duration of sickness absence separately for young men and women with musculoskeletal and psychological diagnoses, and to identify whether economic activity and graded SA modified these effects. Our results indicate that there are differences between those with and without the IA Agreement, as those working in companies with the IA Agreement tended to have a shorter mean duration of both musculoskeletal- and psychological-related SA. This result was even stronger when considering only those on full SA. The potential impact of the IA Agreement on men and women varied according to economic activity. The only clear trend in

DID estimates was observed in the wholesale and retail economic activity, which showed consistent benefits for both prevalence and mean duration in both diagnoses and both genders for those working in companies with the IA Agreement.

Previous evaluations of the IA Agreement come from reports and peer-reviewed studies, and suggest either a positive effect [5, 8, 9, 23, 28], or no significant effect on overall SA [7, 10, 29]. Our results indicate a general beneficial contribution of the IA Agreement towards reduced duration of both musculoskeletal and psychological diagnoses in both genders, particularly in men, and a mixed contribution with regards to prevalence. However, few of these estimates were statistically significant, meaning that these trends could be due to chance.

If the trends can be attributed to the IA Agreement, our results could indicate that the measures included in the IA Agreement contribute more towards faster return to work than prevention of initial SA. This is supported by the fact that many of the IA-related measures focused on longer-term SA are related to maintaining contact with the individual and adjusting the workplace to ensure faster return to work [11]. Graded SA also has the same aim [4]. Full SA episodes were generally shorter than graded SA episodes for those with the IA Agreement compared to controls. This could indicate that IA companies facilitate for graded SA to ensure the individual can participate in working life, where the individual would ordinarily have continued with full SA.

Economic activities varied in how and to what extent the IA Agreement impacted SA prevalence and duration. As mentioned, only the wholesale/retail economic activity showed a consistent beneficial impact of the IA Agreement on both prevalence and duration, though many economic activities showed a beneficial trend with regards to mean SA duration. Only musculoskeletal SA appeared to show a trend towards an impact of the IA Agreement on full and graded SA, with shorter SA episodes on full SA and more frequent, longer SA episodes with graded SA. Economic activity seems therefore to have a modifying effect on any potential impact of the IA Agreement on SA, which is in line with previous studies and reports [5, 7, 10]. Potential explanations for differences between economic activities may lie in how much effort economic activities have put into implementing the IA Agreement [7], or through the degree of manual labour involved and the ease with which tasks can be adjusted [10]. We did not have information relating to potential differences in the level of effort available in this study, but it is possible that economic activities do have differing levels of effort into implementation [30]. We did find that economic activities that tend to be associated with manual labour (e.g. wholesale/retail and construction) also tended to show a beneficial impact of the IA Agreement. However, we also found a similar result for psychological-related SA, which is not necessarily correlated with manual labour and has been shown to respond differently to workplace interventions [18]. We did not find any clear trends relating to gender within the economic activities, indicating that economic activity may play more of an important role than gender when considering the effectiveness of IA-related measures.

Methodological considerations

This study used the DID method, which aims to observe and evaluate effects of quasi-experiments, such as the IA Agreement, where no large-scale RCTs are possible. However, DID includes assumptions that are very difficult to test in practice [22]. We were able to visually inspect the trend in all-cause SA in our study population prior to study start, but the young age of the study population meant we could not focus specifically on musculoskeletal and psychological SA. The distribution of SA duration is also skewed, which could introduce some bias into our results, though we chose the negative binomial regression method to try to account for this. This could be mitigated by using a DID approach that uses the median, though this requires a different method of analysis and additional assumptions [31].

We also controlled for variables that could cause the groups to have different levels in SA at baseline (e.g. mean company size) [5, 17]. We did not, however, have information on other potentially important confounders, such as sector (public or private) or employees' work histories, which may influence group membership and level of SA and could thus have affected our estimates [17, 23]. Another important assumption underlying DID is that the intervention and control groups are well-defined [22], which includes the assumption that individuals cannot randomly switch group. We excluded those who switched group in 2000 or in 2005, as well as those in a different group in 2005 compared to 2000, but we included individuals who switched groups in the 4-year period between 2000 and 2005. When excluding those who changed IA status between 2000 and 2005, the results were similar to those of the original analysis. It is, however, important to follow up studies using DID with other analytical approaches, in order to understand more about the causal effects of interventions, including the IA Agreement.

We only included those in work for more than 10 months during the year (2000 or 2005), and we excluded people who switched group (intervention/control) or economic activity. These criteria could result in the exclusion of vulnerable individuals who have temporary contracts or who are struggling to find a secure

and stable job, a situation that may be prevalent among our population of younger adults (aged 24–38). Applying these inclusion/exclusion criteria, though necessary to ensure proper exposure to the intervention, could limit the extent to which our findings can be applied to the general younger working population. In addition, younger individuals are less likely to experience SA compared with older adults [17] and therefore the SA levels in this study are not representative of the general working population. Finally, due to data limitations, only SA > 16 calendar days were included; this limits the generalisability of our findings to short-term SA (< 16 days).

Implications and future research

The first goal of the IA Agreement was to reduce SA by 20% from the 2001 level [5]. This goal was not reached [4]; however, the IA Agreement may still have contributed to meaningful reductions in SA, particularly for SA duration. An example of this is the reduction in mean duration of musculoskeletal SA, which was almost 17 days in men. In addition, IA companies appear to use graded SA to keep people in contact with the workplace during illness, which aids in achieving the overarching goal of keeping people in work [4].

The variation found between outcome measure, diagnosis, gender and economic activity in this study suggests that the overall impact of the IA Agreement is considerably heterogeneous. This indicates the importance of the economic activity-specific focus in the current IA Agreement [11], and suggests the potential relevance of focusing more on gender differences. Future studies should look closer at the reasons behind the heterogeneities; for example, whether differences are due to overall implementation of specific IA-related measures, which we did not have information on in this study, or due to variance in measure implementation that may depend on, for example, company motivation or job tasks. Looking closer at economic activities such as the wholesale/retail economic activity, which showed a consistent beneficial impact of the IA Agreement in this study, may provide further insights into what aspects of the IA Agreement contribute to SA reduction. Stratifying by occupational categories would also be useful, to study differences according to job tasks. Additionally, it would be beneficial for future studies to identify gender and economic activity differences in other samples, e.g. older samples or the whole working population.

Looking beyond Norway, the results indicate that other countries considering national interventions to reduce SA may find it useful to know that such interventions could have differential impact depending on the economic activity and gender. This would allow them to tailor the intervention accordingly. Our results also indicate that there may be variations in effects dependent on which SA outcome countries are interested in reducing (prevalence versus duration). Lastly, countries considering interventions to reduce SA are recommended to implement such interventions in a way that allows for proper evaluation, e.g. by random allocation of the intervention.

Conclusions

The impact of the IA Agreement on SA prevalence varied according to diagnosis, gender, and economic activity. The IA Agreement appeared to generally contribute towards a reduction in the duration of SA in both genders, both for musculoskeletal and psychological diagnoses. This trend was also seen in the economic activity-stratified analyses. A consistent beneficial impact of the IA Agreement was found only in the wholesale/retail economic activity. The use of graded/full SA varied, but individuals working in IA companies generally utilised graded more, compared to controls. This may indicate that graded SA is used more by IA companies to reduce full SA and keep people in contact with their workplace. Identifying what workforce and enterprise characteristics are associated with a beneficial impact of the IA Agreement, as well as which IA-related measures are most effective, will help increase the chances of achieving the IA Agreement's goal of reducing SA.

Abbreviations

CI: confidence interval; DID: Difference-in-difference; IA (Agreement): The Norwegian Agreement for a More Inclusive Working Life; ICPC-2 code: International Classification of Primary Care code; IQR: interquartile range; NACE: Statistical Classification of Economic Activities in the European Community; NAV: Norwegian Labour and Welfare Administration; PP: percentage points; RCT: randomised controlled trial; SA: sickness absence; SD: standard deviation; SSB: Statistics Norway.

Supplementary Information

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Additional file 1: Supplementary Fig. 1. Graph depicting percentage of all-cause SA in men between 1993 and 2000, in intervention and control group respectively. **Supplementary Fig. 2.** Graph depicting percentage of all-cause SA in women between 1993 and 2000, in intervention and control group respectively. **Supplementary Table 1.** Descriptive statistics for employees in the intervention group (IA) and control group (no IA) in 2000 and 2005, musculoskeletal and psychological subpopulations (those with SA > 0). **Supplementary Table 2.** Comparison of DID analyses for musculoskeletal SA prevalence and duration in original analysis to those with graded (< 100%) SA and full (100%) SA[a]. **Supplementary Table 3.** Comparison of DID analyses for psychological SA prevalence and duration in original analysis to those with graded (< 100%) SA and full (100%) SA[a]. **Supplementary Table 4.** Sickness absence prevalence in the intervention (IA) group and control (non-IA) group, by diagnosis, industry and gender. **Supplementary Table 5.** Sickness absence duration for those with SA > 0 in the intervention (IA) group and control (non-IA) group, by diagnosis, industry and gender.

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Authors' contributions
The article was conceived by RLH, TNH, SLM, ISM and PK. RLH and TNH were responsible for data cleaning and preparation. RLH conducted all analysis. SLM, TNH, ISM, PK and JMG contributed to interpretation of results. RLH drafted the manuscript with feedback and contributions from all authors. All authors read and approved the final draft of the manuscript.

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Availability of data and materials
The data that support the findings of this study are available from Statistics Norway (FD-Trygd/Central Register of Establishments and Enterprises) and the Norwegian Labour and Welfare Administration (NAV; IA Agreement data/sickness absence diagnoses), and were collected in accordance with national guidelines. Restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Contact the corresponding author for more details on data availability.

Declarations

Ethics approval and consent to participate
Ethical approval was obtained from the South-East A Regional Committee for Medical and Health Research Ethics (case number 17344). The requirement for informed consent was waived by the Regional Committee for Medical and Health Research Ethics in accordance with Section 35 of the Norwegian Health Research Act. All data were handled and processed in accordance with the ethical standards of the national research ethics committee.

Consent for publication
Not applicable, data is retrieved from national registries.

Competing interests
The authors declare that they have no competing interests.

Author details
[1]Department of Occupational Medicine and Epidemiology, National Institute of Occupational Health, PB 5330 Majorstuen, 0304 Oslo, Norway. [2]Department of Occupational Health Surveillance, National Institute of Occupational Health, Oslo, Norway. [3]Oslo Centre for Biostatistics and Epidemiology, Department of Biostatistics, University of Oslo, Oslo, Norway. [4]Oslo Centre for Biostatistics and Epidemiology, Oslo University Hospital, Oslo, Norway. [5]Department of Community Medicine and Global Health, Institute of Health and Society, University of Oslo, Oslo, Norway.

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Publisher's Note

II

The effects of a voluntary agreement for a more inclusive working life on work participation and repeated sickness absence: a cohort study in Norway

Rachel L Hasting, MPhil[1], Ingrid S Mehlum, PhD[1,2], Karina Undem, MPhil[1], Suzan JW Robroek, PhD[3], Alex Burdorf, PhD[3], Jon Michael Gran, PhD[4,5], Suzanne L Merkus, PhD[6]

[1] Department of Occupational Medicine and Epidemiology, National Institute of Occupational Health, Oslo, Norway;

[2] Department of Community Medicine and Global Health, Institute of Health and Society, University of Oslo, Oslo, Norway;

[3] Erasmus University Medical Center Rotterdam, Department of Public Health, Rotterdam, the Netherlands;

[4] Oslo Centre for Biostatistics and Epidemiology, Oslo University Hospital, Oslo, Norway;

[5] Oslo Centre for Biostatistics and Epidemiology, Department of Biostatistics, University of Oslo, Oslo, Norway;

[6] Research Group for Work Psychology and Physiology, National Institute of Occupational Health, Oslo, Norway

Corresponding author:

Rachel Louise Hasting, rachel.hasting@stami.no

National Institute of Occupational Health

Department of Occupational Medicine and Epidemiology

PB 5330 Majorstuen, 0304 Oslo, Norway

Abstract

Objectives: To estimate the average effect of the Norwegian Agreement on a More Inclusive Working Life (IA Agreement) on individuals' 1) remaining in work after a sickness absence (SA) episode, and 2) repeated SA.

Methods: Using register data, 79,253 men and 94,914 women born in Norway between 1967-1976 were followed for one year between 2005-2010 after returning to work from an SA episode (>16 days). Weighted Cox proportional hazard models analysed time to first exit from work by IA status (IA/non-IA). Weighted cumulative incidence differences between IA and non-IA groups with 95% bootstrapped confidence intervals were calculated for the competing events of full SA, graded (<100%) SA, unemployment/economic inactivity, education, disability pension, and death/emigration. Stabilised inverse probability of treatment weights balanced IA/non-IA groups according to nine covariates. Analyses were stratified by gender and initial SA diagnosis (musculoskeletal or psychological).

Results: Both men (adjusted hazard ratio (HR) 0.96, 95% CI 0.93-0.99) and women (adjusted HR 0.97, 95% CI 0.94-0.99) in IA companies were more likely to remain in work in the year following SA. Similar findings were seen in individuals with musculoskeletal diagnoses, and in women with psychological diagnoses. Men with psychological diagnoses were more likely to exit work. Repeated full and graded SA were more likely, and unemployment/economic inactivity less likely, in IA companies.

Conclusions: Individuals working in IA companies were more likely to remain in work. This was mainly due to reduced unemployment/economic inactivity, suggesting the IA Agreement may have influenced work participation through other means than reduced SA.

Key Terms: absenteeism; gender differences; longitudinal study; musculoskeletal diagnoses; non-employment; psychological diagnoses; return-to-work; sick leave;

Background

Absence due to illness and loss of paid employment have a negative impact both at the societal and the individual level. Member states of the European Union spent approximately 1.1% of their GDP on sickness absence (SA) benefits in 2019 (1). In the EU an average of 12.4 days per worker were lost due to SA in 2018 (2). In Norway, the corresponding number was 16 days in 2019, equivalent to 5.9% of available work days (2, 3). Repeated SA episodes can increase the risk of individuals' permanent exclusion from working life and lead to financial issues and poor mental health, particularly if experienced early on in working life (4, 5). Therefore, reducing SA can have positive and long-lasting effects.

In 2001, the Norwegian Government and organisations representing employers and employees committed to increasing work participation through the national Agreement on a More Inclusive Working Life (the IA Agreement) (6). The IA Agreement had three aims; (I) to reduce SA by 20% from its 2001 level, (II) to include more individuals in the labour market and prevent withdrawal, and (III) to increase the pension age. "IA companies", who voluntarily signed the IA Agreement, received tailored help from Working Life Centres administered by the Norwegian Labour and Welfare Administration (NAV). This included help with grants for workplace adjustments, and a contact person for IA-related queries. The IA Agreement has been renewed several times, most recently to 2024 (7), and was expanded in 2019 to cover all companies in Norway (8).

The largest focus of the IA Agreement has been on reducing SA. This has been fairly stable at 6% since 2009, 0.6 percentage points short of the IA Agreement's goal (9). Possible effects of the IA Agreement on SA have been investigated in several studies, with results varying from no effect to a possible positive effect of reducing SA prevalence and duration (10-14). A recent report indicated that repeated SA may contribute to difficulties in reducing the overall SA rate, leading to a renewed focus on this in the current IA Agreement (8, 9). No studies have focused specifically on whether the IA Agreement has affected repeated SA.

As in most countries, Norway has gender differences in SA, with women lying around three percentage points higher than men in physician-certified SA (9, 15). This gap is largest in adults aged 30-34 years (16), and is only partly due to pregnancy-related SA and having children (9, 17). Musculoskeletal and psychological diagnoses are the two largest causes of SA, responsible for 30% and 20% of days lost, respectively (9). They are also associated with a high degree of repeated SA and exit from paid employment (18). Men are more likely to have musculoskeletal-related SA, whilst women are more likely to have psychological-related SA (9). Previous studies suggest that both gender and diagnosis group may respond differently to the tools used in the IA Agreement (10, 19, 20), and would benefit from being studied separately.

Goal II of the IA Agreement is associated with the inclusion of individuals who are naturally more prone to SA, thus increasing the SA rate (21). This goal is therefore in direct conflict with the goal to reduce SA and suggests a more holistic approach should be considered when evaluating effects of the IA Agreement. The aim of this study was to assess the effect of the IA Agreement on remaining in work and on the risk of repeated SA, following an initial SA episode in young to middle-aged adults. Men and women were studied separately, and a particular focus was on those returning from musculoskeletal and psychological SA.

Methods

Data Sources

This study utilised a Norwegian cohort comprised of all individuals live-born in Norway between 1967 and 1976 (N=626,928), linking registries using the unique individual identification number. The "FD-Trygd" events database (22), maintained by Statistics Norway (SSB), was used for the following: employment dates, SA (>16 calendar days) dates and grade, SA follow-on benefits (medical and vocational rehabilitation/work assessment allowance) dates and grade, unemployment dates, disability retirement date, death date, emigration date, company industry, and company region. In Norway, SA episodes are registered in the database when the responsibility for covering the benefits passes from the employer to NAV after 16 calendar days, so only episodes longer than this were included. Data on

birth year and month, gender, and civil status were obtained from SSB, and are based on the National Population Register (23, 24). Education information came from the National Education Database (NUDB), maintained by SSB (25). Information on company size (number of employees) came from the Central Register of Establishments and Enterprises, maintained by SSB (26). Data on if/when companies signed the IA Agreement, any changes to their agreement status, and SA diagnoses were obtained from NAV. Ethical approval was obtained from the Regional Committee for Medical and Health Research Ethics (case number 17344).

Study Design and Population

This cohort study included individuals the day after their first SA episode ended between 01.01.2005 and 31.12.2010 (t=0, i.e., the first day with no SA). The source population consisted of 303,390 individuals (Figure 1). To be included in this study, individuals were required to begin in work the day following the end of their SA episode (n=238,239) and to have full information for all covariates (n=211,377). To ensure the intervention was well-defined, individuals were included if they had only worked in either IA or non-IA companies during their 1-year follow-up period (n=202,003). For the purposes of ensuring the SA of men and women were comparable, those returning from pregnancy-related diagnoses were excluded. All individuals were followed for 1 year (until t=364). Thus, the study period was 2005-2011.

Study outcomes

We used the inverse of remaining in work as our first outcome, i.e. the risk of exiting work due to any cause. This included both temporary and permanent lapses in work participation. To assess the risk of repeated SA, we analysed the risk of full and graded SA in the presence of other competing events. We defined SA as receiving sickness absence benefits, which individuals have a right to for up to 52 weeks, as well as follow-on benefits (rehabilitation until 2010, work assessment allowance after 2010) which can be applied for after the right to paid SA has ceased and can last for a further 5 years (27). We did not have data on grade for work assessment allowance, so this was categorised as full SA. Parental leave and annual leave were included in work.

It was possible for individuals to experience more than one event simultaneously; therefore, we used a hierarchy to prioritise the most important events for our study objectives given the other competing events. This resulted in the following prioritisation:

1. Full SA (100%)
2. Graded SA (<100%)
3. Unemployment/economic inactivity
4. Education
5. Disability pension
6. Death and emigration

Individuals were censored if they were still in work at the end of follow-up. If individuals had a gap of less than two months between two jobs and didn't experience another event in this time, the gap was considered work; if the gap was larger than 2 months, the individual was classified in "unemployment/economic inactivity".

The outcomes were also studied in relation to initial musculoskeletal or psychological diagnoses. The diagnoses were identified using the International Classification of Primary Care (ICPC-2) codes for diagnoses (L for musculoskeletal diagnoses, and P for psychological diagnoses) (28).

Intervention: IA Agreement

We aimed to identify the average effect of having access to the IA agreement compared to not having access to the IA agreement at the time of first return to work after sick leave in the period 2005-2011. Employees working in companies that had signed the IA Agreement at baseline were compared to employees working in companies that had not signed the IA Agreement, adjusting for baseline differences between groups. IA status was coded as a binary variable (yes/no) and was recorded annually.

Covariates

Covariates included in this study were calendar year (at baseline), age (in years), civil status, education level, length of initial SA (in days), grade of initial SA, industry, company size, and company region.

All covariates were measured at baseline (t=0). Civil status was coded into a binary variable denoting single or married/in a civil partnership. Education was coded into five categories based on the Norwegian Standard Classification of Education (NUS2000) (29): lower secondary education or lower, upper secondary (basic), upper secondary (completed), tertiary (undergraduate), and tertiary (graduate). Grade of initial SA was included as a binary variable denoting full (100%) or partial (<100%) sick leave. The industry variable was coded according to the Standard Industrial Classification 2002 (30), based on either the Statistical Classification of Economic Activities in the European Community (NACE) Revision 1.1 before 2009, or NACE Revision 2 after 2009, and included 13 different industrial categories (see Table 1). Company size was measured by number of employees and was modelled using a linear spline with 3 knots. Company region was coded into east, south, west, middle, or north. Where possible, missing values were imputed from either the previous year or the following year; otherwise, the individual was excluded from analysis.

Statistical Analyses

As the IA Agreement is voluntary, IA companies and their employees are likely to differ from non-IA companies and their employees. To adjust for such differences, stabilised inverse probability of treatment weights (sIPTW) were calculated using logistic regression and used to weight individuals based on their probability of having an IA Agreement according to their combination of the nine covariates described above. Analyses were then performed on the weighted dataset, where the two groups (IA/non-IA) can be considered balanced with respect to the covariates.

To analyse the probability of exit from work due to any cause, weighted gender-specific Cox proportional hazard models were used to analyse time to exit from work by IA status.

To analyse repeated SA, we first calculated weighted cumulative incidence curves for all individual causes of exit from work (described above) plus the likelihood of remaining in work. This method considers competing risks from other outcomes than SA. We used the “stcompet” command in Stata. The gender-specific analyses were stratified by IA status. For each competing event, the absolute difference in cumulative incidence between IA and non-IA groups were visualised in graphs along with 95% confidence intervals (CI) generated by bootstrapping (1,000 repetitions).

The same analyses were performed separately on those returning from SA with a musculoskeletal diagnosis and a psychological diagnosis, respectively. All analyses were conducted in Stata, version 16.1 (31).

Results

The final study population was comprised of 174,167 individuals (57% of the source population, Figure 1). Total follow-up time was 49,632,881 days (135,887 years), with an average follow-up time of 285 days (standard deviation (SD): 118 days). In the IA population, the average follow-up time was 286 days (SD: 119 days), whilst in the non-IA population it was 284 days (SD: 118 days).

Table 1 shows the population characteristics. Men worked more often in non-IA companies, and women more often in IA companies. Men and women working in IA companies tended to have a higher education level. The majority of IA companies were in the manufacturing (for men), health/social (particularly for women), education and public administration industries. IA companies also had on average a higher number of employees than non-IA companies. Finally, for diagnosis-specific analyses, IA companies had slightly fewer individuals returning from a musculoskeletal-related SA and slightly more returning from a psychological-related SA than non-IA companies.

Effect of the IA Agreement on remaining in work

Over half of the weighted study population remained in work following SA (Table 2). Compared to non-IA companies, both men and women working in IA companies were more likely to remain in work throughout the 1-year follow-up, i.e., they had a lower risk of all-cause exit from work (hazard ratio (HR) men: 0.96, 95% CI 0.93, 0.99; HR women: 0.97, 95% CI 0.94, 0.99) (Table 3). This effect of the IA Agreement was seen after 100 days for men, and after 60 days for women (Figure 2).

Effect of the IA Agreement on repeated SA

Approximately a quarter to a third of the weighted study population experienced repeated SA (Table 2). The differences in cumulative incidence for repeated SA ranged from approximately -0.2 to 1.2 percentage points by the end of the 1-year follow-up (Figure 2). A negative value indicates the outcome is less likely to occur in IA companies compared to non-IA companies, whereas a positive value indicates the outcome is more likely to occur in IA companies. Men working in IA companies

were more likely to have full SA during follow-up than men in non-IA companies, though this was not before 120 days for men and 180 days for women. Compared to non-IA companies, both men and women working in IA companies were more likely to have graded SA during follow-up. This difference was larger for women than for men and increased in both groups over time.

Effect of the IA Agreement on other cause-specific exits

The differences in cumulative incidence for the other cause-specific exits from work ranged from approximately -2 to 0 percentage points by the end of the 1-year follow-up (Figure 2). Both men and women working in IA companies were less likely to experience unemployment/economic inactivity than those working in non-IA companies; this difference increased over time (Figure 2).

Effect of the IA Agreement following musculoskeletal SA

Following an SA episode with a musculoskeletal diagnosis, both men and women working in IA companies had a lower risk of all-cause exit from work than those working in non-IA companies (Table 3). This higher likelihood of remaining in work is seen in the graph after 100 days for men and 60 days for women (Figure 2).

There were no obvious differences in repeated all-cause SA, either graded or full, following a musculoskeletal diagnosis in men (Figure 2). Women were slightly more likely to experience graded SA following the first 100 days back in work, and full SA after 120 days, if they worked in an IA company compared to a non-IA company. Both genders were less likely to be unemployed/economically inactive if they were working in an IA company, compared to a non-IA company.

Effect of the IA Agreement following psychological SA

Following an SA episode with a psychological diagnosis, men working in IA companies had a slightly higher risk of all-cause exit from work (HR 1.04, 95% CI 0.97, 1.11; Table 3); they were less likely to remain in work throughout follow-up than men in non-IA companies (Figure 2). They were also more likely to experience full or graded SA but less likely to experience unemployment/economic inactivity.

Women working in IA companies were more likely to remain in work when returning from an SA episode with a psychological diagnosis than women in non-IA companies (HR 0.96, 95% CI 0.91,

1.02; Table 3); this was seen after the first 50 days (Figure 2). Women were more likely to experience graded SA throughout follow-up if they worked in an IA company, as well as full SA after 200 days in work, and less likely to be unemployed/economically inactive compared with those working in non-IA companies.

Discussion

Our results indicate that both men and women were somewhat more likely to remain in work in the year following SA (all-cause or musculoskeletal) if they worked in a company that had signed the IA Agreement at baseline. There was a gender difference in those returning from psychological SA: compared to those in a non-IA company, men were slightly less likely to remain in work while women were more likely to remain in work if they worked in an IA company. Both men and women in IA companies were slightly more likely to have repeated full and graded SA, including when returning from musculoskeletal or psychological SA.

These findings suggest that the IA Agreement is succeeding in increasing work participation, albeit to a small extent. Individuals working in a company that had signed the IA Agreement were on average more likely to remain in work (except men returning from a psychological SA) and less likely to end up unemployed/economically inactive following an SA episode. This indicates that IA companies prevent withdrawal of potentially sicker individuals to a greater extent than non-IA companies, as the second goal of the IA Agreement promotes. The effect size was small, but when extrapolated to the larger working population this can translate to many working days that would otherwise have been lost. The variation in effect sizes suggests that there may be differences in how the IA Agreement affects different genders and diagnosis groups.

We found that individuals working in IA companies were more likely to remain in work but also more likely to experience repeated SA compared to those in non-IA companies. To our knowledge, this is the first study that has specifically analysed the effect of the IA Agreement on repeated SA. We cannot therefore directly compare our findings to previous studies. More general research on SA and the IA Agreement indicates that IA companies have generally higher rates of SA, in line with our findings (12, 32, 33) The similarity between the present study findings and research into general SA could

indicate that the mechanism by which the IA Agreement affects repeated SA is not very different. Although IA companies may have higher rates of SA, previous studies suggest that the IA Agreement may have a small positive effect on SA duration (14, 32). If the IA Agreement works mainly by shortening SA duration, this may contribute to achieving the overall goal of reducing SA by reducing working days lost, rather than reducing the occurrence of SA (8).

The higher likelihood of remaining in work in this study was most likely related to the lower risk of being unemployed/economically inactive. The simultaneous increase in SA and decrease in unemployment/economic inactivity suggests that individuals who would otherwise have stopped working for health-related reasons may instead have more repeated SA. A recent study into those beginning SA episodes between 2004-2011 in the same cohort similarly found a decreased risk of non-employment (not in work, education, or SA) in IA companies (14). The differences between IA and non-IA companies appear after around 60 days, suggesting that the measures may work effectively for diagnoses that respond well to adjustments, and where adjustments reduce the risk of relapse over time.

An interesting finding was that men returning from psychological SA were less likely to remain in work and more likely to experience repeated SA if they worked in IA companies compared to non-IA companies. This contrasts with the other analysis groups and may be because psychological conditions tend to be underdiagnosed or diagnosed later in men, who are less likely than women to visit their doctor with health concerns (34, 35). If IA companies are better at keeping people in work, as this study suggests, it may be the case that men who return from psychological SA and work in IA companies have more serious conditions than those in non-IA companies. Only one other study has looked specifically at the IA Agreement and psychological diagnoses in men, finding a slight decrease in initial SA prevalence and duration in IA companies (32). The differing results here may be because the present study looks at repeated SA specifically, rather than SA more generally.

Methodological considerations

Strengths of this study include the use of register-based data, which are assumed to be complete without loss to follow-up and are collected objectively. The methods used took into account

competing risks, presenting a more accurate picture of the IA Agreement's effects on repeated SA than other observational methods and setting it in a larger context (36). Due to its voluntary nature, it was not possible to evaluate the IA Agreement using experimental methods. Therefore, we used sIPTW weighting to ensure the groups were balanced with respect to confounding factors. This increases the generalisability of our findings to others in a similar age range, though there is always a possibility of residual confounding. The population in this study is restricted to young and middle-aged adults (28-44 years), which means the results cannot be generalised to older workers, who may have a different pattern of SA or who may exit work faster/more often than younger workers (17, 19).

A weakness of our study is that we only had information on whether the companies had signed the IA Agreement, not on their actual use of IA measures which vary greatly between IA companies (19). Additionally, we did not have information on all covariates that likely influence whether companies sign the IA Agreement, such as whether they belong to the public or private sector (37). We have, however, adjusted for other company-level covariates such as industry, which can account for some of this potential confounding.

We did not have information on SA episodes shorter than 17 calendar days. If the IA Agreement does reduce SA duration (32) some individuals in IA companies would not be included, because their SA would be shorter than 17 days. This would lead to selection bias, where IA individuals returning from SA in our study may be sicker and more prone to repeated SA than non-IA individuals, which could explain the higher rate of repeated SA found in this study. This may result in an underestimation of the effects of the IA Agreement on repeated SA. We included duration and grade of initial SA in the IPTW weights to account for these sources of bias, but it is possible that some bias still remains.

Implications and future research

The small effect sizes observed in this study can be meaningful on the larger scale. Men in IA companies had an average of 297 days until exit from work during the 1-year follow-up period, whereas for non-IA companies this was 291 days (6 days' difference; data not shown). For women the corresponding numbers were 280 days for those in IA companies and 276 days for those in non-IA companies (4 days' difference). As around 5% of male and 10% of female employees aged between

30-44 had physician-certified SA at the end of 2021 (38), these differences would amount to a considerable number of working days gained over the course of a year.

There is a need to better understand the effects of graded SA, and to what extent this may substitute full SA. Additional research into the duration and frequency of all SA episodes during an individual's working life would aid assessments of to what extent the IA Agreement is reaching its goals. Explanations for why men with psychological diagnoses have different outcomes to the other groups should be further investigated.

Finally, it would be interesting to look at effects of the IA Agreement on work participation in a more general working population, i.e., not only individuals returning from SA, and see if this affects the pattern observed in this study. Studying multiple exits from work is beneficial for understanding the larger picture of the IA Agreement, as demonstrated by the findings in this study.

Conclusions

Following an initial SA episode, access to the IA Agreement was associated with a higher likelihood of remaining in work and an increased risk of repeated SA in men and women overall, and in those with musculoskeletal diagnoses, the year after returning from an SA episode. This may have been due to reducing withdrawal from work through unemployment/economic inactivity. Men with psychological diagnoses had a slightly lower likelihood of remaining in work if they worked in IA companies, which may be due to a higher risk of repeated SA. The results of this study indicate that the IA Agreement is contributing to increasing participation in working life following an SA episode, but not necessarily through its goal of reducing SA.

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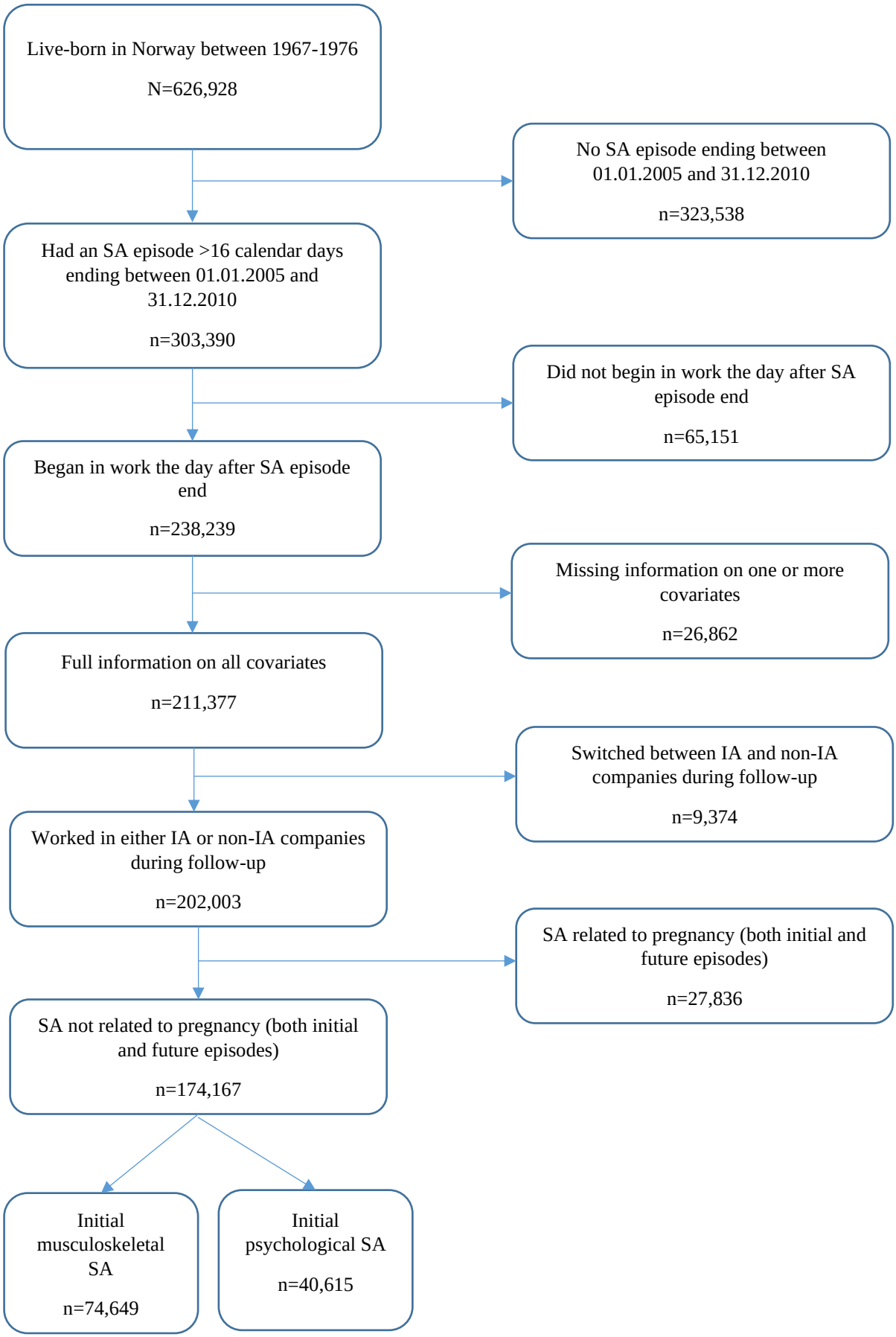

Figure 1. Population flowchart

Table 1. Characteristics of the main study population (n=174,167), stratified by gender and IA status at baseline. All covariates are measured at baseline (t=0)								
	Male (n=79,253)				**Female (n=94,914)**			
	IA (n=29,697)		Non-IA (n=49,556)		IA (n=51,930)		Non-IA (n=42,984)	
	Quartiles	*n (%)*	*Quartiles*	*n (%)*	*Quartiles*	*n (%)*	*Quartiles*	*n (%)*
Age (years)	34 – 36 - 38		33 – 36 - 38		34 – 36 - 38		33 – 35 - 38	
Education								
Lower secondary or below		4,069 (14)		10,727 (22)		5,394 (10)		7,844 (18)
Upper secondary, basic		1,709 (6)		4,050 (8)		3,571 (7)		3,721 (9)
Upper secondary, completed		13,552 (46)		26,105 (53)		15,432 (30)		17,506 (41)
Tertiary, undergraduate		7,895 (27)		6,940 (14)		23,495 (45)		12,005 (28)
Tertiary, graduate		2,472 (8)		1,734 (4)		4,038 (8)		1,908 (4)
Civil status								
Single		17,762 (60)		31,337 (63)		27,872 (54)		24,507 (57)
Married/in a civil partnership		11,935 (40)		18,219 (37)		24,058 (46)		18,477 (43)
Industry								

Agriculture/forestry/fishing		139 (<1)		1,041 (2)		57 (<1)		373 (1)
Mining/quarrying		465 (2)		1,602 (3)		294 (1)		288 (1)
Manufacturing		7,377 (25)		8,421 (17)		2,865 (6)		3,214 (7)
Electricity/gas/water supply		316 (1)		217 (<1)		166 (<1)		95 (<1)
Construction		3,016 (10)		8,966 (18)		318 (1)		629 (1)
Wholesale/retail		2,176 (7)		10,384 (21)		2,272 (4)		11,447 (27)
Hotels/restaurants		294 (1)		1,012 (2)		773 (1)		1,939 (5)
Transport/storage		2,529 (9)		6,242 (13)		1,789 (3)		2,300 (5)
Financial/real estate		2,077 (7)		6,505 (13)		2,768 (5)		6,893 (16)
Public administration		2,873 (10)		961 (2)		4,173 (8)		1,292 (3)
Education		3,069 (10)		578 (1)		9,031 (17)		1,678 (4)
Health/social		4,358 (15)		1,657 (3)		26,189 (50)		10,161 (24)
Other		1,008 (3)		1,970 (4)		1,235 (2)		2,675 (6)
Number of employees	38 – 100 – 320		8 – 22 – 68		27 – 69 – 213		8 – 19 – 57	
Work region in Norway								
East		13,749 (46)		22,905 (46)		22,954 (44)		21,874 (51)
South		2,863 (10)		4,077 (8)		4,489 (9)		3,457 (8)
West		7,295 (25)		11,747 (24)		13,256 (26)		9,575 (22)
Middle		2,676 (9)		4,578 (9)		5,008 (10)		3,867 (9)

North		3,114 (10)		6,249 (13)		6,223 (12)		4,211 (10)
Initial SA diagnosis								
Musculoskeletal (ICPC code L)		14,013 (47)		24,973 (50)		18,968 (37)		16,695 (39)
Psychological (ICPC code P)		6,162 (21)		9,540 (19)		13,794 (27)		11,119 (26)
Other		9,522 (32)		15,043 (30)		19,168 (37)		15,170 (35)
Grade of initial SA								
Full (100%)		22,546 (76)		38,194 (77)		32,772 (63)		27,365 (64)
Partial (<100%)		7,151 (24)		11,362 (23)		19,158 (37)		15,619 (36)

Table 2. Number of individuals remaining in work and events experienced during follow-up for the weighted study population (n=172,769), stratified by gender and IA status at baseline.

	Male (n=78,489)		**Female (n=94,280)**	
	IA (n=28,878)	Non-IA (n=49,611)	IA (n=52,309)	Non-IA (n=41,971)
	n (%)	*n (%)*	*n (%)*	*n (%)*
Remained in work	19,175 (66)	32,346 (65)	30,302 (58)	23,887 (57)
Full (100%) SA	5,645 (20)	9,319 (19)	11,302 (22)	8,797 (21)
Graded (<100%) SA	1,434 (5)	2,293 (5)	5,444 (10)	3,865 (9)
Unemployment/economic inactivity	2,074 (7)	4,568 (9)	4,130 (8)	4,166 (10)
Education	238 (1)	374 (1)	617 (1)	645 (2)
Disability pension	31 (<1)	39 (<1)	57 (<1)	72 (<1)
Death/emigration	281 (1)	672 (1)	457 (1)	539 (1)

Table 3. Weighted[1] Cox proportional hazard models for the risk of all-cause exit from work after an initial sickness absence (SA) episode during a 1-year follow-up between 2005 and 2011 in IA companies compared to non-IA companies, stratified by gender and initial SA diagnosis group	
	Hazard Ratio (95% CI) for all-cause exit in IA companies vs non-IA companies
Men	
All-cause initial sickness absence (n=79,253)	0.96 (0.93, 0.99)
Musculoskeletal (n=38,986)	0.92 (0.88, 0.97)
Psychological (n=15,702)	1.04 (0.97, 1.11)
Women	
All-cause initial sickness absence (n=94,914)	0.97 (0.94, 0.99)
Musculoskeletal (n=35,663)	0.96 (0.92, 1.00)
Psychological (n=24,913)	0.96 (0.91, 1.02)

CI = confidence interval

[1]All analyses were weighted for calendar year (at baseline), age, civil status, education level, length of initial SA (days), grade of initial SA, industry, company size, and company region.

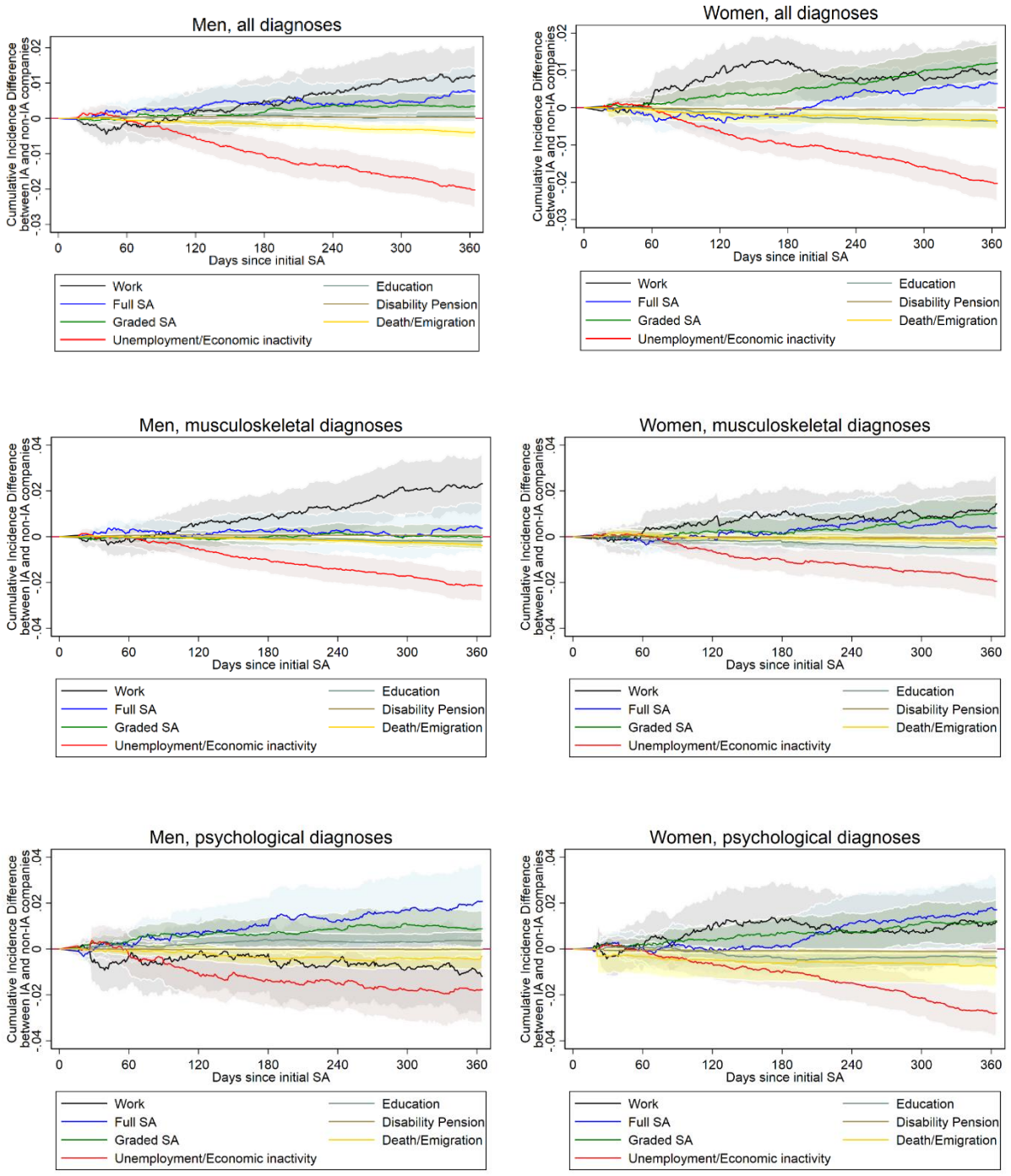

Figure 2. Difference in cumulative incidence for employees in IA companies compared to those in non-IA companies, for the following states: work, full sickness absence, graded sickness absence, unemployment/economic activity, education, disability pension, and death/emigration. Stratified by gender and diagnosis. 95% confidence intervals calculated using 1,000 bootstrap samples.

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