Sickness Absence trajectories and its relationship with prior Labour Market Participation patterns: a life course approach

Julio César Hernando Rodríguez

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DIRECTORES DE LA TESI

Dra. Mònica Ubalde López, (Center for Research in Occupational Health, CiSAL-UPF/IMIM, and currently at the Barcelona Institute for Global Health, Barcelona, Spain)

Dra. Laura Serra Saurina, (Center for Research in Occupational Health, CiSAL-UPF/IMIM, and currently at the Research Group on Statistics, Econometrics and Health, University of Girona, Spain)

TUTOR

Dr. Fernando G. Benavides (Center for Research in Occupational Health, CiSAL-UPF/IMIM)

DEPARTAMENT DE CIÈNCIES EXPERIMENTALS I DE LA SALUT

Universitat Pompeu Fabra Barcelona

CISAL Center for Research in Occupational Health

To my family and friends

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"Humility is not thinking less of yourself, it's thinking of yourself less."
-C.S. Lewis

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Abstract

Background: Previous studies have focused on analysing specific labour market situations and their relationship with sickness absence (SA). However, little is known about the relationship between mobility between different employment status and the course of future SA with a life course perspective.

Methods: A cohort study of Spanish affiliated workers, residents of Catalonia, who accumulated SA days during 2012-2014 (objective 1) or more than 15 SA days in the same period (objectives 2 and 3). We applied sequence and cluster analysis to identify patterns of labour market participation (LMP) and latent class growth models to identify SA trajectories. Finally, we applied multinomial logistic regression models to assess the relationship between LMP patterns and SA trajectories.

Results: SA trajectories were not related to prior ten-year LMP patterns, except in men from the early working life stage, where an increasing employment pattern was associated with a lower risk for increased days on SA over time. Nevertheless, considering two-year LMP patterns, we found associations with SA trajectories in women of the early and middle stage of working life. The former had U-shaped employment patterns that were negatively associated with increasing SA trajectories, while the latter had increasing employment patterns and patterns without coverage that were positively associated with increasing SA trajectories.

Conclusion: Knowing the evolution of transitions between employment status close to SA could provide useful information to prevent specific SA courses in the future.

Keywords: working life transitions, life course, sick leave

Resumen

Antecedentes: Estudios previos se han enfocado en analizar situaciones del mercado laboral específicas y su relación con la incapacidad temporal (IT). Sin embargo, se sabe poco sobre la relación entre la movilidad entre diferentes situaciones de empleo y el curso futuro de la IT con una perspectiva de curso de vida.

Métodos: Un estudio de cohorte de personas afiliadas españolas, residentes en Cataluña, que acumularon días en IT durante 2012-2014 (objetivo 1) o más de 15 días en IT en el mismo período (objetivos 2 y 3). Aplicamos análisis de secuencia y de agrupamiento para identificar patrones de participación en el mercado laboral (PML) y modelos de crecimiento de clases latentes para identificar trayectorias de IT. Finalmente, aplicamos modelos de regresión logística multinomial para evaluar la relación entre los patrones de PML y las trayectorias de IT.

Resultados: Las trayectorias de IT no estaban relacionadas con diez años de PML previa, excepto en hombres de la etapa de vida laboral temprana, donde un patrón de empleo creciente se asocia con un menor riesgo de acumular más días en IT en el tiempo. Sin embargo, considerando dos años previos de PML se encontraron asociaciones con el curso futuro de la IT en mujeres de la etapa temprana y media de la vida laboral. Las primeras tenían patrones de empleo en forma de U que se asociaban negativamente con trayectorias de IT crecientes, mientras que las últimas tenían patrones de empleo creciente y sin cobertura que se asociaban positivamente con trayectorias de IT crecientes.

Conclusión: Conocer la evolución de las transiciones entre situaciones de empleo cercanas a la IT podría proveer información útil para prevenir cursos específicos de IT en el futuro.

Palabras clave: transiciones de vida laboral, curso de vida, ausencia por enfermedad

Preface

The labour market is changing due to population ageing, the appearance of new technological jobs, globalization, climate change, migration, and the entry of women into a gendered segregated labour market. To this, we must add the Great Recession of 2008, which had hit the global economy and has further amplified the existing job insecurity, precariousness and temporality as mechanisms for job creation. These changes are leading to a "new normality" in which stable employment tends to be less common, while higher mobility between different jobs throughout the working life is becoming the most frequent pattern. This situation could entail health risks if the appropriate circumstances that provide employment security are not met, or in the event of dismissal, stability in the concatenation of successive jobs is not guaranteed.

Previous studies have focused on employment status in a one-dimensional way (i.e. employment, unemployment or inactivity) and, even less on transitions between various employment status (i.e., labour market participation patterns) and their effect on health. However, there are no previous studies that have investigated the potential relationship between employment status and sickness absence from a life course perspective.

In this thesis, we proposed to study labour market participation patterns and its relationship with the course of future sickness absence longitudinally framed in a life course perspective to shed light on whether employment instability can lead to unfavourable sickness absence trajectories (i.e. the accumulation of increased days on sickness absence over time).

As far as we know, it is the first time that labour market participation and sickness absence are measured longitudinally in the same study taking a life course approach. For this, novel statistical techniques, in the field of occupational health, have been used, such as sequence and cluster analysis, and latent class growth analysis. The life course approach in occupational epidemiology emphasises how work life and the social context affect the relationship between the labour market and health. Furthermore, the analysis has been separated not only by sex but by cohorts according to the working life stage. Considering three working life cohorts adds context about socioeconomic conditions and early life circumstances that people share within the cohorts, which can shape the relationship of labour market participation and the course of future sickness absence.

To carry out this research, we first constructed sickness absence trajectories based on accumulated days and also accumulating more than 15 days in any quarter of the follow-up. We studied concomitant predictors for SA trajectories. Second, we reconstructed prior ten and two years of labour market participation among people who subsequently accumulated more than 15 days on SA in any quarter. Finally, we studied labour market participation patterns as prior determinants of the course of future SA.

The research was carried out at the Center for Research in Occupational Health (CiSAL) of the Pompeu Fabra University. Besides, this research has benefited from a 3-month international stay at the Karolinska Institutet. This thesis is part of the FIS project (PI17/00220) entitled “Evaluation of the impact of social benefits on the relationship between working life and mortality from causes in a cohort of affiliates to Social Security in Spain 2004-2016”. The thesis was supported by Health Institute Carlos III, the European Regional Development Fund-FEDER, and the CIBER in Epidemiology and Public Health-CIBERESP (group 47).

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CWLS	Spanish Continuous Working Life Sample
CiSAL	Center for Research in Occupational Health
GDP	Gross Domestic Product
ICAM	Catalan Institute for Medical and Health Evaluations
ICD-10	International Classification of Diseases - tenth revision
ILO	International Labour Organization
LCGA	Latent Class Growth Analysis
LMP	Labour Market Participation
NAF	Social Security affiliation number
NHS	National Health System
OECD	Organization for Economic Cooperation and Development
SA	Sickness Absence
WORKss	Spanish WORKing Life Social Security
WLC	Working Life Cohort

INTRODUCTION

"*A journey of a thousand miles begins with a single step*."

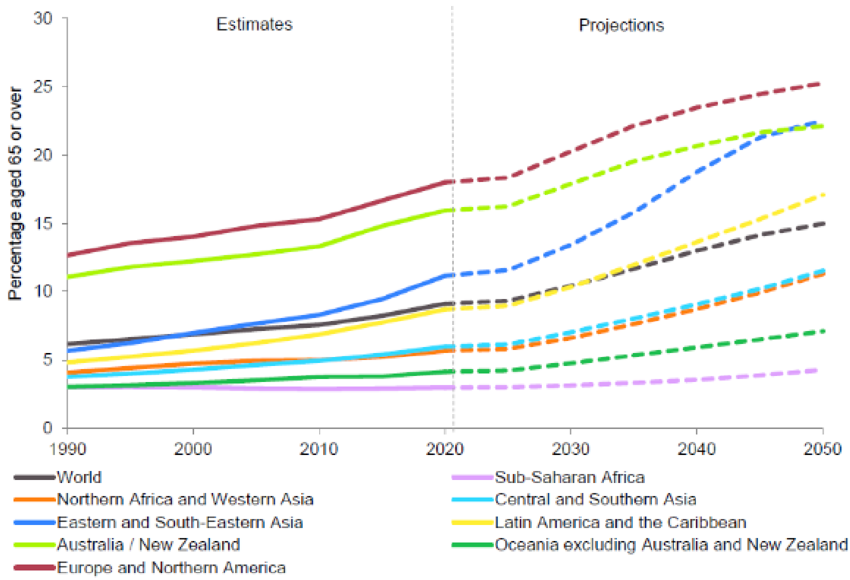
-Lao Tzu

1. INTRODUCTION

1.1. Sociodemographic, technological and gender differences in the labour market

The world of work is changing due to a myriad of factors such as sociodemographic and migration shifts, globalization, climate change, technological innovation, and gender inequality, which shape societies (1). Social Security and the health systems may be subject to increased pressure due to the ageing population expansion worldwide, which, in turn, is due to the decline in fertility rates and the increase in life expectancy (2). Around 9% of people in the world was aged 65 years or over in 2019, a percentage expected to reach 15% in 2050. In Europe, the proportion of older persons represented 17% in 2019 and probably will grow to 25% in 2050 (Figure 1).

Figure 1. Share of total population aged 65 years or over, by region, from 1990 to 2050.



Source: United Nations Department of Economic and Social Affairs, Population Division (2019). World Population Prospects 2019.

In the Spanish context, the share of population older than 64 is 19% of the total in 2019 (3) and if the current demographic evolution is maintained it would rise to 25.2% in 2033 according to the National Statistics Institute of Spain (4). This trend of increasing population ageing affects the labour market since the active population that contributes to the Social Security is reduced and the proportion of pensioners who receive benefits (the retirement of baby boomers) increases, which can hinder the sustainability of the public pension system (5,6). In order to improve the viability of this system, it is proposed to improve productivity in the economy, the achievement of equal employment rates between women and men, and the adjustment of the retirement age by increasing life expectancy depending on the type of occupation (7). Nevertheless, this increase in longevity does not necessarily imply added years lived in good health for everyone, as it will depend on having a healthy lifestyle and social and economic equality experienced over the life course. Therefore, workers with poor health, particularly those with fewer education levels and lower socioeconomic status, are less likely to extend working life (8,9).

Respect to the migration, labour migration may be a way to answer to changes in labour supply and demand, seeking economic opportunities and decent work, and for transferring and updating skills (10). The evolution of labour market outcomes of immigrants shows positive trends in 2018 since more than two-thirds of migrants were employed that year across OECD countries. Also, the European Union migrant's unemployment rate dropped to lower than its precrisis levels (15%) and reach 10.6% (four points higher than the native-born), while higher unemployment rates remain in Southern European countries (13%). However, young and low-educated immigrants have difficulties in accessing employment, especially immigrant women. In this sense, more than 18% of immigrants aged 15-24 were not in employment, education or training compared to 11% of their native peers in the European Union in 2018 (11).

Regarding globalization, it has changed the nature of global production systems and employment. The liberalization of financial markets, combined with the advances of technology, have facilitated the development of new industries. Global production has implied flexible employment (part-time, temporary), women's increasing participation on the labour market, and the emergence of informal employment, which allows producers to put the risks of production from market fluctuations on workers (12).

The previously mention globalization and its worst expression with the global financial crisis has brought an opportunity to search for alternative models of growth to take a more critical approach to consumption and production practices towards a low-carbon economy. Climate change may affect labour markets through: impacts from regulations to reduce actions that generate negative externalities; impacts on natural and built environments, since global warming, may lead to floods, and food shortages will affect workforce mobility; and, finally, impacts on green social conscience affecting, in turn, regulations, and labour markets by changing consumer choices of green products. The creation of green jobs (i.e., jobs that contributes to preserving or restoring the environment) will require to upgrade workers qualifications to include green skills. Therefore, the green economy may stimulate businesses, society and governments to shift towards a more sustainable economy (13).

On the other hand, the technological revolution through industrial automation, digitalization, artificial intelligence and robotics has increased the demand of new jobs which require workers to acquire new skills, leading to low qualified workers having a higher risk of been displaced by automation compared to high skilled workers. Hence, upskilling and training for low skilled workers should be ensured to regain competitive advantage (14). At the same time, the impact on job destruction has been the subject of several studies. A study estimate that 47% of US jobs will be at risk of being automated (15), while other views from the Organization for Economic Cooperation and Development (OECD) shows that 9% of jobs will be at risk of a high degree of automation (at least 70% of the tasks) with variations across countries (from 6% in Korea to 12% in Austria) (14).

According to the International Labour Organization (ILO), the global gender gap in labour force participation in 2018 was 27%, being women participation rates (48%) lower than men (75%) (16). High-income countries (a third of which are from Europe) reduced the gender gap in labour force participation to approximately 15%, a similar proportion than low-income countries where high female labour participation is due to subsistence activities and informal employment (i.e. employment not subject to labour regulations and social protection) (16). In most parts of the world, women experience a motherhood gap in labour participation around the age of 25-35 years (17), work fewer hours than preferred than men (16), work less in productive jobs and overrepresent unpaid family work (18). In the Spanish context, the gendered division of labour is persistent and affects availability for employment among women, since domestic and care work are present during women's career, and absent among men's career. The acceptance of the gendered division of labour makes women normalise informal employment as a way to enter into the labour market and provides flexibility to combine with unpaid care work (19). Furthermore, informal care for dependent relatives, who need help to carry out their essential daily activities, is mostly provided by women, and it is not compatible with doing paid work (20).

All these situations have an impact on the gender pay gap. On average, women receive lower wages for work of equal value than men across the world (around 20% less), even in countries where women are more highly educated than men (17). In Spain, women with university studies earned 32% less than men with similar education level (21). Furthermore, part of the gender pay gap is explained by the undervaluation of women's work in highly feminised jobs and the motherhood pay gap related to labour market interruptions, reductions in working time and preference for family-friendly jobs, which may have a long-term effect on wages (17).

1.2. A life course approach to investigate labour market participation, social protection and health

Life course research is a broad multidisciplinary field that analyses human development over the lifespan (from gestation to adulthood, and death). More specifically, the life course theoretical model applied to epidemiology investigates the interactions between biological and social changes and their influence on the health over time. In the life course framework, the idea of time is essential, since this approach accounts for the timing of multiple exposures and outcomes over time, reflecting the impact that early exposure may have on later life (22).

The integration of the labour market and health from a life course perspective results in the investigation of working life trajectories. This framework conceptualises the changing nature of work as a life course experience in which the effect of labour market transitions on future health depends on place and time. Previous epidemiology research has measured exposures one time at baseline or several times during a period, and have assessed the relation to a health outcome. The life course approach considers the sequence of multiple exposures and the health course during the working life, emphasizing critical and sensitive periods, and allow to unveiled patterns of transitions that require time to appear (e.g. school-employment), which are unnoticed with other approaches focused on single and isolated events (23–25).

Further development of life course theories integrates the diverse multidisciplinary life course research area into the "life course cube", in which life course processes are characterised by three interrelated dimensions: time, life domains and levels of analysis. First, the time-related interdependence means that past accumulated experiences, current circumstances and future life course are interrelated. Second, the interdependence between life domains means that resources and behaviours (such as time) in one domain (such as work) are related to resources and behaviours in other domains (such as leisure). Third, the multilevel interdependence of life course means that individual life course behaviour is connected with internal psychological and physiological performing and external social structures (26).

In practice, life course approaches have been applied in various studies in occupational epidemiology. Some of these studies found differences in labour market participation (LMP) patterns according to the stage of working life. In this sense, young workers at the beginning of their working career have higher transitions into several employment statuses compared with those at their late careers (27). Another study found that women typically have a part-time job or experience an outflow from the LMP, while men follow stable full-time employment (28). A study examined the relationship between LMP transitions and health. The authors found that those patterns characterised by long-term exposure to blue-collar jobs have a similar impact on health outcomes than having an intermittent unstable employment pathway (29).

Other studies examined this relationship in the opposite direction; that is, the effect of health and health-related outcomes such as chronic diseases and sickness absence (SA) on LMP (30–33). However, as far as we know, none has investigated the relationship between LMP patterns and the subsequent course of SA.

1.3. The labour market participation dynamics: Europe, Spain and Catalonia

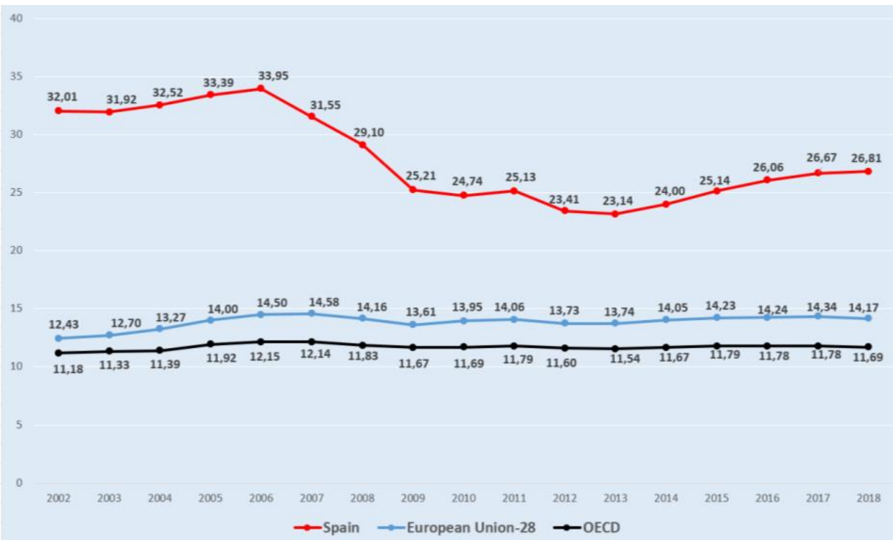
The Sustainable Development Goals, among other objectives, promote inclusive and sustainable economic growth, and decent work for all (goal 8), which means stable and well-paid jobs that deliver better prospects for personal and societal development and leaving out of poverty (34).

In its 2019 report entitled "World Employment and Social Outlook", the ILO analyses trends for several labour market indicators across different regions. The working-age population represented more than two-thirds of the world population in 2018 (5.7 billion people). Of those, 61.4% participated in the labour force (58.4% employed and 3% unemployed), and the rest included people out of the labour force (students, unpaid care workers, retired people) and a potential labour force (unavailable job seekers and available non-job seekers). However, having paid work is not a guarantee to gain access to basic living needs, this is the case of employment in the informal economy (i.e. economic activities not regulated or social protected), which represents 61% of the total employment in the world. In Europe, the informal economy represents 25.1%, which is the lowest proportion in the world (16).

According to the report mentioned above, in Northern, Southern and Western Europe, despite the deceleration in the pace of job creation over the second decade of the 21st century, the unemployment rate was at the lowest levels. Nevertheless, the share of long-term unemployment (looking for a job more than 12 months or longer) for half of the countries in the subregion (such as Greece and Italy) was above 40% and the number of people with low labour market attachment was high, particularly among women (52%) and young people (44%). Against this background, there was the low quality of new jobs created, since not only the share of temporary employment increased in several countries, but also their duration was shorter (e.g. in Spain, Italy, Finland and Belgium half of temporary contracts last six months or less), which could be related to worse career development. Moreover, shorter temporary contract durations are related to higher rates of involuntary temporary employment. On the other hand, around 20% of new employment in this European subregion was part-time, and almost one-third of this was involuntary, rising to 60% in Southern European countries (16). Temporary and part-time workers are more likely to earn low wages (35) and are at higher risk of poverty compared to full-time workers (16).

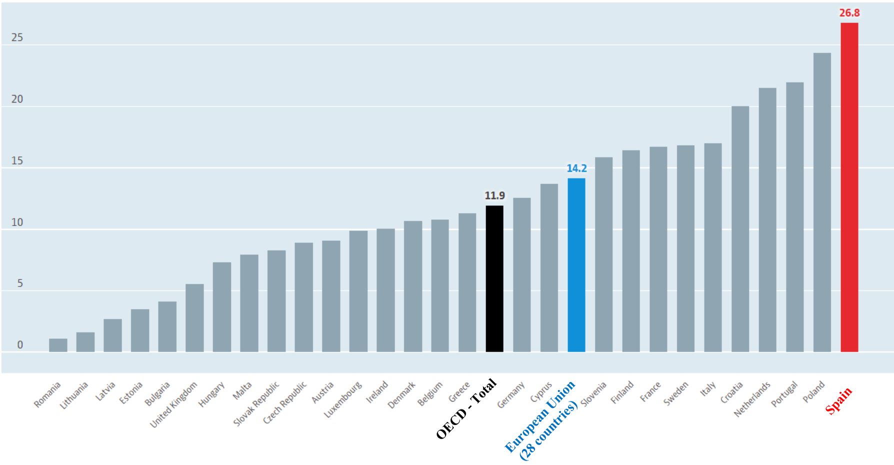
The aforementioned increasing trend in temporary employment in Europe began in the seventies, and it was a response to the low levels of job creation to provide flexibility to employers to better adapt organisational and productive systems to the fluctuations of the labour market and to reduce unemployment. However, in Spain, labour market deregulation has not led to higher hiring and higher real wages, leading to a labour market dualisation. This dual model consisted in a group of permanent insider workers highly protected by legislation and with high bargaining power, opposed to the other group of outsider temporary workers characterised by low dismissal costs and increased labour turnover (36,37). Spain constitutes a paradigmatic case of a dual labour market since the proportion of temporary employment was above the European Union average for the period 2002-2018 (Figure 2), and the highest among the European Union countries in 2018 (Figure 3).

Figure 2. Temporary employment - Total, (%) of dependent employment, 2002-2018



Note: Temporary employment includes wage and salary workers (i.e. dependent employees) under a pre-fixed termination date as a share of the total dependent employees.
Adapted from: OECD (2019), Temporary employment (indicator). doi: 10.1787/75589b8a-en (Accessed on 1 October 2019).

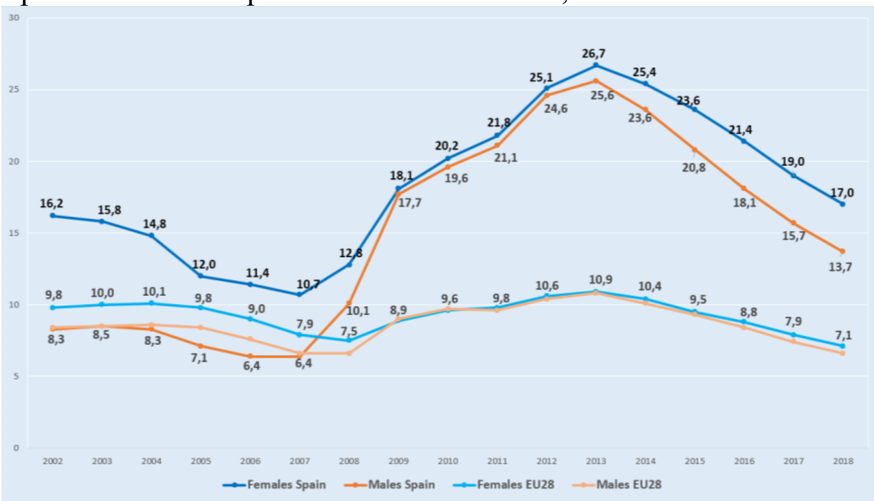
Figure 3. Temporary employment (%) across European Union 28 countries, 2018



Note: Temporary employment includes wage and salary workers under a fixed-term contract.
Source: OECD (2019), Temporary employment (indicator). doi: 10.1787/75589b8a-en (Accessed on 1 October 2019)

The effects of dualism are evident when assessing the high impact of the Great Recession in the unemployment rate in Spain (25.1% for women and 24.6% for men in 2012) compared to the average in the European countries (10.6% for women and 10.4% for men in 2012) (Figure 4). Besides, when compared with a country like France with similar temporary contracts levels, the impact of the recession on unemployment was higher in Spain due to the weaker employment protection for temporary workers, and the less restricted compliance with the reasons for using temporary contracts (37).

Figure 4. Unemployment rates (%) among women and men in Spain and the European Union 28 countries, 2002-2018



Adapted from: Eurostat, statistical office of the European Union, based on the Labour Force Survey; Unemployment rates, annual average (Accessed on 1 October 2019).
Available: https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=une_rt_a&lang=en

Given the economic downturn and the need to improve the competitiveness of the economy, the Spanish Government adopted several measures, among those the 2012 labour market reform. Among other measures, this reform was an attempt to reduce labour market duality by promoting flexibility for companies by reducing the strictness legislation on dismissal costs for permanent workers. The effect of the reform slightly increased the probability of transit from unemployment to permanent employment. However, this effect was small in the short term, since hiring was mainly carried out through temporary contracts (38). There is still room to a greater convergence of firms' dismissal costs between temporary and permanent contracts since the severance pay for the latter in Spain is one of the highest in the OECD countries (39). Furthermore, the 2012 reform apply limited changes in active labour market policies such as the limited spending on job creation subsidies, and no changes in passive labour market policies since the unemployment benefit coverage remained the same. Thus, the 2012 reform favoured greater prominence to flexibility to the employer rather than Social Security protection to the employee (40).

Overall, the increasing unemployment rates during the crisis, affected young people, immigrants with low levels of education, and men particularly, since the financial bubble hit the construction industry (highly masculinised) rather than the services sector (highly feminised) (41). Nevertheless, Catalonia, an autonomous community of Spain, has been slightly less affected by the financial crisis (unemployment rates in the first quarter of 2012 were 24.2% and 22% in Spain and Catalonia, respectively) (42). The evolution of unemployment rates by sex of workers living in Catalonia during the period 2008-2015 showed disparities. The unemployment rate fluctuated from 6.8% among women (5.3% among men) at the beginning of 2008 to 17% at the end of 2014 (same level of convergence in men) (43).

The dynamics of the labour market in Catalonia from a job insecurity perspective (i.e. the guarantee of keeping a job or finding one when unemployed) have been studied considering the mobility between stable, unstable occupation and non-occupation during the period 2002-2012. Researchers showed a strong influence of the previous working life on job security at present, so those with unstable occupations or without occupation (i.e. unemployed and inactive jointly) the previous year are highly likely to remain in these labour states. On the other hand, this labour market dynamic is influenced by education, since attaining high levels of education favour transitions towards stable employment and protect from the exclusion of the labour market (i.e. transitions towards unstable occupations and without occupations) (44). Similarly, other research about the working life course of young (20-40 years) workers in Catalonia during the economic crisis has explored if sex and education attained discriminate the development of employment pathways. Women increase their participation in the labour force, particularly in unskilled occupations and are overrepresented in unpaid and care work. Educational credentials do not guarantee employment stability, since workers follow temporary employment trajectories regardless of the educational level; however, it prevents trajectories characterised by unemployment and inactivity (45). Furthermore, in a context of labour market uncertainty, the family support (e.g. living at the parental home until finishing the studies) facilitates the transition into adulthood (46). In this sense, a study investigated trajectories on young people and their social networks as a resource for labour market integration in Barcelona (Spain) and found that young people with better-positioned social profiles have access to useful professional contacts in the labour market, while those more disadvantaged have more diversified social networks, including neighbourhood and family contacts (47).

1.4. Sickness absence

An outlook to the welfare state, social protection systems and health: sickness absence

Welfare states aim to reduce social and health inequalities and promote social justice through redistributive social transfers (e.g. unemployment benefits, SA, pensions) and social and health services (48). A broad conception of the welfare state considers it has a role in organizing the economy, so what they do is more important than how much is spent on social provisions (49). Given that welfare state varies in generosity across regions, researchers have proposed several classifications of regimes based on different criteria. Esping-Andersen proposed three typologies (Liberal, Corporatist and Social Democratic) based on the degree of decommodification (i.e. the independence of living standards from labour market forces), social stratification, and how the state, the market and the family are combined. The liberal is characterized by modest universal transfers, and state emphasizes the market. In the Corporatist, market efficiency and commodification are not preeminent, and state displaces market and keeps a traditional family-hood. The Social Democratic is based on universalism and decommodification of social rights that encompasses the middle class, and have a high commitment to social-service (49). However, one of the main criticism of the typologies mentioned above is that gender was omitted as a form of social stratification and have been proposed alternative typologies (50).

Research has extended the study of the welfare state as a determinant of health (48,51–53). It has been investigated gender inequalities in different welfare states and its relationship with health (54) or the combination of paid and domestic work according to five family policy models (dual-earner, traditional family, market-oriented, post-communist and Southern European) (55). In the latter, they found that countries with traditional models such as Spain, combining employment and family demands are positively associated with poorer health since women have a double burden of paid work in jobs with poor working conditions and domestic and caring unpaid work.

In Europe, the majority of the population has access to at least one social protection benefit, while slightly less than half of the population in the world are uncovered (56). More precisely, in Spain, the population has access to a wide range of social benefits, of which we highlight the unemployment benefits and the sickness benefits, given their importance for this thesis.

Regarding the unemployment provision, in Spain, unemployed workers are entitled to contributory unemployment benefit if they are registered with the Social Security, registered as a job seeker and have paid Social Security contributions at least one year over the last six years. The duration of the benefits ranges between four months and two years depending on the paid contributions into the Social Security, and the amount of the benefit is based on the average salary prior of becoming unemployed and the replacement rate (the first six months is 70% and then 50%). Unemployed who have not paid enough Social Security contributions (at least one year) or have exhausted these contributory benefits can access to the non-contributory unemployment benefit (also known as means-tested unemployment benefits) if they have a monthly income of less than 75% of the minimum wage or, in other words, having less than 712.50€ (the minimum wage was 950€ in 2020 according to the Spanish Royal Decree 231/2020). Also, it is required to have paid contributions for at least three months in case of having family responsibilities or for at least six months in case of not having family responsibilities. The duration is the same as the time contributed, with exceptions, and the amount received is the 80% of the Public Indicator of Multiple Effects Income (IPREM, 537.84€ monthly in 2020), that is, 430.27€. An amount lower than the minimum wage (57,58).

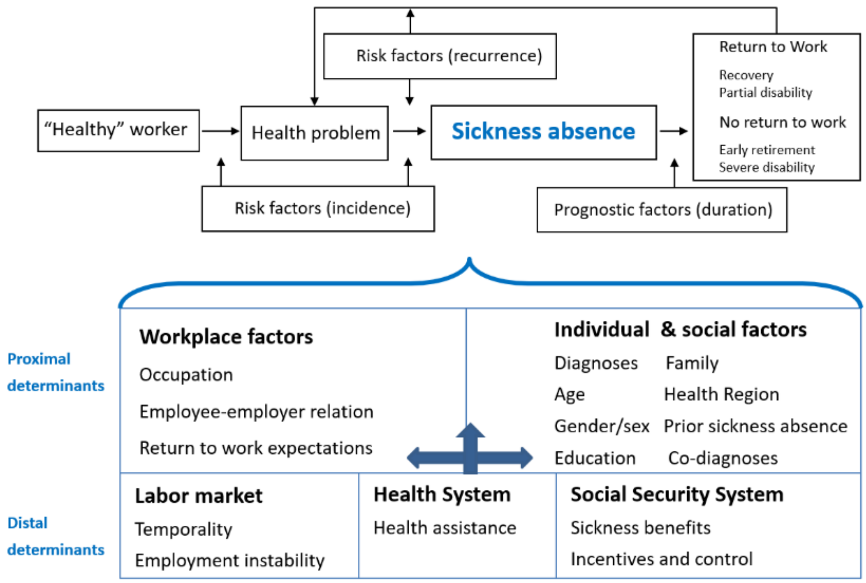
The provision of sickness benefits coverage is a crucial element of the Welfare State in high-income countries since it protects workers against loss of income when they are unable to work due to ill health and provides health care during a SA spell (59). In this way, SA potentially decommodifies the labour relationship between the employee and the employer, preventing the poverty that can generate a health problem that prevents the person from working and maintaining their income. Nevertheless, to what extent SA behaviour reflect decommodification depends on the influence that factors such as employment conditions, job insecurity or the unemployment rate have on it (60).

From an epidemiological perspective, SA is more than a health measure of the working population, as it reflects physical, psychological, and social factors (e.g. quality of the work could affect SA rates, regardless the health status) (61). Also, SA is a tool for social protection. Thus, a study showed that a reduction in SA generosity may decrease SA rates in the short-term, but may increase them in the long-term (62). The previous SA behaviour could be related to the fact that less generous benefits could restrict people gaining access to resources beneficial for their health, and lead them to a future prolonged SA. Furthermore, SA could be a social and employment policy response to protect income, health and jobs during a health pandemic as the COVID-19 crisis by allowing workers exposed to the virus to self-isolate to contain the virus, to quarantine to care for an ill family member and facilitating an orderly de-confinement (63).

Determinants of sickness absence

According to the conceptual model to understand the natural course of SA (Figure 5), multiple proximal and distal determinants affect the worker, before, during and after the onset of SA. Proximal factors: the nature of the pathology (diagnosis), biological factors (age, sex, comorbidity), sociodemographic factors (education attained, family structure, health-related behaviours, place of living), workplace factors (type of contract, occupational category, income); and distal factors: labour market, social protection generosity (i.e. eligibility criteria, compensation amount and duration of the benefits), healthcare consumption, and legal framework.

Figure 5. Natural history of sickness absence.



Adapted from: Castejón E, Benavides FG, Murillo C. "La incapacitat laboral per contingències comunes a Catalunya". Barcelona: Consell de Treball, Econòmic i Social de Catalunya, 2003.

Prior scientific evidence has examined a large group of determinants related to the appearance of new episodes of SA (incidence) and its duration, as well as recurrence, and the probability that a SA become a permanent disability and, in some cases, premature death (64).

Extensive research has investigated the effects of working conditions such as psychosocial hazard exposures and physical hazards, and also, employment conditions such as temporary contract, and shift work on health and/or SA spells (65–67).

One of the determinants of the SA prognosis is the diagnosis of SA. According to a Spanish study, prolonged SA episodes (>15 days in employed and >3 days in self-employed workers) shows differences in duration by pathologies. Thus, musculoskeletal disorders have intermediate median durations and are the most frequent, while psychiatric disorders and neoplasms have the most extended length, although with differences according to sex and age (68). Another study analysed the relationship between the length of SA episodes due to musculoskeletal disorders and gender differences. The study shows that, in general, women have longer SA durations than men. Nevertheless, in men, SA duration increases with age and, in women, there is a fluctuant pattern, since, after an initial ascending trend, SA duration decreases at the ages of 31 to 45 years compared to younger ones. The overall longer SA duration among women reflect health inequalities due to the gendered division of work. Accordingly, women are more likely to assume paid work and family demands, a work overload which could affect their health status and, therefore, the length of SA due to musculoskeletal disorders (69).

Preceding SA episodes predict the risk of future SA episodes (recurrence) (70,71). The risk of a new SA episode increased with the number of previous SA episodes and was higher for prior longer SA episodes rather than for shorter ones. Also, shorter SA episodes predicted subsequent longer SA episodes (70). Likewise, the risk for subsequent long SA due to mental disorders increased with the increasing amount of previous short SA episodes and days (71).

Regarding sociodemographic factors, prior research points out that health-related behaviours such as smoking, alcohol and physical activity are associated with diagnosis-specific SA (72).

About geographical factors, the duration of SA differs between the health geographic regions, so the geography captures part of the effect ignored by other variables (73).

In terms of contextual factors (e.g. the social protection system) and from an economics discipline perspective, it has been studied whether SA behaviour is affected or not by economic incentives. A reduction in the short-term sick pay level of benefits showed a reduction in the average sick days, which increased presenteeism (attending to work being ill) and decreased absenteeism (not attending to work being healthy). On the other hand, an increase in the short-term sickness benefits leads to the rise in SA (lower presenteeism and higher absenteeism). Therefore, in both studies, workers short-term SA behaviour responded to changes in sickness benefits. Nevertheless, another study found that, overall, a cut in the sick pay level do not affect incidence and duration of long-term SA (> six weeks), since long-term SA is due to severe illness, regardless of monetary incentives (74). Furthermore, another study found that a reduction in the SA benefit has a delayed effect on the incidence of SA, since the incidence of SA reduces in the short term, while, it increases in the long term. A cut in the sick pay level reduces the economic resources of workers to keep healthy while being sickness absent and that in the long-run has effects on health (62).

As mentioned earlier, previous studies have mainly studied the relationship between working and employment conditions on health and health-related outcomes. However, the LMP, as a determinant of SA course, the core of this thesis, have been scarcely studied. Previous studies have analysed the relationship between certain labour market situations and health-related outcomes. One of them studied unemployment among young individuals was positively associated with an increased risk of SA, disability pension and death (75). Prior studies showed that the most unstable and unsafe LMP patterns (measured by the number of contracts and affiliation periods) are associated with early retirement due to permanent disability (76) and that the exposure to employment instability (77) and the cumulative time in peripheral labour market positions (i.e. insecure employment) is associated with worse health status (77,78). A Finnish study examined ten-year trajectories of an early exit from employment and the concurrent cumulative incidence of SA and found that people with a pattern of permanent exit from labour market during the follow-up had the highest incidence of SA due to mental disorders (79).

Research have examined sex and age differences in health and SA (80,81), and across labour market states (82). A gender-focus review on SA found that women have higher short-term SA rates than men, which depend on country and age. This higher SA proportions among women may be related to pregnancy-related health problems or distress when employed in female minority occupations (81).

Life course processes may have heterogeneous effects on health when considering the role of cohort dynamics since different cohorts reflect exposures to unique past social and economic circumstances and contexts (83). For this reason, in this thesis, we defined cohorts by working life stage.

As far as we know, no previous studies have investigated the relationship between LMP patterns and future SA trajectories across working life stages from a life course perspective.

Management and impact of sickness absence in the Spanish framework.

According to the legal framework in Spain, SA is defined as a situation recognised by the Social Security system in which workers are unable to work temporarily because of a disease or injury, either non-work related or work-related and receive health care and social protection benefits (84). A particularity of the SA system in Spain, unlike other countries, is the distinction between two types of SA depending on the cause, that is, common disease or non-work related injury and occupational disease or work-related injury, which are differently regulated in terms of eligibility, compensation amount, maximum duration and insurance payer (85). The focus of this thesis is SA due to common disease or non-work-related injury, which represents the majority of SA spells.

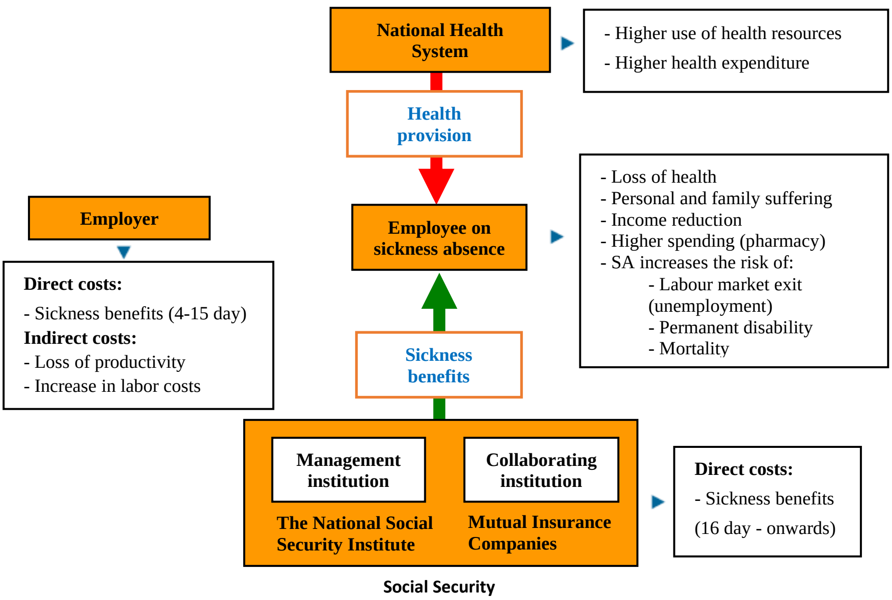
In Spain, workers have to be affiliated to Social Security at least 180 days within the prior five years to be eligible for SA benefits. SA is medically certified by the general practitioner from the National Health Service (NHS). The maximum duration of SA is 365 days, that can be extended up to 180 days under the Social Security assessment if the worker is expected to recover during this period; otherwise, permanent disability is granted.

The employee on SA receives sickness benefits as a wage replacement and health provision (universal and free healthcare access to all Spanish nationals) to recover the loss of health, while supports personal and family suffering, expenditure in pharmacy and not receiving their full salary. The NHS assumes the health provision costs associated with SA funded through general taxation. The employer and the Social Security share the direct costs of SA, while the employer also assumes the indirect costs derived from the increase in labour costs of replacing the worker in SA and the loss of productivity.

The amount of sickness benefits for private-sector employees is 60% of the wages from the 4 to the 20th day and 75% from the 21st day onwards. The first three days, workers do not receive benefits from SA, unless provided otherwise in the collective bargaining agreement. The employer is responsible for the payment from the 4th to the 15th day, and the Social Security from the 16th day onwards (86,87).

In terms of social and economic burden, SA has a considerable impact which involves several actors: the employee on SA, the NHS, the employer and the Social Security (Figure 6). Direct expenditure on SA accounted for 0.6% (about 7.600 million euros) of the GDP in Spain in 2019 (88), while indirect costs represented almost 4% of the GDP in Spain in 2007 (latest estimates) (89).

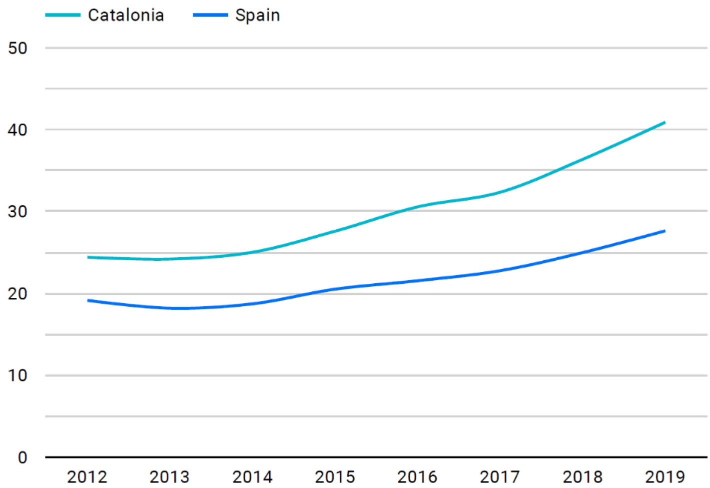
Figure 6. Social and economic impact of sickness absence in Spain.



Adapted from: Sampere, M. “Reincorporación al trabajo después de un episodio de incapacidad temporal por contingencia común de larga duración. Análisis de los factores pronóstico”. Doctoral thesis.

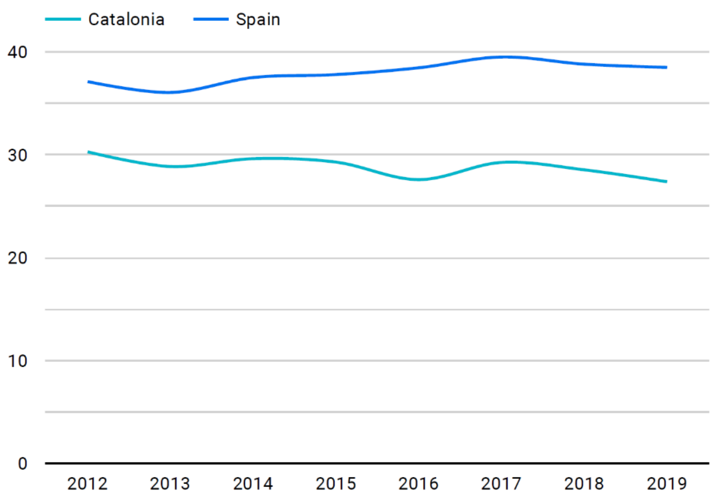
According to the Spanish Social Security statistics, the average monthly incidence rate of SA in Catalonia in 2019 was 40.9 per 1.000 workers (Figure 7), and the average duration of SA episodes was 27.38 days in the same year (Figure 8) (48% higher and 29% lower than Spain, respectively) (90).

Figure 7. Monthly incidence rate of sickness absence (per 1000 workers) in Catalonia and Spain, 2012-2019.



Elaborated from: Seguridad Social, Estadísticas, Presupuestos y Estudios, Incapacidad Temporal. (Accessed on 7 June 2020). Available: http://www.seg-social.es/wps/portal/wss/internet/EstadisticasPresupuestosEstudios/Estadisticas/EST45/EST46

Figure 8. Average duration of sickness absence episodes in Catalonia and Spain, 2012-2019.



Elaborated from: Seguridad Social, Estadísticas, Presupuestos y Estudios, Incapacidad Temporal. (Accessed on 7 June 2020). Available: http://www.seg-social.es/wps/portal/wss/internet/EstadisticasPresupuestosEstudios/Estadisticas/EST45/EST46

1.5. Justification

The labour market structure is changing due to the effect of the digitising economy, population ageing, and competitiveness in a global market, which is leading to a situation of volatile employment. New forms of employment are emerging, characterised by increasing job insecurity, precarity and employment instability, which can have a detrimental effect on the health of the working population. Consequently, low employment quality and career interruptions can lead to an increase in SA or a reduction of it due to presenteeism or not having paid enough Social Security contributions to qualify for SA.

Previous research has focused on the effect of risk factors such as working and employment conditions on SA. However, little is known about factors such as participation in the labour market in terms of mobility between multiple employment status (i.e., transitions from employment to unemployment or without Social Security coverage) throughout working life and their relationship with the course of future SA. Furthermore, few longitudinal studies have taken a life course perspective into account and analysed different working life stages.

This thesis contributes to elucidate the relationship between LMP patterns across different working life stages and the SA course from a life course approach. This novel approach allows us to consider the cumulative effect of past employment experiences on later health, and to reflect socioeconomic circumstances at different life stages.

Investigating LMP patterns can provide useful information to identify working population groups at a higher risk for a worst future SA course, and to guide earlier preventive and health promotion interventions.

HYPOTHESIS AND OBJECTIVES

"*The most important decisions a scholar makes are what problems to work on.*"

-James Tobin

2. HYPOTHESIS AND OBJECTIVES

2.1. Hypothesis

A prior working life characterised by low or unstable LMP pattern will be associated with an unfavourable course of future SA. This relationship will differ among women and men at different working life stages.

2.2. Objectives

Objective 1

Study I: Trajectories of sickness absence among salaried workers: evidence from the WORKss cohort in Catalonia (Spain), 2012-2014.

- To identify and describe trajectories of accumulated days on SA, among salaried workers living in Catalonia.

- To assess employment-related conditions and diagnosis groups as potential determinants of SA trajectories.

Objective 2

Study II: Labour market participation patterns among people on sickness absence in Catalonia, 2002-2011.

- To identify and describe ten-year LMP patterns, at early, middle and late working life stages, in salaried workers living in Catalonia who accumulated future SA days (>15 days on SA).

Objective 3

Study III: Sickness absence trajectories following labour market participation patterns: a cohort study in Catalonia (Spain), 2012–2014

- To investigate the association between prior ten-year LMP patterns, at three different working life stages, and future SA trajectories (>15 days on SA) among salaried workers living in Catalonia.

Secondary objectives (excluded from Study III):

- To assess employment-related conditions and diagnosis groups as potential determinants of SA trajectories (> 15 days on SA).

- To investigate the association between prior two-year LMP patterns, at three different working life stages, and future SA trajectories (>15 days on SA) among salaried workers living in Catalonia.

METHODS

“*A well-designed model is, after all, a judiciously chosen set of lies, or perhaps more accurately put, partial truths about reality, which have been chosen so as to permit us to reason more effectively about some issue than we otherwise could. The model must be an oversimplification if it is to be tractable analytically. Optimality in model construction must be based on the trade-off between these two desiderata – accuracy of representation of reality and usability in analysis.*”

-William Baumol

3. METHODS

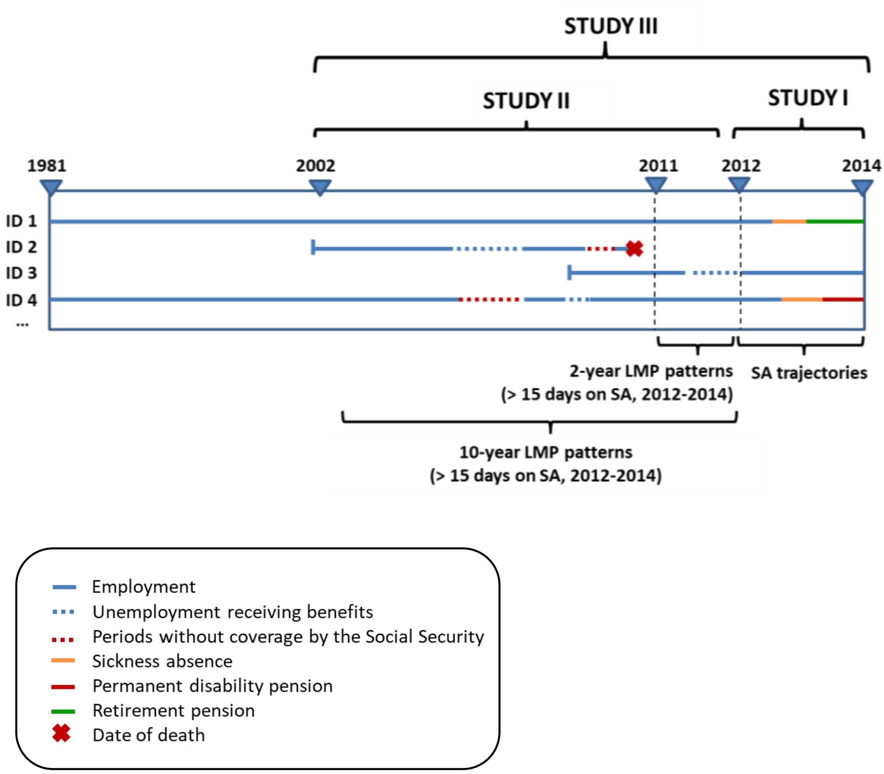
3.1. Study population, sources of information and study design

The total study population consists of salaried workers affiliated with the Social Security system living in Catalonia, who had at least one closed SA episode during 2012-2014 (n=39,972; 55% women).

The data comes from the linkage of two administrative register data sources: the Spanish Continuous Working Life Sample (CWLS) and Catalonia SA records. The CWLS is provided by the General Directorate for the Organization of the Social Security in Spain. The CWLS is an annual random representative sample of 4% of the individuals affiliated (contributors and beneficiaries) with the Spanish Social Security system starting in 2004 (roughly 1,1 million people) (91). It is based on administrative registers (reliable since 1981) and includes employment history (type of contract, occupation, and employment status), and health-related data (date of permanent disability benefits onset and date of death). The sample extraction began in 2004, and based on algorithms, randomised sequences of numbers match identification codes of individuals affiliated with the Social Security. Each annual sample update allows to select the same individuals from previous years if they continue affiliated; otherwise, because of loss of contact with Social Security or death, people from the target population with similar characteristics replace them until the sample reaches a 4% (91–93). From the CWLS the Spanish WORKing life Social Security (WORKss) cohort was built (see http://www.cisal.upf.edu/workss/eng), which is a longitudinal cohort created by linking the annual waves of the CWLS and contains only data of affiliates who have a registered employment history (94). SA records are managed by the Catalan Institute for Medical and Health Evaluations (ICAM), which include the onset and closure date of SA episodes and medical diagnosis from 2012 to 2014.

The study design of this thesis is longitudinal with a life course approach (Figure 9).

Figure 9. Study design.



Study I

In Study I, the study population consisted of salaried workers affiliated with the Social Security system living in Catalonia, belonging to an early cohort (aged 22-42 years in 2012) and a middle-late cohort (aged 43-63 years in 2012), and who had at least one closed SA episode during 2012-2014 (n=38,420; 55% women).

Trajectories of accumulated SA days (2012-2014) were analysed over a three-year follow-up (Figure 9).

Study II & III

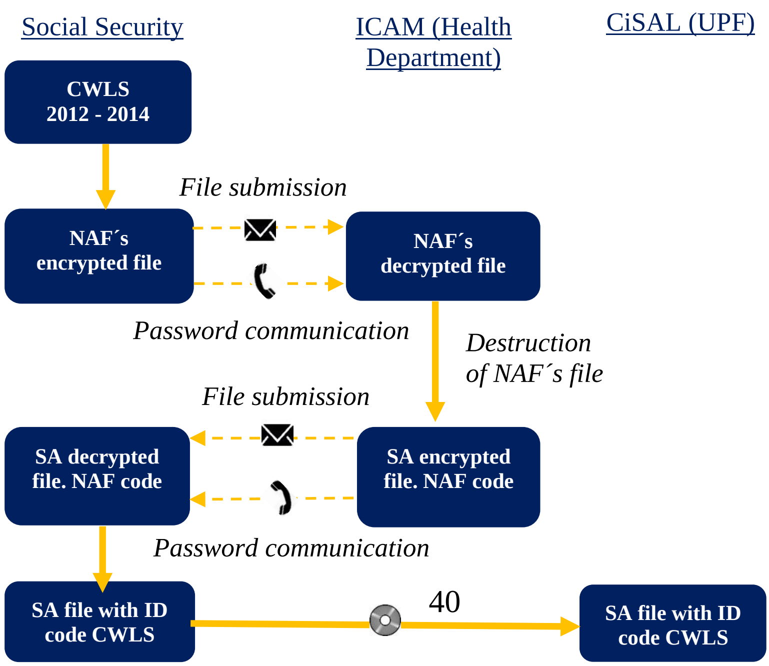
The study population consisted of salaried workers affiliated with the Social Security system living in Catalonia, who accumulated more than 15 days on SA at least in one quarter during 2012-2014. Individuals belong to three working life cohorts (WLCs): early WLC (aged 18-25 years); middle WLC (26-35 years) and late WLC (36-45 years) (ten-year LMP: n=11,968 and 62% women; two-year LMP: n=10,237 and 63% women).

In Study II, LMP patterns were reconstructed for each WLC for ten years of working life (2002-2011) (two years for the additional analysis, 2010-2011) among people who subsequently accumulated more than 15 days on SA (2012-2014). In Study III, the association between ten years (two years for the additional analysis) of LMP patterns obtained for each WLC and subsequent SA trajectories among people who accumulated more than 15 days was assessed (Figure 9). In Study II and III, the rationale behind the selection of workers who accumulated more than 15 days on SA at least in one-quarter of the period 2012-2014 is that such SA spells are more likely to represent more severe SA episodes, which may reflect better the long-lasting effects of prior working life on SA.

3.2. Ethical approval

The Parc de Salut Mar Ethics Committee in Barcelona evaluated and approved this research project (nº 2017/7398/I). The confidentiality of the administrative records is ensured by a record linkage agreement from the Spanish Social Security, the ICAM and the Centre for Research of Occupational Health (CiSAL), in respect of which the researchers receive anonymised databases. The steps to connect both registers are illustrated below (Figure 10).

Figure 10. Protocol for the merger of two register data sources.



First, the Social Security affiliation number (NAF) is extracted from the individuals who were part of the CWLS between 2012 and 2014, and an encrypted file is generated that is transferred to the ICAMS Department of Health. Second, the ICAMS Department of Health prepares a file with the data related to the SA processes and merge it with the workers that appear in the NAF file, while the original NAF file is destroyed. Third, the SA file is encrypted again and sent to the Information Technologies Department of the Social Security where the NAF is replaced by the identifier of the CWLS, being the data anonymized. Finally, the CiSAL researchers receive the anonymized SA file that contains the personal identifier of the CWLS.

3.3. Study variables

Outcome

SA trajectories were based on the number of accumulated days on SA at least one quarter for the period 2012-2014 (12 time points). Those quarters in which individuals had zero days on SA or did not have information on SA due to a delayed entry or an early departure from the cohort were considered as a missing value.

Explanatory variable

For this study individuals were investigated in three working life cohorts, according to their working life stage in 2002 (or 2010 in the two-year additional analysis): early, middle, late. Ten (2002-2011) and two (2010-2011) years of working life were used to reconstruct LMP patterns based on weekly measures of six labour market states: employment, unemployment receiving benefits, means-tested unemployment benefits, transition, without coverage with the Social Security and without long-term coverage with the Social Security. The “transition” state represents a period up to 30 days without contact with the Social Security (e.g. administrative transition between employment status changes). Periods longer than 30 days were considered within the state “without coverage”. If this non-affiliation period occurred at the beginning and/or at the end of the follow-up (censorship to the left and/or right, respectively), it was called a state “without long-term coverage”. Censorship on the left could be due to the entry into the labour market for the first time or a return to it after a period of employment prior to follow-up, while censorship on the right could be the consequence of the definitive abandonment of the labour market or a temporary departure if there were a period of employment after the follow-up. Therefore, this labour market state represents the delayed entries and the earlier departures during the follow-up.

Covariates

The following covariates were included to study determinants of SA trajectories and their relationship with prior LMP patterns: type of contract (permanent or temporary), working time (full-time, part-time from 51% up to 99%, and part-time up to 50%), occupational category (skilled non-manual, skilled manual, unskilled non-manual, and unskilled manual), income (salary + unemployment benefits) and medical diagnosis for SA. The occupational category was categorised according to the professional qualification reported by the employer (95). Income was based on the contribution base of the Spanish

Social Security, which is used to calculate the access to future social benefits, and included the total monthly remuneration for work and unemployment benefits within limits established by law (91). SA medical diagnosis was grouped according to the tenth revision of the International Classification of Diseases (ICD-10).

Since workers could change their employment-related conditions during the LMP periods (2002-2011 and 2010-2011) and during the SA course (2012-2014), they were assigned to the category they spent most of the time for each period. The same was applied to the diagnosis group the period 2012-2014 in which SA data is available. Similarly, LMP states were assigned to the state they spent most of the time for each week of the LMP periods.

Employment-related conditions were assessed as descriptive variables and potential predictors for SA trajectories (Study I), descriptive variables for LMP patterns (Study II), and potential confounders for the association between LMP patterns and SA trajectories (Study III). The income was measured in two different ways. In Study I, the income was the ratio between the sum of the individual monthly income during the follow-up period and the total follow-up time (three years). In Studies II and III, what changes in the income measure is the denominator, instead of dividing by the total follow-up time, it is only divided by the affiliated time. In both income measures, the obtained average monthly income was converted into quartiles, separately, for women and men in each cohort.

3.4. Statistical analysis

All the analyses were separated by sex and WLC.

Two different statistical techniques have been applied to determine LMP patterns and SA trajectories: sequence analysis, and Latent Class Growth Analysis (LCGA), respectively. Also, Pearson's Chi-square test (or Fisher's exact test when applicable) and multinomial logistic regression models.

In brief, sequence analysis is an algorithmic method that allows describing and visualising individual ordered elements (or states) over time (96). Once the first descriptive analysis is done, optimal allows the comparison of sequences by counting the minimum number of transformations required to each pair of them to be identical, given a defined replacement cost (i.e. insertion, deletion and substitution costs). (97). A custom substitution costs matrix was defined according to the characteristics of our data and study population, with a higher weight in the transitions considered less frequent (i.e. from employment to means-tested unemployment benefits, or from employment to without Social Security coverage, and vice versa). In a third step, hierarchical cluster analysis was used to group similar typologies of sequences (i.e. LMP patterns) (98). The number of clusters was selected using the index average silhouette width, which assesses the quality of the clustering and measures the intra-group and inter-group variability. ASW values between 0.5-0.7 show reasonable well-separated clusters, with a higher value showing higher homogeneity of the groups (98).

LCGA is a modelling technique that classifies individuals in homogeneous classes (or groups) according to an estimated probability, given the development of an individual outcome over time within a population (99). This method is a type of Growth Mixture Model which assumes that individuals within each trajectory are homogeneous. Although the assumption of homogeneity is less realistic than heterogeneity, we decided to use this model for practical considerations such as model convergence and lower computational load when handling a considerable amount of data (100). The number of classes was selected based on the Bayesian Information Criteria (preferable as lower the best) and two likelihood ratio tests (LRT), the Lo-Mendell-Rubin adjusted LRT and the Bootstrapped LRT, to assess the goodness of fit (i.e. the improvement in fit for the inclusion of one more class) (101). Also, high posterior probabilities (closed to 1.0) were considered. Minimum size of 1% was ensured in each class, although this rule depends on how meaningful are classes for the study (102). The final number of trajectories was determined considering the previous fit indices, the visual analysis of figures (comparing the estimated and the observed trajectories with different linear and quadratic functional forms), and the research criteria.

Study I

SA trajectories based on accumulating days on SA quarterly (if any) as a repeated measure during 2012-2014 were estimated using LCGA.

Pearson's Chi-square tests (or Fisher's exact test when applicable) were used to evaluate how likely it is that any observed difference between SA trajectories and either employment-related conditions or diagnosis groups arose by chance.

Multinomial logistic regression models were applied to analyse employment-related conditions and medical diagnosis groups as predictors for SA trajectories.

Study II

The reconstruction of LMP patterns was based on sequence analysis to identify individual LMP patterns between 2002 and 2011 considering transitions among employment-related status over the working life.

Pearson's Chi-square tests (or Fisher's exact test when applicable) were used to assess differences in employment-related conditions across LMP patterns.

Study III

SA trajectories based on accumulating more than 15 days at least in one quarter during 2012-2014 were estimated using LCGA.

Pearson's Chi-square tests (or Fisher's exact test when applicable) were used to assess differences in employment-related conditions or diagnosis groups across SA trajectory groups.

Multinomial logistic regression models were used to assess the relationship between the prior ten years (two years[1] for the additional analysis) of LMP patterns (identified in Study II) and SA trajectories of more than 15 days for the period 2012-2014. Models were adjusted for SA medical diagnosis groups, employment-related conditions measured during the SA follow-up period, and time spent in employment during the prior ten years (two years for the additional analysis) of working life. Additionally, employment-related conditions and medical diagnosis groups measured during the SA follow-up were used as predictors for SA trajectories of more than 15 days.

[1] Following the recommendation of Amrhein et al "Scientists rise up against statistical significance" (2019), we consider the practical implications of the values inside the confidence interval (i.e. compatibility interval). Therefore, the association between U-shape patterns and increasing SA trajectories among women at the early working life stages (ORa: 0.41 [95% IC: 0.16-1.04]) should be interpreted as a risk difference compatible with a large reduction of 84% to a small increase of 4%.

RESULTS

"Nothing in life is to be feared, it is only to be understood. Now is the time to understand more, so that we may fear less."

-Marie Curie

4. RESULTS

STUDY I

I

Ubalde-Lopez M, Hernando-Rodriguez JC, Benavides FG, Serra L. Trajectories of sickness absence among salaried workers: evidence from the WORKss cohort in Catalonia (Spain), 2012-2014. BMJ Open 2019;9:e029092. DOI: 10.1136/bmjopen-2019-029092

BMJ Open

Trajectories of sickness absence among salaried workers: evidence from the WORKss cohort in Catalonia (Spain), 2012-2014

Monica Ubalde-Lopez,[1,2,3] Julio C Hernando-Rodriguez,[1,2,3] Fernando G Benavides,[1,2,3] Laura Serra[1,2,3]

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MU-L and JCH-R contributed equally.

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[1]Department of Experimental and Health Sciences, Centre for Research in Occupational Health (CiSAL), Pompeu Fabra University, Barcelona, Spain
[2]CIBER of Epidemiology and Public Health (CIBERESP), Barcelona, Spain
[3]IMIM - Parc Salut Mar, Barcelona, Spain

Correspondence to
Dr Monica Ubalde-Lopez; monica.ubalde@upf.edu

ABSTRACT

Objectives Sickness absence (SA) is a widely studied integrated measure of health status. To better understand how SA behaves over time (SA trajectory) a longitudinal and individual-centred approach will allow identifying groups of individuals who share common characteristics. The aim of this study was to identify and describe SA trajectories and to assess employment conditions and diagnosis groups as determinants.

Setting Working-life and sickness absence administrative records from a representative sample of affiliated with the Spanish Social Security system.

Participants 38 420 workers affiliated with the Spanish Social Security system, born 1949 to 1969 or 1970 to 1990, resident in Catalonia who had SA between 2012 and 2014 (75 212 episodes).

Results We identified three different SA trajectories in both birth cohorts for men and women: low-stable (86.2% to 90.8% of individuals), decreasing (4.4% to 5.9% of individuals) and increasing (4.1% to 8.7% of individuals) accumulated days of SA. The main characteristic of SA trajectories was the medical diagnosis group. The increasing SA trajectory had a higher proportion of workers with SA due to mental disorders compared with the other trajectories. The association analysis showed diagnosis group strongly related with all SA trajectories, particularly SA due to mental disorders showed the strongest association with the increasing trajectory among young men (adjusted OR (aOR): 42.40, 95% CI 17.03 to 105.57). Low salary levels exhibited a strong relationship with decreased accumulation of SA days over time for old women (aOR: 2.08, 95% CI 1.36 to 3.18) and men (aOR: 2.75, 95% CI 1.77 to 4.27). Unskilled manual occupations were associated with increasing trajectories among young women (aOR: 1.36, 95% CI 1.01 to 1.84). No significant differences were observed for other employment conditions across trajectories.

Conclusions Workers with mental disorders are more likely to have increased days of SA, whereas low salary levels at later ages are related to a decrease in SA days over time. Special attention to preventing the course of mental disorders at young and middle age is warranted.

Strengths and limitations of this study

- This study provides novel insight into sickness absence research from a longitudinal and individual-centred approach by investigating sickness absence trajectories.
- Trajectory analysis allows the identification of workers who require specific and early intervention, such as those with mental disorders, which follows an increasing pattern of days of sickness absence over time.
- The use of high-quality administrative registries from a large representative sample of the Spanish working population, together with access to medically certified sickness absence registries, provides higher validity to the results than self-rated sickness absence measures.
- Potential selection bias may be present when classifying workers into categories of accumulated employment-related factors, which could lead to underestimating their relationship with sickness absence trajectories.
- Information related to working conditions, health-related behaviours, healthcare consumption, family structure and prior health status that would be worth considering to identify and describe sickness absence trajectories were not available.

INTRODUCTION

Sickness absence (SA), considered a holistic measure of health status and work functioning,[1] is also one of the basic social benefits provided by welfare states to protect workers unable to work temporarily due to a health limitation.[1–4] SA has a major impact in terms of social, economical and individual burden. According to the Organisation for Economic Cooperation and Development, the expenditures for SA account for 0.8% of the European Union's average annual gross domestic product.[5]

Prior research has built a solid body of evidence focused on studying determinants and risk factors associated with the incidence and duration of SA episodes.[6–9] Studies have consistently shown that SA follows different behaviour according to sex and age.[10–12] As women tend to have a higher incidence of SA and duration generally increases with age,[13] a separate sex-specific birth cohort analysis would be useful to control for the effect of the study design on assessing the role of other SA determinants. In addition, results from occupational epidemiology, occupational medicine and Social Security schemes in SA research are commonly built on assessing variable-centred measures at one time point or using dichotomous outcomes.[14 15] However, to better understand SA behaviour, a more dynamic longitudinal and person-centred approach is needed,[16] as it will allow the identification of phenotypes of individuals who share similar patterns of SA over time.

Research on the course of SA over time (ie, SA trajectories) is still scarce. The limited number of studies that have investigated SA trajectories were based on the number of overall spells and/or duration,[17–20] or due to specific pathologies, such as acute myocardial infarction and depression.[21 22] The aim of this study was to contribute to expanding the evidence to research questions that arise when investigating longitudinal SA behaviour by identifying and describing SA trajectories based on the accumulated days of SA in two sex-specific birth cohorts of Spanish salaried workers and assess the role of employment conditions and diagnosis group as determinants of SA trajectories.

METHODS

Study population

The study population (n=38420) was based on a sample of workers affiliated with the Spanish Social Security System who were born during the time period 1949 to 1969 or 1970 to 1990, residents of the Catalonia region and had at least one closed episode of SA between 2012 and 2014 (75212 total SA episodes). This sample is part of the Spanish WORKing life Social Security (WORKss) cohort.[23] Briefly, the WORKss cohort includes an annual sample of 4% of the total affiliates in the Spanish social security system each year since 2004 (roughly 1.1 million people) who had registered at least one working day. The selection of affiliates followed a panel study methodology using an algorithm of randomised number sequences that match their identification codes. In subsequent years, selected affiliates will continue in the sample if they continue affiliated with the Social Security system. To ensure representativeness, those lost to death or administrative inactivity in a specific year are replaced with an affiliate with similar characteristics from the target until the sample reaches 4%.

SA records were only available for those who live and work in Catalonia, and data were provided by the Catalan Institute for Medical and Health Evaluations. All SA records contain information on the starting/closure date and diagnoses of medically certified SA episodes. In order to ensure a homogeneous working population that shares similar general socioeconomic characteristics and labour market regulations, we selected two birth cohorts: a young cohort of workers born between 1970 and 1990 (n=24071, 56% women) and an old cohort born between 1949 and 1969 (n=14349, 54% women), with an age range of 22 to 42 years in the young cohort and 43 to 63 years in the old cohort in 2012.

Patient and public involvement

Patients were not involved in the study design or conduct of the study. The study was based on secondary administrative records from Spanish social security and the Catalan Institute for Medical and Health Evaluations. The confidentiality of the databases is ensured by a record linkage agreement between Spanish social security, the Catalan Institute for Medical and Health Evaluations and the Centre for Research in Occupational Health-Pompeu Fabra University. Databases arrived to the authors already anonymised.

STATISTICAL ANALYSIS

Accumulated days of SA were computed quarterly from 2012 to 2014 to estimate SA trajectories using latent class growth analysis (LCGA), which assigns individuals who follow a similar outcome pattern over time to different subgroups. LCGA considers all individuals belonging to a trajectory to be homogeneous and provides an estimation of class membership probabilities for each individual. The optimal number of trajectories was assessed considering both quantitative and qualitative criteria: the Bayesian Information Criterion (BIC), with lower being best, and the likelihood ratio test (LRT) to assess the improvement in fit for the inclusion of one more class, specifically the Lo-Medell-Rubin (LM-LRT). These two criteria give numerical information on goodness of fit.[24] In addition, to assess class separation, average posterior class probability and entropy were also considered (>0.80 indicated good fit). Also, a minimum size of close to 5% of the study population is preferable for each trajectory group, as SA trajectories with small size could give inaccurate estimates.[25] In addition, researcher criteria were applied to determine the final number of trajectories. Finally, the associations between employment conditions or diagnosis and SA trajectories were assessed using a multinomial logistic regression model.

The SA trajectories were described by different employment conditions: type of contract (permanent or temporary), working time (full-time, part-time >50% up to 99% and part-time ≤50%), occupational category (skilled non-manual, skilled manual, unskilled non-manual and unskilled manual) and salary in quartiles. Medical diagnosis was grouped into the main groups according to the 10^{th}revision of the International Classification of Diseases (ICD-10).[26]

As workers can change their category of employment conditions over time, we assigned individuals to the category they spent most of the time in paid employment during the follow-up. Similarly, as individuals are likely to have more than one SA episode (43% of our study population) due to the same or a different medical diagnosis, we assigned them to the diagnosis group that accounted for the greatest number of accumulated days of SA. We tested differences in employment conditions and diagnosis groups among trajectories by applying Pearson's X^2 tests for categorical variables and Fisher's test when applicable. The statistical analyses were conducted using Mplus V.7 and R V.3.2.5 for LCGA, and Stata V.13 for the multinomial logistic regression.

RESULTS

We identified three different trajectories of days accumulated in SA trajectories in both birth cohorts for men and women (figure 1): low-stable (86.2% to 90.8% of individuals), decreasing (4.4% to 5.9% of individuals) and increasing (4.1% to 8.7% of individuals) accumulated days of SA. All trajectories had an average probability >0.8, the BIC and LM-LRT for model fit reached their optimum values with three classes in the two cohorts, indicating a good model fit, though the entropy hardly reached 0.8. In men, we identified two trajectory groups of <5% of the study population in both birth cohorts, but we decided on three classes because the LM-LRT for model fit confirmed that three classes was better than two classes to describe the observed data (p<0.001 in both cases). In addition, the BIC was smaller when considering three classes compared with two (111 464 vs 112 064 in the old cohort, and 167 471 vs 168 815 in the young cohort; online supplementary appendix 1). The low-stable trajectory was the most represented in both cohorts for both men and women, with a mean of accumulated days of SA per quarter of 7 to 13 days. Decreasing and increasing trajectories exhibited a higher accumulation of SA days, ranging from 63 to 11 and from 7 to 62 days per quarter, respectively, during the 3 years of follow-up (figures 1 and 2).

Regarding employment conditions, we observed significant differences in salary levels among trajectories in both birth cohorts, with the exception of young women. The decreasing trajectories had the highest proportion of workers with low salaries for both men and women (range 14.5% to 23.1%) compared with the other two trajectories. In addition, women in the old birth cohort belonging to the decreasing and low-stable trajectories had the highest proportion of part-time contracts (27.2% and 27.6%, respectively) compared with the low-stable trajectory. No significant differences were found by type of contract across trajectories.

The main difference among the three SA trajectories was due to the diagnosis group for both men and women in both birth cohorts. More specifically, the increasing trajectory had a higher proportion of workers with SA due to mental disorders (19.2% women and 17.3% men in the young cohort; 17.4% women and 9.8% men in the old cohort) compared with the low-stable and decreasing patterns. Workers with SA due to musculoskeletal disorders were similarly distributed to the decreasing and increasing patterns, with a higher proportion from the old cohort than the young cohort. However, old women significantly accounted for musculoskeletal disorders in the increasing trajectory (35.2%), in contrast to the decreasing pattern (28.9%). Overall, workers who accumulated SA days for episodes due to infectious and respiratory diseases (tables 1-2) mostly represented the low-stable trajectory. The number of SA episodes followed a similar pattern across trajectories (table 3). Overall, increasing SA trajectories represented to a larger extent long SA spells (median duration range from 25 to 54 days) rather than repeated short ones (data not shown).

The multinomial logistic regression analysis showed that diagnosis was the strongest determinant for all SA trajectories obtained. Compared with episodes due to infectious diseases, individuals who had SA due to mental disorders showed a higher risk to increase accumulated days on SA over time than to develop a low stable trajectory (adjusted OR (aOR): 33.52; 95% CI 16.40 to 68.51 and aOR: 34.09; 95% CI 10.74 to 108.15 for young and old women, respectively; aOR: 42.40; 95% CI 17.03 to 105.57 for young men). Among old women, SA due to musculoskeletal disorders was associated with an increasing SA trajectory (aOR: 25.35; 95% CI 8.07 to 79.64), while for young men it showed an association with a decreasing SA trajectory (aOR: 34.83; 95% CI 11.06 to 109.73).

Low salary levels were significantly associated with a higher risk of decreased accumulated days of SA over time compared with the low stable SA trajectory among older women (aOR: 2.08; 95% CI 1.36 to 3.18) and men (aOR: 2.75; 95% CI 1.77 to 4.27). A similar but weaker association was found among low salary levels and a higher risk of increasing SA trajectories (aOR: 1.51; 95% CI 1.01 to 2.26 for women and aOR: 1.56; 95% CI 1.11 to 2.19 for men). Unskilled manual occupations were associated with an increasing SA trajectory for young women (aOR: 1.36; 95% CI1.01 to 1.84) (table 4).

DISCUSSION

In this study, three SA trajectories were identified in two birth cohorts of salaried Spanish workers residing in Catalonia during 3 years of follow-up: low-stable, decreasing and increasing accumulated days of SA. We found that the medically certified diagnosis that caused the SA episode was the main factor characterising SA trajectory. More specifically, the increasing trajectory was characterised by a higher proportion of young women who accumulated more days and spells of SA due to mental disorders. Regarding employment conditions, we found that decreasing trajectories had the highest proportion of individuals with low salary levels; the decreasing and low-stable trajectories had the highest proportion of older women with part-time employment. In the association analysis, we found diagnosis to be the strongest determinant for all SA trajectories, particularly SA due to mental disorders with increasing SA trajectories among

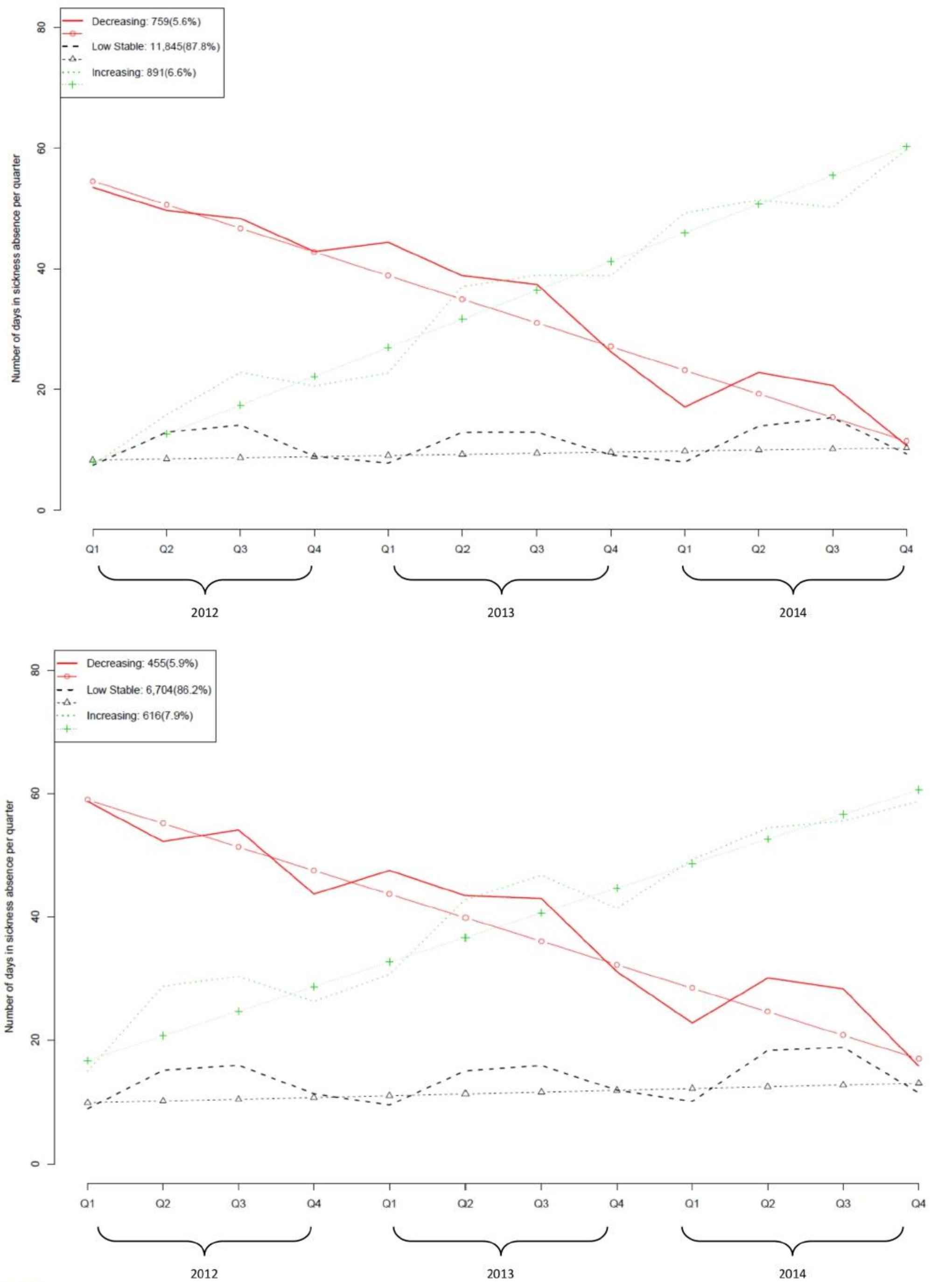

Figure 1 Trajectories of accumulated days of sickness absence per quarter in women born between 1970 to 1990 (n=13 495) or 1949 to 1969 (n=7775). Catalonia, 2012–2014.

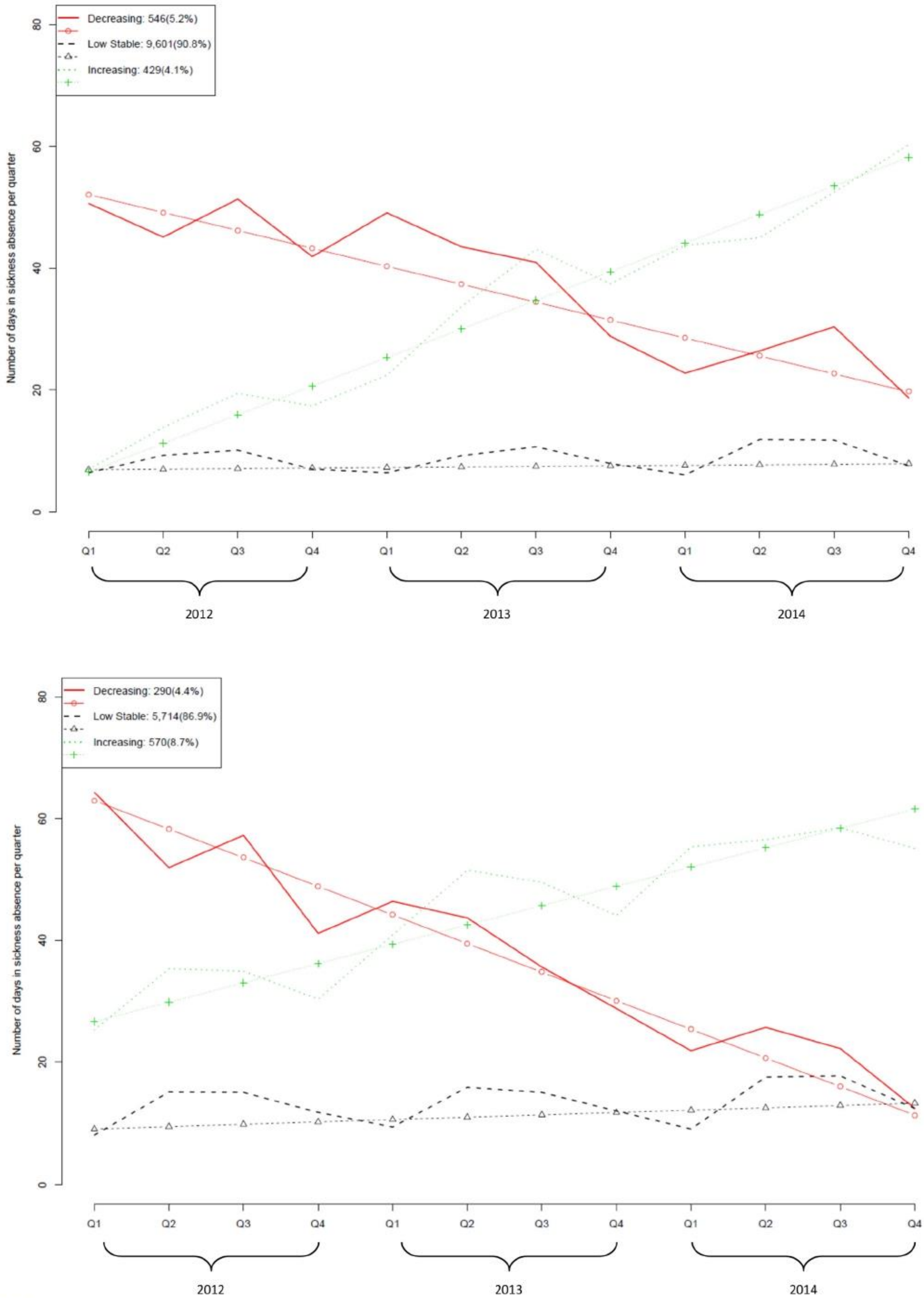

Figure 2 Trajectories of accumulated days of sickness absence per quarter in men born between 1970 to 1990 (n=10 576) or 1949 to 1969 (n=6574). Catalonia, 2012–2014.

Table 1 Description of sickness absence trajectories in salaried women from the WORKss cohort (n=21 270) based on employment conditions and diagnosis group. Catalonia, 2012–2014

	Cohort born 1970–1990 (n=13 495)				Cohort born 1949–1969 (n=7775)			
	Decreasing (5.6%)	Low-stable (87.8%)	Increasing (6.6%)		Decreasing (5.9%)	Low-stable (86.2%)	Increasing (7.9%)	
Women	N (%)	N (%)	N (%)	P value*	N (%)	N (%)	N (%)	P value*
Type of contract								
Permanent contract	572 (75.4)	8737 (73.8)	687 (77.1)	0.063	386 (84.8)	5639 (84.1)	523 (84.9)	0.818
Temporary contract	187 (24.6)	3108 (26.2)	204 (22.9)		69 (15.2)	1065 (15.9)	93 (15.1)	
Working time								
Full-time	474 (62.5)	7717 (65.1)	559 (62.7)	0.313	331 (72.8)	4854 (72.4)	473 (76.8)	0.009
Part-time: >50% up to 99%	196 (25.8)	2814 (23.8)	233 (26.2)		57 (12.5)	1056 (15.8)	71 (11.5)	
≤50%	89 (11.7)	1314 (11.1)	99 (11.1)		67 (14.7)	794 (11.8)	72 (11.7)	
Occupational category								
Skilled non-manual	146 (19.5)	2554 (21.9)	193 (22.2)	0.379	78 (17.6)	1387 (21.2)	105 (17.8)	0.047
Skilled manual	121 (16.2)	1739 (14.9)	136 (15.6)		68 (15.3)	1056 (16.1)	91 (15.5)	
Unskilled non-manual	411 (55.0)	6309 (54.0)	446 (51.3)		211 (47.5)	3022 (46.1)	270 (45.9)	
Unskilled manual	69 (9.2)	1089 (9.3)	95 (10.9)		87 (19.6)	1087 (16.6)	122 (20.8)	
Salary in quartiles								
High	240 (31.7)	3858 (32.6)	299 (33.5)	0.619	120 (26.4)	2061 (30.8)	150 (24.4)	
Middle-high	240 (31.7)	3743 (31.6)	300 (33.7)		121 (26.6)	2156 (32.2)	207 (33.6)	
Middle-low	194 (25.6)	2973 (25.1)	211 (23.7)		130 (28.6)	1632 (24.4)	165 (26.8)	<0.001
Low	83 (11.0)	1266 (10.7)	81 (9.1)		84 (18.5)	850 (12.7)	94 (15.3)	
Diagnosis group (ICD-10)								
Infectious	9 (1.2)	1240 (10.5)	8 (0.8)	<0.001	3 (0.6)	502 (7.5)	3 (0.4)	<0.001
Neoplasms	17 (2.2)	187 (1.6)	22 (2.5)		37 (8.2)	221 (3.3)	28 (4.6)	
Mental	117 (15.4)	792 (6.7)	171 (19.2)		69 (15.2)	511 (7.6)	107 (17.4)	
Cardiovascular	11 (1.5)	178 (1.5)	16 (1.8)		23 (5.1)	170 (2.5)	17 (2.8)	
Respiratory	6 (0.8)	2560 (21.7)	18 (2.0)		20 (4.4)	1483 (22.2)	15 (2.4)	
Digestive	23 (3.0)	554 (4.7)	26 (2.9)		20 (4.4)	340 (5.1)	23 (3.7)	
Musculoskeletal	253 (33.4)	2464 (20.8)	300 (33.7)		131 (28.9)	1374 (20.5)	217 (35.2)	
Pregnancy	107 (14.1)	700 (5.9)	135 (15.2)		5 (1.1)	25 (0.4)	3 (0.5)	
Injuries and poisoning	69 (9.1)	734 (6.2)	63 (7.1)		61 (13.4)	564 (8.4)	85 (13.8)	
Other	146 (19.3)	2417 (20.4)	132 (14.8)		85 (18.7)	1506 (22.5)	118 (19.2)	
Total	759 (100.0)	11 845 (100.0)	891 (100.0)		455 (100.0)	6704 (100.0)	616 (100.0)	

*Missing values in occupational category (OC), income (I) and diagnosis group (DG): N(%) in the cohorts born 1970 to 1990 (decreasing – DG, 3 (0.55); low-stable – OC, 4 (0.04); I, 1 (0.01); DG, 25 (0.26); increasing - OC, 1 (0.23)) and 1949 to 1969 (low-stable – OC, 4 (0.07); DG, 9 (0.16); increasing - OC, 3 (0.52)) by sickness absence trajectory in the period 2012 to 2014. Salary quartiles based on the average individual salary in the cohorts born 1970 to 1990 (high: 63 778€, middle-high: 21 656€, middle-low: 13 630€, low: 6274€) and 1949 to 1969 (high: 81 226€, middle-high: 25 283€, middle-low: 15 701€, low: 8307€) in the period 2012 to 2014.

*χ^2 tests. ICD-10, International Classification of Diseases, 10th revision.

young men. This result is expected, as the SA trajectory is based on accumulated days of SA, which is closely linked to the prognosis of specific diseases.[27] Low salary levels had a higher risk of decreased accumulated days of SA over time and a weaker association for increasing SA trajectories for older women and men, as well as unskilled occupations increasing SA days over time among young women.

Most workers shared a low-stable pattern driven by accumulated SA days due to infectious or respiratory diseases or musculoskeletal disorders, with a mean <20

Table 2 Description of sickness absence trajectories in salaried men from the WORKss cohort (n=17 150) based on employment conditions and diagnosis group. Catalonia, 2012–2014

	Cohort born 1970–1990 (n=10 576)				Cohort born 1949–1969 (n=6574)			
	Decreasing (5.2%)	Low-stable (90.8%)	Increasing (4.1%)		Decreasing (4.4%)	Low-stable (86.9%)	Increasing (8.7%)	
Men	N (%)	N (%)	N (%)	P value*	N (%)	N (%)	N (%)	P value*
Type of contract								
Permanent contract	416 (76.2)	7306 (76.1)	346 (80.6)	0.095	241 (83.1)	4862 (85.1)	476 (83.5)	0.419
Temporary contract	130 (23.8)	2295 (23.9)	83 (19.4)		49 (16.9)	852 (14.9)	94 (16.5)	
Working time								
Full-time	473 (86.6)	8377 (87.2)	365 (85.0)	0.087	256 (88.2)	5187 (90.8)	506 (88.8)	0.079
Part-time: >50% up to 99%	32 (5.9)	648 (6.8)	26 (6.1)		10 (3.5)	184 (3.2)	15 (2.6)	
≤50%	41 (7.5)	576 (6.0)	38 (8.9)		24 (8.3)	343 (6.0)	49 (8.6)	
Occupational category								
Skilled non-manual	57 (10.4)	1269 (13.2)	44 (10.2)	0.094	62 (21.3)	1144 (20.0)	100 (17.6)	0.756
Skilled manual	239 (43.8)	3916 (40.8)	172 (40.2)		113 (39.0)	2323 (40.7)	243 (42.9)	
Unskilled non-manual	160 (29.3)	3009 (31.4)	151 (35.3)		87 (30.0)	1677 (29.4)	162 (28.6)	
Unskilled manual	90 (16.5)	1403 (14.6)	61 (14.3)		28 (9.7)	566 (9.9)	62 (10.9)	
Salary in quartiles								
High	173 (31.7)	3083 (32.1)	143 (33.4)	0.004	66 (22.8)	1565 (27.4)	132 (23.1)	<0.001
Middle-high	152 (27.8)	3171 (33.0)	137 (31.9)		81 (27.9)	1789 (31.3)	177 (31.1)	
Middle-low	142 (26.0)	2455 (25.6)	109 (25.4)		76 (26.2)	1604 (28.1)	154 (27.0)	
Low	79 (14.5)	891 (9.3)	40 (9.3)		67 (23.1)	756 (13.2)	107 (18.8)	
Diagnosis group (ICD-10)								
Infectious	3 (0.5)	1309 (13.7)	5 (1.1)	<0.001	5 (1.6)	413 (7.2)	4 (0.7)	<0.001
Neoplasms	7 (1.3)	60 (0.6)	9 (2.0)		19 (6.6)	120 (2.1)	23 (4.0)	
Mental	80 (14.7)	456 (4.8)	74 (17.3)		24 (8.3)	279 (4.9)	56 (9.8)	
Cardiovascular	16 (3.0)	187 (2.0)	9 (2.1)		27 (9.3)	234 (4.1)	42 (7.4)	
Respiratory	19 (3.5)	2503 (26.1)	14 (3.3)		11 (3.8)	1181 (20.7)	26 (4.6)	
Digestive	32 (5.9)	626 (6.5)	43 (10.0)		22 (7.6)	531 (9.3)	61 (10.7)	
Musculoskeletal	126 (23.2)	1562 (16.3)	92 (21.5)		89 (30.7)	1216 (21.3)	171 (30.0)	
Injuries and poisoning	186 (34.3)	1291 (13.5)	129 (30.1)		36 (12.4)	482 (8.5)	69 (12.1)	
Other	74 (13.6)	1582 (16.5)	54 (12.6)		57 (19.7)	1249 (21.9)	118 (20.7)	
Total	546 (100.0)	9601 (100.0)	429 (100.0)		290 (100.0)	5714 (100.0)	570 (100.0)	

Missing values in occupational category (OC), income (I) and diagnosis group (DG): N(%) in the cohorts born 1970 to 1990 (decreasing - DG, 3(0.55); low-stable – OC, 4 (0.04); I, 1 (0.01); DG, 25 (0.26); increasing – OC, 1 (0.23)) and 1949 to 1969 (low-stable – OC, 4(0.07); DG, 9 (0.16); increasing – OC, 3 (0.52)) by sickness absence trajectory in the period 2012 to 2014. Salary quartiles based on the average individual salary in the cohorts born 1970 to 1990 (high: 78 928€, middle-high: 25 944€, middle-low: 16 710€, low: 7209€) and 1949 to 1969 (high: 99 880€, middle-high: 36 095€, middle-low: 23 227€, low: 14 171€) in the period 2012 to 2014.
*χ^2 tests. ICD-10, International Classification of Diseases, 10th revision.

accumulated days of SA each quarter. These diagnosis groups included pathologies that usually represent acute disease processes that lead to short-term SA episodes.[28] We identified, especially among young workers, a small but not negligible group with increased accumulated days of SA due mainly to mental disorders, followed by musculoskeletal disorders. SAs due to mental health problems have continuously increased in recent years and shown

Table 3 Distribution of SA closed episodes (n=75 212) across sickness absence trajectories by diagnosis groups in the WORKss cohort (n=38 420). Catalonia, 2012–2014

	SA episodes, cohort born 1970–1990 (n=27794)				SA episodes, cohort born 1949–1969 (n=15665)			
	Decreasing (6%)	Low-stable (86.6%)	Increasing (7.4%)		Decreasing (6.1%)	Low-stable (85.1%)	Increasing (8.8%)	
Women	**Episodes (%)**	**Episodes (%)**	**Episodes (%)**	**P value**	**Episodes (%)**	**Episodes (%)**	**Episodes (%)**	**P value**
Diagnosis group (ICD-10)								
Infectious	124 (7.4)	3547 (14.7)	162 (8.0)	<0.01*	33 (3.4)	1446 (10.8)	66 (4.7)	<0.01†
Neoplasms	22 (1.3)	262 (1.0)	38 (1.9)		59 (6.2)	328 (2.5)	40 (2.9)	
Blood	14 (0.8)	48 (0.2)	4 (0.2)		2 (0.2)	30 (0.2)	5 (0.4)	
Metabolism	13 (0.8)	84 (0.4)	13 (0.6)		5 (0.5)	68 (0.5)	7 (0.5)	
Mental	191 (11.4)	1295 (5.4)	268 (13.0)		113 (11.8)	871 (6.6)	197 (14.2)	
Neurological	26 (1.6)	467 (1.9)	39 (1.9)		25 (2.6)	318 (2.4)	65 (4.7)	
Eyes	12 (0.7)	241 (1.0)	12 (0.6)		15 (1.6)	275 (2.1)	23 (1.7)	
Ear	11 (0.7)	330 (1.4)	15 (0.7)		14 (1.5)	292 (2.2)	21 (1.5)	
Cardiovascular	24 (1.4)	260 (1.1)	32 (1.6)		35 (3.7)	287 (2.2)	34 (2.5)	
Respiratory	155 (9.3)	5844 (24.4)	243 (11.8)		95 (9.9)	3181 (24.0)	149 (10.8)	
Digestive	73 (4.4)	1378 (5.7)	88 (4.3)		39 (4.1)	782 (5.9)	54 (3.9)	
Skin	10 (0.6)	247 (1.0)	12 (0.6)		4 (0.4)	149 (1.1)	9 (0.6)	
Musculoskeletal	415 (24.8)	3934 (16.4)	465 (22.6)		274 (28.6)	2473 (18.6)	427 (30.8)	
Urogenital	136 (8.1)	1143 (4.8)	82 (4.0)		36 (3.8)	526 (4.0)	51 (3.7)	
Pregnancy	160 (9.6)	1120 (4.7)	230 (11.2)		6 (0.6)	39 (0.3)	6 (0.4)	
Perinatal	4 (0.2)	12 (0.1)	–		–	1 (0.0)	–	
Congenital	5 (0.3)	23 (0.1)	3 (0.1)		2 (0.2)	11 (0.1)	4 (0.3)	
Other symptoms	141 (8.4)	2363 (9.8)	201 (9.8)		70 (7.3)	1183 (8.9)	90 (6.5)	
Injuries and poisoning	101 (6.0)	1119 (4.7)	126 (6.1)		98 (10.2)	814 (6.1)	119 (8.6)	
External causes	26 (1.6)	215 (0.9)	17 (0.8)		33 (3.4)	170 (1.3)	16 (1.2)	
Health services	10 (0.6)	63 (0.3)	5 (0.2)		–	33 (0.2)	2 (0.1)	
Total	1673 (100.0)	23995 (100.0)	2055 (100.0)		958 (100.0)	13277 (100.0)	1385 (100.0)	
	SA episodes, cohort born 1970–1990 (n=20200)				**SA episodes, cohort born 1949–1969 (n=11553)**			
	Decreasing (4.9%)	**Low-stable (89.9%)**	**Increasing (5.2%)**		**Decreasing (5.1%)**	**Low-stable (86.3%)**	**Increasing (8.6%)**	
Men	**Episodes (%)**	**Episodes (%)**	**Episodes (%)**	**P value**	**Episodes (%)**	**Episodes (%)**	**Episodes (%)**	**P value**
Diagnosis group (ICD-10)								
Infectious	69 (7.1)	3195 (17.6)	89 (8.3)	<0.01†	35 (6.0)	971 (9.7)	23 (2.4)	<0.01†
Neoplasms	13 (1.4)	88 (0.5)	28 (2.6)		30 (5.1)	179 (1.8)	34 (3.4)	
Blood	–	10 (0.1)	–		1 (0.2)	8 (0.1)	6 (0.6)	
Metabolism	4 (0.4)	30 (0.2)	8 (0.8)		7 (1.2)	49 (0.5)	10 (1.0)	
Mental	116 (11.8)	736 (4.1)	133 (12.5)		49 (8.4)	483 (4.9)	92 (9.3)	
Neurological	10 (1.0)	265 (1.5)	29 (2.7)		43 (7.3)	104 (1.0)	20 (2.0)	

Continued

Table 3 Continued								
	SA episodes, cohort born 1970–1990 (n=20200)				SA episodes, cohort born 1949–1969 (n=11553)			
	Decreasing (4.9%)	Low-stable (89.9%)	Increasing (5.2%)		Decreasing (5.1%)	Low-stable (86.3%)	Increasing (8.6%)	
Men	Episodes (%)	Episodes (%)	Episodes (%)	P value	Episodes (%)	Episodes (%)	Episodes (%)	P value
Eyes	9 (0.9)	231 (1.3)	16 (1.5)		12 (2.0)	244 (2.5)	23 (2.3)	
Ear	10 (1.0)	206 (1.1)	9 (0.8)		6 (1.0)	173 (1.7)	10 (1.0)	
Cardiovascular	25 (2.5)	259 (1.4)	13 (1.2)		38 (6.5)	343 (3.4)	58 (5.9)	
Respiratory	83 (8.4)	4904 (27.1)	142 (13.3)		37 (6.3)	2198 (22.1)	83 (8.4)	
Digestive	68 (6.9)	1267 (7.0)	83 (7.8)		38 (6.5)	871 (8.7)	91 (9.2)	
Skin	14 (1.4)	327 (1.8)	23 (2.2)		3 (0.5)	141 (1.4)	10 (1.0)	
Musculoskeletal	225 (22.9)	2693 (14.9)	214 (20.1)		153 (26.1)	2052 (20.6)	311 (31.4)	
Urogenital	13 (1.3)	422 (2.3)	17 (1.6)		14 (2.4)	425 (4.3)	27 (2.7)	
Congenital	3 (0.3)	17 (0.1)	1 (0.1)		–	10 (0.1)	2 (0.2)	
Other symptoms	64 (6.5)	1511 (8.3)	67 (6.3)		38 (6.5)	877 (8.8)	82 (8.3)	
Injuries and poisoning	235 (23.9)	1768 (9.8)	185 (17.4)		63 (10.8)	654 (6.6)	91 (9.2)	
External causes	23 (2.3)	121 (0.7)	6 (0.6)		17 (2.9)	145 (1.5)	15 (1.5)	
Health services	–	40 (0.2)	2 (0.2)		2 (0.3)	29 (0.3)	2 (0.2)	
Total	984 (100.0)	18090 (100.0)	1065 (100.0)		586 (100.0)	9956 (100.0)	990 (100.0)	

Missing values: Episodes (%) in the cohorts born 1970 to 1990 (women: decreasing, 1 (0.06); low-stable, 67 (0.27); increasing, 3 (0.14); men: decreasing, 3 (0.30); low-stable, 58 (0.32)) and 1949 to 1969 (women: decreasing, 1 (0.10); low-stable, 41 (0.31); increasing, 3 (0.22); men: decreasing, 2 (0.34); low-stable, 17 (0.17); increasing, 2 (0.20)) by sickness absence trajectory in the period 2012 to 2014.
Episodes: sickness absence episodes with closure date.
*χ^2 tests.
†Fisher exact tests with Monte Carlo simulations.
ICD-10, International Classification of Diseases, 10th revision; SA, sickness absence.

Table 4 Association between employment conditions and diagnosis group with sickness absence trajectories in salaried workers from the WORKss cohort (n=38420). Catalonia (Spain), 2012–2014

	Sickness absence trajectories[a]							
	Women				Men			
	Cohort: 1970–1990 (n=13 495)		Cohort: 1949–1969 (n=7775)		Cohort: 1970–1990 (n=10 576)		Cohort: 1949–1969 (n=6574)	
	Decreasing vs low stable	Increasing vs low stable	Decreasing vs low stable	Increasing vs low stable	Decreasing vs low stable	Increasing vs low stable	Decreasing vs low stable	Increasing vs low stable
	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)
Type of contract								
Permanent contract	1	1	1	1	1	1	1	1
Temporary contract	0.98 (0.81 to 1.19)	0.97 (0.81 to 1.17)	0.80 (0.60 to 1.07)	0.83 (0.64 to 1.07)	0.87 (0.69 to 1.10)	0.79 (0.60 to 1.03)	0.82 (0.57 to 1.19)	0.85 (0.64 to 1.12)
Working time								
Full-time	1	1	1	1	1	1	1	1
Part-time: >50% up to 99%	1.11 (0.92 to 1.33)	1.18 (1.00 to 1.40)	0.62 (0.45 to 0.85)	0.62 (0.46 to 0.82)	0.78 (0.53 to 1.16)	0.94 (0.62 to 1.45)	0.82 (0.41 to 1.62)	0.80 (0.46 to 1.40)
≤50%	1.08 (0.83 to 1.41)	1.22 (0.95 to 1.57)	0.84 (0.59 to 1.19)	0.82 (0.60 to 1.14)	0.87 (0.60 to 1.26)	1.53 (1.03 to 2.27)	1.13 (0.69 to 1.86)	1.42 (0.99 to 2.04)
Salary in quartiles								
High	1	1	1	1	1	1	1	1
Middle-high	1.02 (0.83 to 1.25)	1.03 (0.85 to 1.24)	0.99 (0.73 to 1.34)	1.33 (1.02 to 1.74)	0.81 (0.64 to 1.03)	0.88 (0.68 to 1.14)	1.27 (0.88 to 1.83)	1.16 (0.90 to 1.51)
Middle-low	1.02 (0.81 to 1.30)	0.83 (0.66 to 1.04)	1.56 (1.12 to 2.17)	1.48 (1.09 to 2.01)	1.00 (0.76 to 1.30)	0.86 (0.64 to 1.15)	1.42 (0.96 to 2.11)	1.13 (0.85 to 1.49)
Low	1.03 (0.74 to 1.44)	0.65 (0.47 to 0.92)	2.08 (1.36 to 3.18)	1.51 (1.01 to 2.26)	1.60 (1.12 to 2.29)	0.82 (0.52 to 1.29)	2.75 (1.77 to 4.27)	1.56 (1.11 to 2.19)
Occupational category								
Skilled non-manual	1	1	1	1	1	1	1	1
Skilled manual	1.21 (0.91 to 1.60)	1.17 (0.90 to 1.53)	0.88 (0.59 to 1.31)	0.83 (0.58 to 1.18)	1.28 (0.93 to 1.77)	1.26 (0.88 to 1.81)	0.70 (0.48 to 1.02)	1.09 (0.82 to 1.45)
Unskilled non-manual	1.17 (0.94 to 1.45)	1.01 (0.83 to 1.23)	1.08 (0.79 to 1.48)	0.94 (0.71 to 1.24)	1.12 (0.81 to 1.56)	1.44 (1.00 to 2.06)	0.78 (0.54 to 1.12)	1.00 (0.76 to 1.33)
Unskilled manual	1.07 (0.77 to 1.51)	1.36 (1.01 to 1.84)	1.00 (0.67 to 1.49)	1.08 (0.76 to 1.53)	1.24 (0.84 to 1.83)	1.32 (0.85 to 2.05)	0.57 (0.34 to 0.97)	1.04 (0.71 to 1.53)
Diagnosis group (ICD-10)								
Infectious	1	1	1	1	1	1	1	1
Neoplasms	11.92 (5.19 to 27.39)	17.12 (7.47 to 39.25)	28.78 (8.77 to 94.44)	19.49 (5.82 to 65.28)	51.91 (13.09 to 205.93)	38.56 (12.52 to 118.71)	12.40 (4.52 to 34.02)	19.24 (6.52 to 56.77)
Mental	20.11 (10.14 to 39.86)	33.52 (16.40 to 68.51)	21.61 (6.75 to 69.19)	34.09 (10.74 to 108.15)	75.97 (23.87 to 241.82)	42.40 (17.03 to 105.57)	6.75 (2.54 to 17.94)	20.69 (7.41 to 57.74)
Cardiovascular	8.76 (3.58 to 21.46)	13.05 (5.45 to 31.26)	20.84 (6.15 to 70.59)	15.33 (4.41 to 53.32)	38.06 (10.98 to 131.97)	12.15 (4.03 to 36.67)	9.13 (3.46 to 24.06)	18.47 (6.54 to 52.19)
Respiratory	0.32 (0.11 to 0.91)	1.08 (0.47 to 2.49)	2.33 (0.69 to 7.87)	1.61 (0.46 to 5.63)	3.36 (0.99 to 11.38)	1.45 (0.52 to 4.03)	0.77 (0.26 to 2.22)	2.27 (0.79 to 6.53)
Digestive	5.45 (2.49 to 11.92)	6.72 (3.00 to 15.05)	8.05 (2.33 to 27.88)	11.44 (3.41 to 38.42)	22.38 (6.83 to 73.39)	17.70 (6.98 to 44.93)	3.34 (1.25 to 8.90)	11.47 (4.13 to 31.84)
Musculoskeletal	14.24 (7.30 to 27.80)	18.33 (9.05 to 37.14)	15.91 (5.04 to 50.23)	25.35 (8.07 to 79.64)	34.83 (11.06 to 109.73)	15.17 (6.15 to 37.44)	5.94 (2.40 to 14.74)	14.31 (5.27 to 38.81)
Pregnancy	21.46 (10.79 to 42.71)	28.56 (13.89 to 58.72)	37.41 (8.41 to 166.35)	21.79 (4.17 to 113.89)	N/A	N/A	N/A	N/A
Injuries and poisoning	12.45 (6.16 to 25.14)	12.84 (6.11 to 26.99)	18.23 (5.68 to 58.51)	24.71 (7.75 to 78.74)	62.66 (19.97 to 196.60)	25.29 (10.31 to 62.01)	6.18 (2.40 to 15.93)	14.87 (5.38 to 41.12)
Other	8.22 (4.17 to 16.17)	8.26 (4.03 to 16.94)	9.32 (2.93 to 29.62)	12.38 (3.91 to 39.15)	20.33 (6.39 to 64.64)	8.82 (3.52 to 22.12)	3.64 (1.45 to 9.16)	9.40 (3.45 to 25.63)

aOR, adjusted OR; ICD-10, International Classification of Diseases, 10th revision; N/A, not available.

in a UK study to be the main medical diagnosis of long-term SA, above musculoskeletal disorders.[12] Common mental disorders, such as anxiety and depression, are strong predictors of long-term and recurrent SA, and they affect health over an extended period.[29] A Finnish study investigating SA trajectories preceding disability retirement showed that patients belonging to the high-stable SA trajectory were more likely to retire because of common mental disorders.[27] Recently, sociodemographic factors, morbidity characteristics and employment status were found to be predictors of work disability trajectory among workers struggling with long-lasting SA depressive episodes.[22] In our study, the increasing trajectory revealed a concerning group of workers who had a continuously increasing number of days out of work due to mental health-related diagnoses. Facing an unbalanced relationship between mental health limitations and work-related demands may be a cause of a delayed return to work, with recurrent SA episodes and steadily accumulating SA days over time. We found this pattern to be more noticeable among all women and young men. A further step should be to investigate the in depth patterns of SA due to mental diagnoses and its predictors among the young-middle age working population. Our study took a broad approach to examining the general picture of SA patterns over time among a Spanish working population; a diagnosis-specific approach would help disentangle SA trajectories more accurately. However, as we included the total number of SA episodes, our study accounts for SA recurrence, but only for the 3 years of follow-up.

Mental disorders and musculoskeletal disorders are the leading causes of long-term SA.[30] In general, approximately one in four SA episodes are due to musculoskeletal disorders.[31] Similarly, we found musculoskeletal disorders distributed across the two non-stable trajectories. In a prior study, high-stable work absence patterns were strongly associated with the number of pain sites in middle-aged workers.[18] Workers belonging to this trajectory likely had more severe, long-lasting musculoskeletal pathologies and accumulated multiple pain locations. In contrast, those in the decreasing and low-stable patterns may have had SA episodes due to other isolated, acute and short-term specific musculoskeletal diagnoses, such as cervical or low back pain. As physical and mental ill-health are associated, musculoskeletal disorders may also be considered as a somatisation of a mental health problems or co-occur with a diagnosed mental pathology,[32 33] leading to a limited health status that accumulates long periods of SA.[34]

We found that, apart from salary, employment conditions did not define the SA patterns. However, a higher proportion of workers with low salary had a decreased number of days of SA over time compared with the other two SA patterns. Disincentives related to SA benefits payment regulation could partially explain this result. In Spain, entitlement to SA benefits starts the fourth sick day, with a maximum duration of 1 year, and an extension of 6 months if recovery is expected during this period. The amount of SA benefit varies between 60% and 75% of the salary for private sector employees; the employer pays from the 4th to 15th day and the Social Security system from the 16th day onwards.[35 36] It is likely that loss of economical resources, particularly among workers with the lowest salaries, encourage them to return to work earlier, reducing the number of days of SA and receiving a reduced income from benefits. Second, perceived insecurity associated with more precarious employment conditions could lead to a fear of dismissal.[37] Changes in labour market regulations in 2012 in Spain led to more flexible labour relationships, which has contributed to an increase in unstable workplaces and perceived insecurity.[38] The association analysis showed that low salary was a determinant of both decreasing and increasing SA trajectory among older workers. A possible explanation for a decreasing number of days of SA, as mentioned above, may be presenteeism (ie, to attend to work while sick) due to reduced economical coverage of the SA provision. Along these lines, a US study found that more than half of workers went to work sick due to a lack in coverage of paid SA.[39] In addition, presenteeism could affect older workers more because of higher perceived job insecurity, as they know that in the case of job loss their chances of getting a new job are reduced compared with their younger counterparts. On the other hand, increased SA days related to low salary may be explained because workers postpone the onset of the SA episode as much as possible to maintain their full salary, while the existing health problem becomes more severe and the SA becomes longer. Similarly, a comorbidity could arise during an SA, which could lead to a long-term SA, especially in the case of mental or musculoskeletal disorders with one or more co-diagnoses.[34] In addition, it is possible that, to a lesser extent, the replacement rate for long-term SA episodes (representing 75% of the salary from day 21 onwards in Spain) may be an incentive to lengthen the SA. Some studies have shown that increases in the generosity of the SA provision are related to increases in SA duration, and that this increase does not translate into an improvement in employee health.[40 41] However, another study showed that generous SA benefits are related to a decrease in the number of days of SA in the long-term, which supports that no incentive exists to extend SA longer than strictly necessary for medical reasons.[4]

A large body of prior research has found worst health outcomes for temporary workers,[42–44] but our study showed that employment conditions, such as type of contract, working time and occupational category, did not differ across SA patterns. One limitation to consider is a potential selection bias when classifying workers into categories of employment conditions. We classified individuals based on the employment condition in which they spent the most time. However, a person who was mainly employed with a permanent contract during the follow-up could, for example, accumulate more days on SA while employed as a temporary worker. This may lead to an underestimation of the relationship between employment conditions and SA patterns. Similarly, information related to working-related conditions, health-related behaviours, healthcare consumption and family structure that would be worth considering to identify and describe SA patterns were not available. In addition, accounting for the effect of baseline health status prior to the SA follow-up was not possible because of the lack of health-related data and prior SA episodes. Finally, SA episodes without a closure date were not included in the study; thus, we were not accounting for some ongoing long-term episodes and may have underestimated accumulated days of SA.

Our findings are likely to be relevant to other working populations. The data came from a high-quality administrative registry that provides a large representative sample of the working population appropriated for the aim of our study. Health-related data derived from medical diagnosis certifications conducted by general physicians from the National Health Service provides a higher validity of results compared with self-reported SA measures, as shown in other studies.[45] In addition, selection of the two birth cohorts allowed us to control for the potential effects of age and contextual factors on SA behaviour, as each cohort includes individuals that share similar socioeconomic characteristics and labour market regulation contexts.

Our results from the trajectory analysis may be useful for guiding occupational health professionals in the more accurate identification of individuals who need support to maintain their work ability and facilitate their return to work. As mental disorders seem to drive a pattern of increasing SA, early detection of workers at risk of mental disorders would help in developing more tailored interventions to deal with and prevent mental health problems in future working life, especially among young workers. Future research should focus on patterns of SA by diagnosis groups and specific pathologies over time. Special attention is warranted on the course of mental disorders among young and middle-aged workers.

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REFERENCES

1. Marmot M, Feeney A, Shipley M, *et al*. Sickness absence as a measure of health status and functioning: from the UK Whitehall II study. *J Epidemiol Community Health* 1995;49:124–30.
2. International Labour Organization. The Future of Work We Want: A global dialogue. 2017 http://socialprotection-humanrights.org/wp-content/uploads/2017/10/The-Future-of-Work-We-Want_2017.pdf (Accessed 8 Jul 2018).
3. Ministerio de Empleo y Seguridad Social. Incapacidad temporal. 2015 http://www.seg-social.es/prdi00/groups/public/documents/binario/47197.pdf (Accessed 21 Feb 2017).
4. Sjöberg O. Positive welfare state dynamics? Sickness benefits and sickness absence in Europe 1997-2011. *Soc Sci Med* 2017;177:158–68.
5. OECD. Health at a Glance: Europe 2016 State of Health in the EU Cycle. 2016 https://ec.europa.eu/health/sites/health/files/state/docs/health_glance_2016_rep_en.pdf (Accessed 10 April 2017).
6. Allebeck P, Mastekaasa A. Chapter 5. Risk factors for sick leave - general studies. *Scand J Public Health* 2004;32(63_suppl):49–108.
7. Wang M, Mittendorfer-Rutz E, Dorner TE, *et al*. Determinants of work disability following lumbar spine decompression surgery. *Scand J Public Health* 2019;47.
8. Goorts K, Rusu D, Vandenbroeck S, *et al*. 790 Predicting long-term sickness absence and supporting return-to work processes using questionnaires. *Occupational and Environmental Medicine* 2018;75:A555–A556.
9. Ubalde-Lopez M, Delclos GL, Benavides FG, *et al*. Measuring multimorbidity in a working population: the effect on incident sickness absence. *Int Arch Occup Environ Health* 2016;89:667–78.
10. Dekkers-Sánchez PM, Hoving JL, Sluiter JK, *et al*. Factors associated with long-term sick leave in sick-listed employees: a systematic review. *Occup Environ Med* 2008;65:153–7.
11. Arcas MM, Delclos GL, Torá-Rocamora I, *et al*. Gender differences in the duration of non-work-related sickness absence episodes due to musculoskeletal disorders. *J Epidemiol Community Health* 2016;70:1065–73.
12. Gabbay M, Shiels C, Hillage J. Factors associated with the length of fit note-certified sickness episodes in the UK. *Occup Environ Med* 2015;72:467–75.
13. Alba-Ramirez A, López-Mourelo E. Sickness absence from work in Spain: are there gender differences? *Universidad Carlos III de Madrid Working papers* 2017:17–15 http://hdl.handle.net/10016/25937 (Accessed 12 March 2019).
14. Akerstedt T, Kecklund G, Selén J. Disturbed sleep and fatigue as predictors of return from long-term sickness absence. *Ind Health* 2010;48:209–14.
15. Johnsson A, Fornander T, Rutqvist LE, *et al*. Predictors of return to work ten months after primary breast cancer surgery. *Acta Oncol* 2009;48:93–8.
16. Amick BC, McLeod CB, Bültmann U. Labor markets and health: an integrated life course perspective. *Scand J Work Environ Health* 2016;42:346–53.
17. Virtanen P, Siukola A, Lipiäinen L, *et al*. Trajectory analyses of sickness absence among industrial and municipal employees. *Occup Med* 2017;67:109–13.
18. Haukka E, Kaila-Kangas L, Ojajärvi A, *et al*. Pain in multiple sites and sickness absence trajectories: a prospective study among Finns. *Pain* 2013;154:306–12.
19. Feleus A, Miedema HS, Bierma-Zeinstra SM, *et al*. Sick leave in workers with arm, neck and/or shoulder complaints; defining occurrence and discriminative trajectories over a 2-year time period. *Occup Environ Med* 2017;74:114–22.
20. Haukka E, Kaila-Kangas L, Luukkonen R, *et al*. Predictors of sickness absence related to musculoskeletal pain: a two-year follow-up study of workers in municipal kitchens. *Scand J Work Environ Health* 2014;40:278–86.

21. Wang M, Vaez M, Dorner TE, *et al*. Trajectories and characteristics of work disability before and after acute myocardial infarction. *Heart* 2018;104:340–8.
22. Farrants K, Friberg E, Sjölund S, *et al*. Work disability trajectories among individuals with a sick-leave spell due to depressive episode≥21 days: A prospective cohort study with 13-month follow up. *J Occup Rehabil* 2018;28:678–90.
23. López Gómez MA, Durán X, Zaballa E, *et al*. Cohort profile: the Spanish WORKing life Social Security (WORKss) cohort study. *BMJ Open* 2016;6:e008555.
24. Nylund KL, Asparouhov T, Muthén BO. Deciding on the number of classes in latent class analysis and growth mixture modeling: A monte carlo simulation study. *Structural Equation Modeling: A Multidisciplinary Journal* 2007;14:535–69.
25. van de Schoot R, Sijbrandij M, Winter SD, *et al*. The GRoLTS-Checklist: Guidelines for Reporting on Latent Trajectory Studies. *Struct Equ Model* 2017;24:451–67.
26. World Health Organization. International Statistical Classification of Diseases and Related Health Problems 10th Revision. 2010;2 https://www.who.int/classifications/icd/ICD10Volume2_en_2010.pdf Accessed 12 Dec 2018.
27. Laaksonen M, Blomgren J, Gould R. Sickness allowance trajectories preceding disability retirement: a register-based retrospective study. *Eur J Public Health* 2016;26:1050–5.
28. Delclós J, Gimeno D, Torá I, *et al*. [Distribution of the duration of nonoccupational sick leave by medical diagnosis (Catalonia, Spain, 2006-2008)]. *Gac Sanit* 2013;27:81–3.
29. Savikko A, Alexanderson K, Hensing G. Do mental health problems increase sickness absence due to other diseases? *Soc Psychiatry Psychiatr Epidemiol* 2001;36:310–6.
30. Wise J. Audit finds large variations in NHS staff sick days. *BMJ* 2011;342:d953.
31. McGee R, Bevan S, Quadrello T. Fit For Work? Musculoskeletal Disorders and the Dutch Labour Market. The Work Foundation 2009.
32. Benjamin S, Morris S, McBeth J, Beth JMC, *et al*. The association between chronic widespread pain and mental disorder: A population-based study. *Arthritis & Rheumatism* 2000;43:561–7.
33. Currie SR, Wang J. Chronic back pain and major depression in the general Canadian population. *Pain* 2004;107:54–60.
34. Ubalde-López M, Delclos GL, Calvo E, *et al*. Influence of new secondary diagnoses on the duration of non-work-related sickness absence episodes. *J Occup Environ Med* 2013;55:460–4.
35. Ministerio de Empleo y Seguridad Social. Procedimiento de gestión de la prestación de Incapacidad Temporal. 2017 http://www.seg-social.es/wps/portal/wss/internet/InformacionUtil/44539/44667?changeLanguage=en (Accessed 7 Mar 2017).
36. Real Decreto Legislativo 8/2015, de 30 de octubre, por el que se aprueba el texto refundido de la Ley General de la Seguridad Social. *Boletín Of. del Estado* 2015:103291–103519 http://www.boe.es/boe/dias/2015/10/31/pdfs/BOE-A-2015-11724.pdf (Accessed 28 Feb 2017).
37. Benach J, Vives A, Tarafa G, *et al*. What should we know about precarious employment and health in 2025? Framing the agenda for the next decade of research. *Int J Epidemiol* 2016;45:232–8.
38. Salas-Nicás S, Moncada S, Llorens C, *et al*. Cognitive and Affective Insecurity Related to Remaining Employed and Working Conditions: Their Associations With Mental and General Health. *J Occup Environ Med* 2018;60:e589–94.
39. Susser P, Ziebarth NR. Profiling the U.S. Sick Leave Landscape: Presenteeism among Females. *Health Serv Res* 2016;51:2305–17.
40. Böckerman P, Kanninen O, Suoniemi I. A kink that makes you sick: The effect of sick pay on absence. *J Appl Econ* 2018;33:568–79.
41. Ziebarth NR, Karlsson M. The effects of expanding the generosity of the statutory sickness insurance system. *J Appl Econ* 2014;29:208–30.
42. Virtanen M, Kivimäki M, Joensuu M, *et al*. Temporary employment and health: a review. *Int J Epidemiol* 2005;34:610–22.
43. Waenerlund AK, Virtanen P, Hammarström A. Is temporary employment related to health status? Analysis of the Northern Swedish Cohort. *Scand J Public Health* 2011;39:533–9.
44. Waenerlund AK, Gustafsson PE, Virtanen P, *et al*. Is the core-periphery labour market structure related to perceived health? findings of the Northern Swedish Cohort. *BMC Public Health* 2011;11:956.
45. Hensing G. Chapter 4. Methodological aspects in sickness-absence research. *Scand J Public Health* 2004;32:44–8.

STUDY II

Hernando-Rodriguez JC, Serra L, Benavides FG, Ubalde-Lopez M. Patrones de participación en el mercado laboral en personas con incapacidad temporal en Cataluña, 2002-2011. Revista Internacional de Sociología. Manuscript submitted (20 September 2020).

II

Patrones de participación en el mercado laboral en personas con incapacidad temporal en Cataluña, 2002-2011[1]

Julio Cesar Hernando-Rodriguez. Centro de Investigación en Salud Laboral (CiSAL), Universidad Pompeu Fabra, Barcelona, España; CIBER de Epidemiología y Salud Pública (CIBERESP), Madrid, España; IMIM – Parc Salut Mar, Barcelona, España.
julio.hernando@upf.edu
ORCID iD: http://orcid.org/0000-0003-0878-667X

Laura Serra-Saurina. Grupo de Investigación en Estadística, Econometría y Salud (GRECS), Universidad de Girona, España.
laura.serra@udg.edu
ORCID iD: https://orcid.org/0000-0002-8835-6890

Fernando G. Benavides. Centro de Investigación en Salud Laboral (CiSAL), Universidad Pompeu Fabra, Barcelona, España; CIBER de Epidemiología y Salud Pública (CIBERESP), Madrid, España; IMIM – Parc Salut Mar, Barcelona, España.
fernando.benavides@upf.edu
ORCID iD: https://orcid.org/0000-0003-0747-2660

Monica Ubalde-Lopez. Instituto de Salud Global de Barcelona (ISGlobal), Barcelona, España monica.ubalde@isglobal.org
ORCID iD: https://orcid.org/0000-0002-2037-6377

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Autora de correspondencia
Laura Serra Saurina, PhD
GRECS-Grupo de Investigación en Estadística, Econometría y Salud
Facultad de Ciencias Económicas y Empresariales
Universidad de Girona (UdG)
C/ Universitat de Girona, 10, Girona, España 17071
Número de teléfono: +34 972 418 728
Email: laura.serra@udg.edu

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Patrones de participación en el mercado laboral en personas con incapacidad temporal en Cataluña, 2002-2011

Resumen

La dinámica del mercado laboral afecta al curso de vida laboral de las personas, condicionando el empleo y sus efectos sobre la salud. Estudios previos han investigado la participación en el mercado laboral (PML) de manera longitudinal, aunque pocos han aplicado un enfoque de curso de vida. El objetivo de este estudio es identificar y describir patrones de PML de personas con incapacidad temporal (IT) con una perspectiva de curso de vida en diferentes etapas de vida laboral. Entorno al 70% de las personas con IT tuvieron una vida laboral previa con empleo estable. Al inicio de la crisis económica, las mujeres experimentaron una entrada creciente al mercado laboral con empleos a tiempo parcial, mientras que los hombres salieron del mismo masivamente. Este artículo concluye que identificar patrones laborales a lo largo del curso de vida de las personas puede ayudar a entender la evolución de su estado de salud.

Palabras clave: empleo; seguridad social; recesión económica; análisis de secuencias; estudios de cohorte.

Labour market participation patterns among people on sickness absence in Catalonia, 2002-2011

Abstract

The dynamics of the labour market affects people's working life course, conditioning employment and its effects on health. Previous studies have investigated labour market participation (LMP) longitudinally, although few have applied a life course approach. The aim of this study is to identify and describe LMP patterns among people with sickness absence (SA) from a life course perspective at different working life stages. Around 70% of workers who had SA experienced a previous working life with stable employment. At the beginning of the economic crisis, women experienced a growing entry into the labour market mainly through part-time jobs, while men left it massively. This article concludes that identifying LMP patterns over the people's working life course can help to understand the evolution of their health status.

Keywords: employment; social security; economic recession; sequence analysis; cohort studies.

Introducción

El empleo, definido como trabajo remunerado, formal y con protección social, es un determinante social de la salud (Ruiz Frutos, García, Delclós, & Benavides, 2013). Éste representa la principal fuente de ingresos para la mayoría de la población, a lo que hay que añadir su importancia en la construcción de la identidad individual, y la proyección de la creatividad de las personas (Billett & Somerville, 2004; Mirowsky, 2011). Por supuesto, el empleo en condiciones precarias es fuente de malestar, alienación y enfermedad (Benach et al., 2014).

Al igual que en todo el mundo, el empleo en España está experimentando profundos cambios, consecuencia de factores demográficos, tecnológicos, socioeconómicos y políticos. El incremento continuado de la esperanza de vida al nacer, 83 años en 2019 en España (Instituto Nacional de Estadística, 2019a), con el consiguiente envejecimiento, un 19% de las personas eran mayores de 64 años en 2019 (Instituto Nacional de Estadística, 2019b), junto con la inmigración (10.7% de personas extranjeras en 2019) (Instituto Nacional de Estadística, 2019c), son retos que tensan el mercado laboral. Por su parte, la revolución tecnológica está transformando la organización de los sistemas productivos a través de la automatización y la robotización de los puestos de trabajo, cuyos efectos aún se desconocen en el empleo (Arntz, Gregory, & Zierahn, 2016). A la vez, la globalización está empujando a la desregulación del mercado laboral, aumentando la frecuencia de entradas y salidas del mismo, así como de largos períodos en desempleo, recibiendo prestaciones o no por parte del sistema de la Seguridad Social

(Organización Internacional del Trabajo, 2017). Por último, la crisis económica de 2008 afectó especialmente al empleo en España, llegando a las tasas de desempleo más altas de la Unión Europea, por encima del 50% de la población joven (15-24 años) en 2012 (un 22% en la Unión Europea), junto a un importante desempleo de larga duración (de 12 meses o más) en mujeres y hombres, que pasó de un 2,5% y 1,1% en 2007 a un 11,6% y 10,8% en 2012, respectivamente(Escribà & Fons, 2014).

Estos cambios se pueden ver reflejados en distintos patrones de participación en el mercado laboral (PML), entendidos como transiciones entre diferentes situaciones de empleo (temporal, parcial o permanente), desempleo e inactividad (sin afiliación a la seguridad social), los cuales, además se suceden en el curso de las diferentes etapas de la vida laboral y que pueden variar según sexo. Así pues, y dada la heterogeneidad de las trayectorias de vida laboral individuales, solo un enfoque de curso de vida (*life course*) a permite identificar y caracterizar, por ejemplo, personas trabajadoras que comparten patrones de PML más inestables o vidas laborales más precarias, y evaluar su relación con la disminución de recursos económicos, menor empleabilidad y peor salud futura (Amick, McLeod, & Bültmann, 2016; Ben-Shlomo & Kuh, 2002; Kuh, Ben-Shlomo, Lynch, Hallqvist, & Power, 2003).

Estudios previos que han investigado la PML, han encontrado que la de las mujeres es cada vez más similar a la de los hombres (Malo & Muñoz-Bullón, 2003). Sin embargo, las mujeres se encuentran con más frecuencia en empleos parciales o fuera del mercado laboral, y los hombres en empleos a jornada completa (Bolano & Haynes, 2016). Junto con factores socioeconómicos, laborales, de género e individuales, la PML puede variar según la etapa de vida laboral. En este sentido, se ha observado que las personas en etapas tempranas de su vida laboral tienen mayor movilidad en su situación laboral comparado con las que están en etapas medias o avanzadas (Malo & Muñoz-Bullón, 2003).

El empleo precario se ha relacionado con una peor salud mental y mayor riesgo de IT de larga duración (Matilla-Santander et al., 2019; Rönnblad et al., 2019; Virtanen, 2005). Sin embargo, no se ha descrito cómo son los patrones previos de PML que podrían conducir a estos resultados en salud. Por ejemplo, en personas con peor salud que podrían acumular mayor número de días en IT. Además, las personas con IT tienen más riesgo de exclusión en el mercado laboral que las que no, ya que aquélla se relaciona con una menor empleabilidad futura (Nwaru, Kivimäki, Pentti, Vahtera, & Virtanen, 2018).

El objetivo de este estudio fue identificar y describir patrones de PML en el período 2002-2011 de personas que acumularon más de 15 días en incapacidad temporal en algún trimestre del período 2012-2014 según condiciones de empleo y categoría ocupacional, considerando tres cohortes según la etapa de la vida laboral en 2002: temprana, media y avanzada.

Material y métodos

Estudio longitudinal basado en una muestra de personas asalariadas afiliadas al régimen general de la Seguridad Social, residentes en Cataluña, con registros de vida laboral en 2002-2011, y que acumularon más de 15 días de incapacidad temporal por contingencia común (ITcc) en algún trimestre del período 2012-2014 (n=11.968). Este último criterio permite analizar aquellas personas con un peor estado de salud y para las que el impacto de la crisis económica en 2008 podría estar afectando más el curso de su vida laboral. La ITcc se midió trimestralmente para reducir la posibilidad de que ésta se debiera a diagnósticos agudos, ya que es más fácil acumular más de 15 días en ITcc por varios episodios agudos a lo largo del año que en un trimestre. Los datos de ITcc fueron proporcionados por el Institut Català d'Avaluacions Mèdiques.

La población de estudio procede de la cohorte WORKss, establecida a partir de la Muestra Continua de Vidas Laborales (MCVL), que incluye anualmente un 4% de las personas que han estado afiliadas a la Seguridad Social española al menos un día cada año desde 2004. La cohorte WORKss permite la reconstrucción de la vida laboral, ya que dispone de registros administrativos como la situación laboral, la categoría profesional o el tipo de contrato, así como las fechas de inicio y final de cada afiliación (López Gómez et al., 2016). Las personas afiliadas residentes en Cataluña incluidas en la MCVL en 2014 representan un 2,6% del total de personas afiliadas en dicha región a finales de 2014 (Ministerio de Empleo y Seguridad Social, n.d.-a, n.d.-b).

La población de estudio se separó por sexo y tres cohortes de nacimiento, para disponer de individuos en distintas etapas de su vida laboral en el año 2002: temprana, entre 18 y 25 años, (n=3.985); media, entre 26 y 35 años, (n=4.486), y avanzada, entre 36 y 45 años (n=3.497).

El estudio fue aprobado por el Comité de Ética Parc de Salut Mar y se realizó bajo los principios de la Declaración de Helsinki. Las personas investigadoras recibieron los datos anonimizados según el protocolo para el intercambio de datos acordado entre la Seguridad Social, el Institut Català d'Avaluacions Mèdiques y el Centro de Investigación de Salud Laboral.

Los patrones de PML se construyeron considerando seis estados laborales medidos semanalmente: empleo, desempleo con subsidio, desempleo con prestación, transición, sin cobertura y sin cobertura de larga duración. El estado *transición* se definió como un período administrativo entre estados que supone la pérdida de cobertura por la Seguridad Social de hasta un máximo de 30 días (López Gómez, Serra, Delclos, & Benavides, 2017). Cuando el período de no afiliación a la Seguridad Social entre estados sobrepasaba los 30 días se denominó estado *sin cobertura*. Si el período de no afiliación se producía al inicio y/o al final del seguimiento se denominó estado *sin cobertura de larga duración*.

Los patrones de PML fueron descritos considerando el tipo de contrato (permanente y temporal), el tipo de jornada laboral (completa, tiempo parcial > 50% hasta 99% y tiempo parcial <=50%), la categoría ocupacional (cualificado no-manual, cualificado manual, no cualificado no-manual y no cualificado manual) (Durán, 2013) y los ingresos (media de ingresos mensuales en cuartiles). Los ingresos incluyen la remuneración del trabajo y la prestación/subsidio por desempleo.

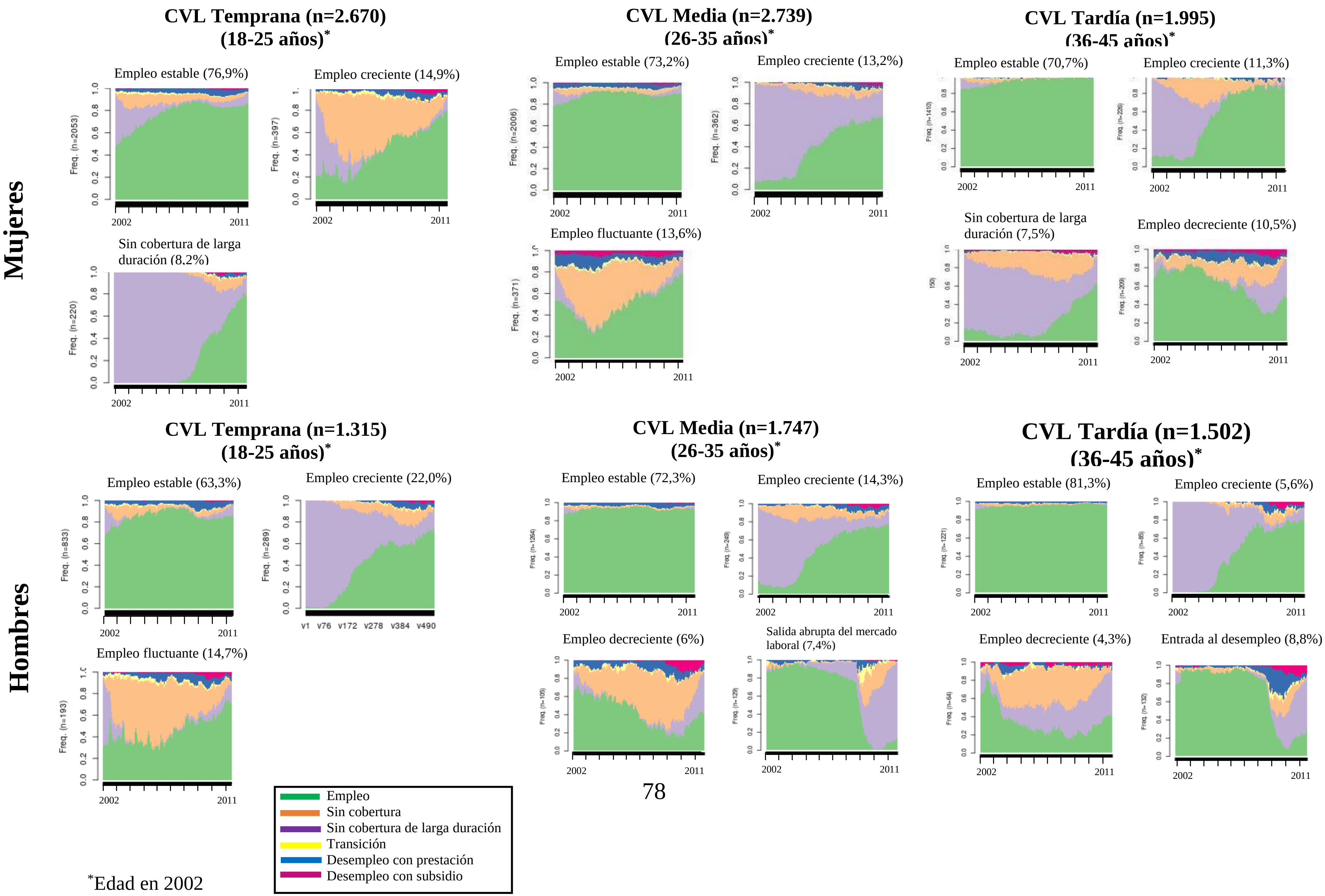
Dado que las personas pueden transitar por distinto tipo de contrato, tipo de jornada y categoría ocupacional a lo largo de su vida laboral, se les asignó aquella categoría en la que había pasado más tiempo durante el período de estudio.

La identificación de los patrones de PML se realizó aplicando el método de análisis de secuencias (*sequence analysis*) que permite describir secuencias de transiciones entre los 6 estados definidos. Mediante el método de emparejamiento óptimo (*optimal matching*) y un posterior análisis de grupos (*clusters*), se agrupan las secuencias que son similares entre ellas (Gabadinho, Ritschard, Müller, & Studer, 2011). La calidad de la agrupación se evaluó con un índice ancho de silueta promedio (*average silhouette width*, ASW) con, un valor mínimo de 0,5 (Studer, 2013).

Resultados

Se identificaron siete patrones de PML: empleo estable (rango de valores si aparece en más de una cohorte: 63,3%-81,3% de la población), empleo creciente (5,6%-22%), sin cobertura de larga duración (7,5%-8,2%), empleo fluctuante (13,6%-14,7%), empleo decreciente (4,3%-10,5%), entrada al desempleo (8,8%), y salida abrupta del mercado laboral (7,4%). El porcentaje de mujeres con un patrón de empleo estable fue más elevado en la cohorte temprana (76,9%), que en la media (73,2%) o la avanzada (70,7%), al contrario que en los hombres (63,3%, 72,3%, y 81,3%, respectivamente). Tanto en las mujeres como en los hombres de las tres cohortes, especialmente en las tempranas, se observó un patrón de empleo creciente (14,9% y 22%, respectivamente) (Figura 1).

Figura 1. Patrones de participación en el mercado laboral (PML) en personas afiliadas a la seguridad social residentes en Cataluña, pertenecientes a tres cohortes de vida laboral (CVL) y que acumularon más de 15 días de incapacidad temporal por trimestre entre 2012-2014 (N=11.968), Cataluña 2002-2011.



Las mujeres de la cohorte temprana con un patrón de empleo creciente, a medida que se incorporaban al mercado laboral transitaron con frecuencia a situaciones sin cobertura. Las mujeres de la cohorte media mostraron un patrón de empleo fluctuante caracterizado por entradas y salidas sin cobertura o al desempleo. Tanto en las mujeres de la cohorte temprana como en la avanzada, se observó un patrón predominante sin cobertura de larga duración.

En el patrón de empleo creciente de las mujeres de la cohorte temprana se observó una mayor proporción de ocupadas en empleos con jornadas parciales (27,7%) comparado con las que siguieron un patrón de empleo estable (14,7%). En las mujeres de las cohortes temprana y avanzada, el patrón sin cobertura de larga duración mostró una mayor proporción de trabajadoras con empleos temporales (48,6% y 47,7%), jornadas parciales (45,7% sólo en la cohorte avanzada), ocupaciones no cualificadas manuales (23,6% y 41,7%) e ingresos bajos (40,8% y 54%) comparado con los demás patrones (tabla 1).

Tabla 1. Distribución de mujeres asalariadas de las cohortes de vida laboral (CVL) temprana, media y avanzada (N=7.404) con más de 15 días acumulados en incapacidad temporal por trimestre entre 2012-2014, según grupos de participación en el mercado laboral y tipo de contrato, tipo de jornada, categoría ocupacional e ingresos. Cataluña 2002-2011.

Mujeres	CVL Temprana (N=2.670)				CVL Media (N=2.739)				CVL Avanzada (N=1.995)				
	Empleo estable (76,9%)	**Empleo creciente (14,9%)**	**Sin cobertura de larga duración (8,2%)**		**Empleo estable (73,2%)**	**Empleo creciente (13,2%)**	**Empleo fluctuante (13,6%)**		**Empleo estable (70,7%)**	**Empleo creciente (11,3%)**	**Sin cobertura de larga duración (7,5%)**	**Empleo decreciente (10,5%)**	
	N (%)	N (%)	N (%)	p-valor[a]	N (%)	N (%)	N (%)	p-valor[a]	N (%)	N (%)	N (%)	N (%)	p-valor[a]
Tipo de contrato													
Contrato permanente	1.612 (78,8)	221 (55,7)	93 (51,4)	<0,001	1.711 (85,6)	217 (65,0)	231 (62,6)	<0,001	1.262 (90,3)	164 (74,9)	69 (52,3)	153 (74,3)	<0,001
Contrato temporal	435 (21,3)	176 (44,3)	88 (48,6)		289 (14,5)	117 (35,0)	138 (37,4)		135 (9,7)	55 (25,1)	63 (47,7)	53 (25,7)	
Tipo de jornada													
Completa	1.752 (85,3)	287 (72,3)	171 (77,7)	<0,001	1.669 (83,2)	261 (72,3)	252 (67,9)	<0,001	1.187 (84,2)	152 (67,3)	81 (54,4)	158 (75,6)	<0,001
Parcial: > 50%-99%	217 (10,6)	54 (13,6)	23 (10,5)		250 (12,5)	55 (15,2)	61 (16,4)		147 (10,4)	33 (14,6)	28 (18,8)	20 (9,6)	
≤ 50%	84 (4,1)	56 (14,1)	26 (11,8)		87 (4,3)	45 (12,5)	58 (15,6)		76 (5,4)	41 (18,1)	40 (26,9)	31 (14,8)	
Categoría ocupacional													
Cualificado No-Manual	402 (19,6)	110 (27,7)	36 (19,8)	<0,001	473 (23,6)	48 (14,3)	55 (14,9)	<0,001	278 (19,8)	16 (7,3)	10 (7,6)	21 (10,1)	<0,001
Cualificado Manual	305 (14,9)	37 (9,3)	46 (25,3)		267 (13,3)	61 (18,2)	65 (17,6)		218 (15,6)	43 (19,6)	29 (22,0)	60 (29,0)	
No cualificado No-Manual	1.226 (59,8)	214 (53,9)	57 (31,3)		1.102 (55,0)	139 (41,5)	174 (47,0)		706 (50,4)	89 (40,6)	38 (28,8)	84 (40,6)	
No cualificado Manual	116 (5,7)	36 (9,1)	43 (23,6)		160 (8,0)	87 (26,0)	76 (20,5)		199 (14,2)	71 (32,4)	55 (41,7)	42 (20,3)	
Ingresos en cuartiles													
Alto	758 (36,9)	106 (26,7)	40 (18,4)	<0,001	721 (35,9)	57 (15,8)	48 (12,9)	<0,001	475 (33,7)	16 (7,1)	15 (10,0)	36 (17,2)	<0,001
Medio-alto	648 (31,6)	94 (23,7)	44 (20,2)		619 (30,9)	80 (22,1)	79 (21,3)		482 (34,2)	48 (21,2)	17 (11,3)	48 (23,0)	
Medio-bajo	453 (22,1)	91 (22,9)	45 (20,6)		442 (22,0)	113 (31,2)	106 (28,6)		323 (22,9)	85 (37,6)	37 (24,7)	64 (30,6)	
Bajo	194 (9,5)	106 (26,7)	89 (40,8)		224 (11,2)	112 (30,9)	138 (37,2)		130 (9,2)	77 (34,1)	81 (54,0)	61 (29,2)	
Total	2.053 (100,0)	397 (100,0)	220 (100,0)		2.006 (100,0)	362 (100,0)	371 (100,0)		1.410 (100,0)	226 (100,0)	150 (100,0)	209 (101,0)	

Valores perdidos en tipo de contrato (TC), tipo de jornada, (TJ) categoría ocupacional (CO) e ingresos (I) – Personas N(%) en la cohorte temprana (Empleo estable: TC: 6 (0.29); CO: 4 (0.19) – Sin cobertura de larga duración: TC: 39 (17.73); CO: 38 (17.27); I: 2 (0,91)), cohorte media (Empleo estable: TC: 6 (0.30); CO: 4 (0.20) - Empleo creciente: TC: 28 (7.73); TJ: 1 (0.28); CO: 27 (7.46) - Empleo fluctuante: TC: 2 (0.54); CO: 1 (0.27)) y cohorte avanzada (Empleo estable: TC: 13 (0.92); CO: 9 (0.64) - Empleo creciente: TC: 7 (3.10); CO: 7 (3.10) – Sin cobertura de larga duración: TC: 18 (12.00); TJ: 1 (0.67); CO: 18 (12.00) - Empleo decreciente: TC: 3 (1.44); CO: 2 (0.96)). Ingresos en cuartiles basado en la media de ingresos mensuales en la cohorte temprana (alto: 4.123€, medio-alto: 1.512€, medio-bajo: 1.141€, bajo: 865€), cohorte media (alto: 4.746€, medio-alto: 1.781€, medio-bajo: 1.234€, bajo: 885€) y cohorte avanzada (alto: 5.262€, medio-alto: 1.855€, medio-bajo: 1.197€, bajo: 822€). [a]Test chi-cuadrado de Pearson.

En los hombres se observó un patrón de empleo creciente, caracterizado por una gran proporción de personas sin cobertura de larga duración al inicio que se mantenían en niveles estables de empleo a medida que se incorporaban. Similar a las mujeres, los hombres de la cohorte temprana mostraron un patrón de empleo fluctuante, aunque con una mayor frecuencia de transiciones entre estados laborales al inicio. Los hombres de las cohortes media y avanzada que partieron de unos niveles elevados de empleo, siguieron patrones de salida abrupta del mercado laboral y entrada al desempleo respectivamente.

El patrón de empleo creciente mostró un mayor porcentaje de trabajadores en la cohorte temprana (22%) comparado con las cohortes media (14,3%) y avanzada (5,6%). Este patrón se caracterizó por una mayor proporción de trabajadores con ocupaciones no cualificadas manuales (25,2%, 28,7% y 24,4% respectivamente) e ingresos bajos, especialmente en hombres de la cohorte avanzada (44,7%). En los hombres de la cohorte temprana se observó un patrón de empleo fluctuante (14,7%) con la mayor proporción de trabajadores con contratos temporales (50,5%), jornadas parciales (15,6%) e ingresos bajos (35,8%). En las cohortes media y avanzada los patrones de empleo decreciente (6% y 4.3%, respectivamente) concentraron una mayor proporción de trabajadores con contratos temporales (49% y 31,8%) e ingresos bajos (41%) en la cohorte media, y jornadas parciales en la cohorte avanzada (23,5%) (tabla 2).

Tabla 2. Distribución de hombres asalariados de las cohortes de vida laboral (CVL) temprana, media y avanzada (N=4.564) con más de 15 días acumulados en incapacidad temporal por trimestre entre 2012-2014, según grupos de participación en el mercado laboral y tipo de contrato, tipo de jornada, categoría ocupacional e ingresos. Cataluña 2002-2011.

Hombres	CVL Temprana (N=1.315)				CVL Media (N=1.747)					CVL Avanzada (N=1.502)				
	Empleo estable (63,3%)	**Empleo creciente (22,0%)**	**Empleo fluctuante (14,7%)**		**Empleo estable (72,3%)**	**Empleo creciente (14,3%)**	**Empleo decreciente (6,0%)**	**Salida abrupta del mercado laboral (7,4%)**		**Empleo estable (81,3%)**	**Empleo creciente (5,6%)**	**Empleo decreciente (4,3%)**	**Entrada al desempleo (8,8%)**	
	N (%)	N (%)	N (%)	p-valor[a]	N (%)	N (%)	N (%)	N (%)	p-valor[a]	N (%)	N (%)	N (%)	N (%)	p-valor[a]
Tipo de contrato														
Contrato permanente	693 (83,7)	189 (66,6)	95 (49,5)	<0,001	1.115 (88,7)	161 (66,0)	53 (51,0)	113 (89,7)	<0,001	1.122 (92,4)	55 (68,8)	43 (68,3)	109 (82,6)	<0,001
Contrato temporal	135 (16,3)	95 (33,5)	97 (50,5)		142 (11,3)	83 (34,0)	51 (49,0)	13 (10,3)		92 (7,6)	25 (31,3)	20 (31,8)	23 (17,4)	
Tipo de jornada														
Completa	809 (97,1)	253 (87,5)	163 (84,5)	<0,001	1.222 (96,7)	221 (89,1)	95 (91,4)	120 (93,0)	<0,001[b]	1.190 (97,5)	72 (86,8)	49 (76,6)	128 (97,0)	<0,001[b]
Parcial: > 50%-99%	13 (1,6)	14 (4,8)	16 (8,3)		22 (1,7)	14 (5,7)	5 (4,8)	4 (3,1)		16 (1,3)	7 (8,4)	1 (1,6)	1 (0,8)	
≤ 50%	11 (1,3)	22 (7,6)	14 (7,3)		20 (1,6)	13 (5,2)	4 (3,9)	5 (3,9)		15 (1,2)	4 (4,8)	14 (21,9)	3 (2,3)	
Categoría ocupacional														
Cualificado No-Manual	54 (6,5)	38 (13,3)	29 (15,1)	<0,001	202 (16,0)	30 (12,2)	13 (12,5)	10 (7,9)	<0,001	263 (21,6)	9 (11,0)	6 (9,5)	12 (9,1)	<0,001
Cualificado Manual	444 (53,5)	99 (34,6)	54 (28,1)		541 (43,0)	96 (38,9)	49 (47,1)	81 (64,3)		481 (39,5)	35 (42,7)	33 (52,4)	82 (62,1)	
No cualificado No-Manual	217 (26,1)	77 (26,9)	73 (38,0)		401 (31,9)	50 (20,2)	28 (26,9)	22 (17,5)		374 (30,7)	18 (22,0)	19 (30,2)	28 (21,2)	
No cualificado Manual	115 (13,9)	72 (25,2)	36 (18,8)		115 (9,1)	71 (28,7)	14 (13,5)	13 (10,3)		101 (8,3)	20 (24,4)	5 (7,9)	10 (7,6)	
Ingresos en cuartiles														
Alto	275 (33,0)	53 (18,3)	35 (18,1)	<0,001	393 (31,1)	30 (12,1)	23 (21,9)	45 (34,9)	<0,001	348 (28,5)	12 (14,1)	17 (26,6)	26 (19,7)	<0,001
Medio-alto	263 (31,6)	81 (28,0)	40 (20,7)		409 (32,4)	42 (16,9)	15 (14,3)	58 (45,0)		397 (32,5)	10 (11,8)	11 (17,2)	51 (38,6)	
Medio-bajo	198 (23,8)	81 (28,0)	49 (25,4)		292 (23,1)	80 (32,1)	24 (22,9)	12 (9,3)		303 (24,8)	25 (29,4)	12 (18,8)	31 (23,5)	
Bajo	97 (11,6)	74 (25,6)	69 (35,8)		170 (13,5)	97 (39,0)	43 (41,0)	14 (10,9)		173 (14,2)	38 (44,7)	24 (37,5)	24 (18,2)	
Total	833 (100,0)	289 (100,0)	193 (100,0)		1.264 (100,0)	249 (100,0)	105 (100,0)	129 (101,0)		1.221 (100,0)	85 (100,0)	64 (100,0)	132 (101,0)	

Valores perdidos en tipo de contrato (TC), tipo de jornada, (TJ) categoría ocupacional (CO) e ingresos (I) - Personas N(%) en la cohorte temprana (Empleo estable: TC: 5 (0.60); CO: 3 (0.36) - Empleo creciente: TC: 5 (1.73); CO: 3 (1.04) - Empleo fluctuante: TC: 1 (0.52); CO: 1 (0.52)), cohorte media (Empleo estable: TC: 7 (0.55); CO: 5 (0.40) - Empleo creciente: TC: 5 (2.01); TJ: 1 (0.40); CO: 2 (0.80) - Empleo decreciente: TC: 1 (0.95); TJ: 1 (0.95); CO: 1 (0.95) - Salida abrupta del mercado laboral: TC: 3 (2.33); CO: 3 (2.33)) y cohorte avanzada (Empleo estable: TC: 7 (0.57); CO: 2 (0.16) - Empleo creciente: TC: 5 (5.88); TJ: 2 (2.35); CO: 3 (3.53) - Empleo decreciente: TC: 1 (1.56); CO: 1 (1.56)). Ingresos en cuartiles basado en la media de ingresos mensuales en la cohorte temprana (alto: 4.252€, medio-alto: 1.695€, medio-bajo: 1.338€, bajo: 1.063€), cohorte media (alto: 5.257€, medio-alto: 2.230€, medio-bajo: 1.603€, bajo: 1.224€) y cohorte avanzada (alto: 5.313€, medio-alto: 2.629€, medio-bajo: 1.786€, bajo: 1.311€). [a]Test chi-cuadrado de Pearson. [b]Prueba exacta de Fisher.

Discusión

El hallazgo principal de este estudio muestra que aproximadamente el 70% de las personas que acumularon días en IT entre 2012 y 2014 tuvieron patrones de PML estables en los 10 años anteriores. La mayor proporción de empleo estable se observó en las mujeres de la cohorte temprana y en los hombres de la avanzada. Asimismo, en ambos sexos, se encontró un patrón de empleo creciente a partir de 2005, que se mantiene elevado, incluso durante la crisis económica de 2008. Por otra parte, las mujeres de la cohorte media y los hombres de la cohorte temprana, mostraron patrones de empleo fluctuantes con frecuentes períodos sin cobertura. Al inicio de la crisis económica de 2008, una parte de las mujeres de las cohortes temprana y avanzada permanecieron largos periodos sin cobertura de la Seguridad Social, mientras que los hombres de las cohortes media y avanzada fueron los más afectados por la pérdida de empleo. En general, las mujeres mostraron una mayor proporción de contratos temporales y tiempo parcial, y las cohortes más tempranas mostraron más temporalidad que las más avanzadas.

Contrario a lo que habría que esperar, las mujeres de la cohorte temprana presentaron mayor proporción de empleo estable comparado con la avanzada e incluso que los hombres de las cohortes temprana y media. Es posible que la crisis económica afectara a la calidad del empleo de las mujeres al inicio de su vida laboral en términos de mayor precariedad y peores condiciones de empleo (la proporción de empleo a tiempo parcial fue cuatro veces superior que en hombres en 2012) en lugar de en términos de desempleo como en los hombres (la pérdida de esperanza de vida laboral fue de 12 años en hombres y de 7 años en mujeres entre 2006 y 2008) (Dudel, López Gómez, Benavides, & Myrskylä, 2018; Escribà & Fons, 2014; Menéndez, Benach, Muntaner, Amable, & O'Campo, 2007). No obstante, en hombres de la cohorte temprana encontramos la menor proporción de empleo estable. Este resultado podría explicarse por el uso generalizado de la contratación temporal que, junto con el aumento del desempleo durante la crisis económica, ha propiciado la entrada al desempleo y/o a la no participación en el mercado laboral (Bentolila, Cahuc, Dolado, & Barbanchon, 2012; Bentolila & Dolado, 1994; Serrano Martínez & Soler Guillén, 2015). En particular, la crisis afectó a un sector muy masculinizado como es el de la construcción (Jimeno & Santos, 2014)

En las tres cohortes, en particular en la temprana, se encontró un patrón de empleo creciente durante todo el seguimiento, incluso tras el inicio de la recesión económica. Este resultado puede estar relacionado con medidas de incentivos sociales y fiscales a la contratación para incorporar y retener personas trabajadoras jóvenes y mayores (Eichhorst et al., 2014).

Los patrones de empleo fluctuante en las mujeres de la cohorte media y, sobre todo, en hombres de la cohorte temprana, presentaron frecuentes transiciones de empleo al estado sin cobertura. También se observa una elevada proporción de mujeres al inicio de la vida laboral, y en la etapa de vida laboral avanzada, con un patrón sin cobertura de larga duración. Posibles explicaciones de esta baja participación en el mercado laboral al inicio de la vida laboral podrían ser la prolongación de los estudios, la maternidad, la emigración, el desánimo de no encontrar empleo, o bien el haber agotado la asistencia social al no haber cotizado lo suficiente para tener derecho a la prestación por desempleo, especialmente en personas que tenían alta temporalidad y tiempo parcial (Escribà & Fons, 2014; Sanz-de-Galdeano & Terskaya, 2017; Serrano Martínez & Soler Guillén, 2015). Asimismo, cuando la salida del mercado laboral ocurre al final de la vida laboral puede deberse al abandono definitivo del mercado laboral posiblemente por jubilación (cohortes avanzadas) o a la salida temporal del mismo si hubo un período de empleo posterior al seguimiento. Por otra parte, en las mujeres de la cohorte avanzada, la incorporación al mercado laboral, coincidiendo con el inicio de la crisis económica de 2008, podría relacionarse con los patrones de salida del mercado laboral y entrada al desempleo de los hombres, puesto que la crisis económica destruyó masivamente el empleo en éstos en las etapas media y avanzada de la vida laboral (32-51 años en 2008). Es posible que las personas de las cohortes avanzadas adoptaran roles sociales en que las mujeres están a cargo del trabajo doméstico y de cuidados no remunerados, y los hombres del trabajo remunerado formal con protección social. Dado que gran parte de los hombres eran los sustentadores principales del hogar, y que el estado de bienestar español no es especialmente generoso (Bambra & Eikemo, 2009), la reducción de ingresos que suponía percibir sólo la prestación/subsidio por desempleo podría haber impulsado la incorporación de las mujeres al mercado laboral para garantizar la seguridad económica del hogar (Artazcoz et al., 2013). En este sentido, se ha observado que durante la época de crisis económica los años de esperanza de vida laboral dedicados al empleo se redujeron y que los años en desempleo y sin cobertura aumentaron (Dudel et al., 2018).

En relación con las condiciones de empleo, encontramos una mayor proporción de mujeres con contratos temporales y, especialmente, jornadas parciales comparado con los hombres. También encontramos mayor temporalidad en las cohortes tempranas que en las avanzadas. Un estudio previo muestra una tasa de temporalidad en las mujeres ligeramente superior a la de los hombres, mientras que la tasa de contratos parciales era mucho más elevada, siendo este resultado similar al hallado en el presente estudio (Escribà & Fons, 2014). Asimismo, la temporalidad y el empleo parcial se incrementó durante la crisis económica, utilizándose como mecanismo de empleo en personas jóvenes (Serrano Martínez & Soler Guillén, 2015).

Entre las limitaciones de este estudio hay que señalar que la asignación de los estados laborales se realizó según el mayor tiempo de permanencia semanal, lo que podría llevar a subestimar los empleos más cortos. No se dispuso de variables relacionadas con las condiciones de trabajo (riesgos higiénicos o ergonómicos, por ejemplo), de estructura familiar (trabajo de cuidados), y de estado de salud previa, lo que podría ayudar a una interpretación más válida de los resultados. Los patrones de PML en las cohortes tempranas podrían no representar grupos homogéneos, ya que los índices de agrupación mostraban valores inferiores a los recomendados. La población de estudio incluye personas que han tenido algún problema de salud que justifica una IT de más de 15 días en algún trimestre de los tres años siguientes al período de reconstrucción de la vida laboral y no se ha comparado con la población sin problemas de salud. No obstante, nuestros resultados son similares a los encontrados en estudios basados en muestras representativas de la población ocupada (Belvis Costes & Benach de Rovira, 2014; Escribà & Fons, 2014; Serrano Martínez & Soler Guillén, 2015).

Por otra parte, una de las principales fortalezas de nuestro estudio es el enfoque de curso de vida el cual permite observar y ordenar de manera precisa las transiciones entre estados laborales a lo largo de un amplio período de 10 años de vida laboral, superando las limitaciones de estudios transversales (Rönnblad et al., 2019). Además, el estudio se basa en registros de datos administrativos, fiables, de calidad y bajo coste, lo que permite reproducir este estudio en el conjunto de la Muestra Continua de Vidas Laborales (García Pérez, 2008; López et al., 2014).

Como conclusión, los resultados de este estudio permiten identificar patrones de PML según transiciones laborales y características sociodemográficas, que varían según la etapa de vida laboral y el sexo, lo que podrán utilizarse para ganar validez en el análisis de la relación causal entre empleo y salud.

Bibliografía

Amick, B. C., McLeod, C. B., & Bültmann, U. (2016). Labor markets and health: an integrated life course perspective. *Scandinavian Journal of Work, Environment & Health*, 42(4), 346–353. https://doi.org/10.5271/sjweh.3567

Arntz, M., Gregory, T., & Zierahn, U. (2016). The risk of automation for jobs in OECD countries: a comparative analysis. *OECD Social, Employment and Migration Working Papers*, (189). https://doi.org/https://doi.org/10.1787/5jlz9h56dvq7-en

Artazcoz, L., Cortès, I., Puig-Barrachina, V., Benavides, F. G., Escribà-Agüir, V., & Borrell, C. (2013). Combining employment and family in Europe: the role of family policies in health. *European Journal of Public Health*, 24(4), 649–655. https://doi.org/10.1093/eurpub/ckt170

Bambra, C., & Eikemo, T. a. (2009). Welfare state regimes, unemployment and health: a comparative study of the relationship between unemployment and self-reported health in 23 European countries. *Journal of Epidemiology and Community Health*, 63(2), 92–98. https://doi.org/10.1136/jech.2008.077354

Belvis Costes, F. X., & Benach de Rovira, J. (2014). *Educació i estabilitat laboral a Catalunya. Mobilitat entre ocupació estable, inestable i no ocupació*, 2002–2012. *Fundació Jaume Bofill, Barcelona*. Retrieved from https://www.fbofill.cat/publicacions/educacio-i-estabilitat-laboral-catalunya-0

Ben-Shlomo, Y., & Kuh, D. (2002). A life course approach to chronic disease epidemiology: conceptual models, empirical challenges and interdisciplinary perspectives. *International Journal of Epidemiology*, 31(2), 285–293. https://doi.org/10.1093/ije/31.2.285

Benach, J., Vives, A., Amable, M., Vanroelen, C., Tarafa, G., & Muntaner, C. (2014). Precarious employment: understanding an emerging social determinant of health. *Annual Review of Public Health*, 35, 229–253. https://doi.org/10.1146/annurev-publhealth-032013-182500

Bentolila, S., Cahuc, P., Dolado, J. J., & Barbanchon, T. Le. (2012). Two-tier labour markets in the great recession: France Versus Spain. *The Economic Journal*, 122(562), F155–F187. https://doi.org/10.1111/j.1468-0297.2012.02534.x.

Bentolila, S., & Dolado, J. J. (1994). Labour flexibility and wages: lessons from Spain. *Economic Policy*, 9(18), 53–99.

Billett, S., & Somerville, M. (2004). Transformations at work: identity and learning. *Studies in Continuing Education*, 26(2), 309–326. https://doi.org/10.1080/158037042000225272

Bolano, D., & Haynes, M. (2016). Methodological approaches to profiling and modelling disadvantaged employment pathways. An application to employment trajectories in Australia. In *Proceedings of the International Conference on Sequence Analysis and Related Methods* (pp. 851–862). (LaCOSA II).

Dudel, C., López Gómez, M. A., Benavides, F. G., & Myrskylä, M. (2018). The Length of Working Life in Spain: Levels, Recent Trends, and the Impact of the Financial Crisis. *European Journal of Population*, 34(5), 769–791. https://doi.org/10.1007/s10680-017-9458-9

Durán, X. (2013). *Trayectoria laboral e incapacidad permanente: análisis de los años de vida laboral perdidos. Un estudio basado en la Muestra Continua de Vidas Laborales (MCVL) de la Seguridad Social*. (doctoral dissertation) Universitat Pompeu Fabra. Retrieved from http://www.tdx.cat/bitstream/handle/10803/279345/txd.pdf?sequence=1

Eichhorst, W., Boeri, T., De Coen, A., Galasso, V., Kendzia, M., & Steiber, N. (2014). Combining the entry of young people in the labour market with the retention of older workers. *IZA Journal of European Labor Studies*, 3(19). https://doi.org/https://doi.org/10.1186/2193-9012-3-19

Escribà, V., & Fons, J. (2014). Crisis económica y condiciones de empleo: diferencias de género y respuesta de las políticas sociales de empleo. Informe SESPAS 2014. *Gaceta Sanitaria*, 28, 37–43. https://doi.org/10.1016/j.gaceta.2014.01.013

Gabadinho, A., Ritschard, G., Müller, N. S., & Studer, M. (2011). Analyzing and Visualizing State Sequences in R with TraMineR. *Journal of Statistical Software*, 40(4), 1–37. https://doi.org/10.18637/jss.v040.i04

García Pérez, J. I. (2008). La muestra continua de vidas laborales: una guía de uso para el análisis de transiciones. *Revista de Economía Aplicada*, *XVI*(1), 5–28. Retrieved from https://www.redalyc.org/articulo.oa?id=96915822001

Instituto Nacional de Estadística. (2019a). Indicadores de mortalidad. Esperanza de vida al nacimiento según sexo. Retrieved

September 17, 2020, from https://www.ine.es/jaxiT3/Datos.htm?t=1414#!tabs-tabla

Instituto Nacional de Estadística. (2019b). Población residente por fecha, sexo y edad. Retrieved August 2, 2019, from http://www.ine.es/jaxiT3/Tabla.htm?t=9663&L=0

Instituto Nacional de Estadística. (2019c). Población y variación interanual (españoles/extranjeros) por sexo y año. Retrieved October 23, 2019, from https://www.ine.es/jaxi/Datos.htm?path=/t20/e245/p08/l0/&file=02004.px#!tabs-tabla

Jimeno, J. F., & Santos, T. (2014). The crisis of the Spanish economy. SERIEs, 5(2–3), 125–141. https://doi.org/10.1007/s13209-014-0116-8

Kuh, D., Ben-Shlomo, Y., Lynch, J., Hallqvist, J., & Power, C. (2003). Life Course Epidemiology. *Journal of Epidemiology & Community Health*, 57(10), 778–783. https://doi.org/10.1016/B978-0-08-097086-8.14085-1

López Gómez, M. A., Durán, X., Zaballa, E., Sanchez-Niubo, A., Delclos, G. L., & Benavides, F. G. (2016). Cohort profile: the Spanish WORKing life Social Security (WORKss) cohort study. *BMJ Open*, 6, e008555. https://doi.org/10.1136/bmjopen-2015-008555

López Gómez, M. A., Serra, L., Delclos, G. L., & Benavides, F. G. (2017). Employment history indicators and mortality in a nested case-control study from the Spanish WORKing life social security (WORKss) cohort. *PLoS ONE*, 12(6), e0178486. https://doi.org/10.1371/journal. pone.0178486

López, M. A., Benavides, F. G., Alonso, J., Espallargues, M., Durán, X., & Martínez, J. M. (2014). La utilidad del uso de datos administrativos en la investigación de salud pública: la Muestra continua de vidas laborales. *Gaceta Sanitaria*, 28(4), 334–337. https://doi.org/http://dx.doi.org/10.1016/j.gaceta.2014.02.010

Malo, M. A., & Muñoz-Bullón, F. (2003). Employment status mobility from a life-cycle perspective: A sequence analysis of work-histories in the BHPS. *Demographic Research*, 9, 119–162. https://doi.org/10.4054/DemRes.2003.9.7

Matilla-Santander, N., González-Marrón, A., Martín-Sánchez, J. C., Lidón-Moyano, C., Cartanyà-Hueso, À., & Martínez-Sánchez, J. M. (2019). Precarious employment and health-related outcomes in the European Union: a cross-sectional study. *Critical Public Health*, 1–12. https://doi.org/10.1080/09581596.2019.1587385

Menéndez, M., Benach, J., Muntaner, C., Amable, M., & O'Campo, P. (2007). Is precarious employment more damaging to women's health than men's? *Social Science & Medicine*, 64(4), 776–781. https://doi.org/10.1016/j.socscimed.2006.10.035

Ministerio de Empleo y Seguridad Social. (n.d.-a). Afiliados medios mes por CC.AA. y provincias según regímenes. Retrieved October 21, 2019, from http://www.seg-social.es/wps/portal/wss/internet/EstadisticasPresupuestosEstudios/Estadisticas/EST8/EST167/3010/3013/3021

Ministerio de Empleo y Seguridad Social. (n.d.-b). Pensiones por CCAA y provincias. Total sistema. Retrieved October 21, 2019, from http://www.seg-social.es/wps/portal/wss/internet/EstadisticasPresupuestosEstudios/Estadisticas/EST23/2575/2772/2779/2781

Mirowsky, J. (2011). Wage Slavery or Creative Work? *Society and Mental Health*, 1(2), 73–88. https://doi.org/10.1177/2156869311413141

Nwaru, C. A., Kivimäki, M., Pentti, J., Vahtera, J., & Virtanen, P. (2018). Sickness absence in a re-employment program as a predictor of labor market attachment among long-term unemployed individuals: A 6-year cohort study in Finland. *Scandinavian Journal of Work, Environment and Health*, 44(5), 496–502. https://doi.org/10.5271/sjweh.3742

Organización Internacional del Trabajo. (2017). *El futuro del trabajo que queremos: un diálogo global*. Génova. Retrieved from https://www.ilo.org/global/topics/future-of-work/WCMS_570288/lang--es/index.htm

Rönnblad, T., Grönholm, E., Jonsson, J., Koranyi, I., Orellana, C., Kreshpaj, B., … Bodin, T. (2019). Precarious employment and mental health: a systematic review and meta-analysis of longitudinal studies. *Scandinavian Journal of Work, Environment & Health*, 45(5), 429–443. https://doi.org/10.5271/sjweh.3797

Ruiz Frutos, C., García, A. M., Delclós, J., & Benavides, F. G. (2013). *Salud laboral: conceptos y técnicas para la prevención de riesgos laborales*. (E. Elsevier, Ed.) (4th ed.).

Sanz-de-Galdeano, A., & Terskaya, A. (2017). The labor market in Spain, 2002–2016. *IZA World of Labor*, 403, 1–12. https://doi.org/10.15185/izawol.403

Serrano Martínez, L., & Soler Guillén, Á. (2015). *La formación y el empleo de los jóvenes españoles. Trayectoria reciente y escenarios futuros*. Bilbao: Fundación BBVA.

Studer, M. (2013). WeightedCluster Library Manual: A practical guide to creating typologies of trajectories in the social sciences with R. https://doi.org/10.12682/lives.2296-1658.2013.24

Virtanen, P. (2005). Labor market trajectories and health: a four-year follow-up study of initially fixed-term employees. *American Journal of Epidemiology*, 161(9), 840–846. https://doi.org/10.1093/aje/kwi107

STUDY III

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III

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RESEARCH ARTICLE

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Sickness absence trajectories following labour market participation patterns: a cohort study in Catalonia (Spain), 2012–2014

Julio C. Hernando-Rodriguez[1,2,3], Laura Serra[4*], Fernando G. Benavides[1,2,3] and Monica Ubalde-Lopez[5]

Abstract

Background: Previous studies have focused on the relationship between employment pathways and health-related outcomes based on cross-sectional or longitudinal approaches. However, little is known about the cumulative effects of employment status mobility on sickness absence (SA) over time. The aim of the present study was to examine the association between prior labour market participation (LMP) patterns and SA trajectories from a life-course perspective.

Methods: This cohort study was based on a sample of 11,968 salaried workers living in Catalonia and affiliated with the Spanish Social Security system, who accumulated more than 15 days on SA in at least one quarter during 2012–2014. Individuals were grouped into three different working life stages: early (18–25 years), middle (26–35 years), and late (36–45 years). To identify LMP patterns, we applied sequence analysis and cluster analysis (2002–2011), and we used latent class growth modelling to identify SA trajectories (2012–2014). Finally, we applied multinomial logistic regression models to assess the relationship between LMP patterns and SA trajectories.

Results: The analyses yielded six LMP patterns: stable employment (value range: 63–81%), increasing employment (5–22%), without long-term coverage (7–8%), decreasing employment (4–10%), fluctuant employment (13–14%), and steeply decreasing employment (7–9%). We also identified four SA trajectories: low stable (83–88%), decreasing (5–9%), increasing (5–11%), and high stable (7–16%). However, the only significant association we identified for LMP patterns and SA trajectories was among young men, for whom an increasing employment pattern was significantly associated with a lower risk for increased days on SA (adjusted odds ratio: 0.21; 95% confidence interval: 0.05–0.96).

Conclusions: SA trajectories are generally not related to prior 10-year LMP patterns at any stage of working life. To disentangle this relationship, future research might benefit from considering working life transitions with a quality-of-work approach framed with contextual factors closer to the SA course.

Keywords: Working life transition, Life course, Sick leave

* Correspondence: laura.serra@udg.edu
[4]GRECS-Research Group on Statistics, Econometrics and Health, Faculty of Economics and Business, University of Girona (UdG), C/ Universitat de Girona, 10, 17071 Girona, Spain
Full list of author information is available at the end of the article

Background

The ongoing phenomenon of increasing life expectancy and job insecurity affects the stability of the labour market structure [1]. Unstable employment pathways might entail the loss of economic resources, a lower likelihood of future employability when unemployed, and most important, loss of health. Experiences during working life are usually characterised as changes in employment and working conditions, the transitions in employment status that may influence an individual's future health course. Such events and transitions may occur independently or be part of a cluster or causal chain, as each working experience increases the risk for other events or transitions. "Working life trajectory" references the co-occurrence of events through the life course, covering critical points in working life such as transitions in and out of the labour market and time spent in each state as a whole unit [2–4].

Previous research has mainly focused on risk and prognostic factors (individual, socio-demographic, occupational) for sickness absence (SA) [5–7], but a less considered aspect is the extent to which transitions in and out of the labour market may affect an individual's work-related health outcomes. In the labour market context, a Norwegian study showed an inverse correlation between unemployment rate and the probability of having SA lasting longer than 14 days [8].

Together with socioeconomic, occupational, gender, and other individual factors, labour market transitions might differ with the stage of working life. For instance, young workers entering their working lives have greater mobility in terms of more gaps and a larger number of transitions between different employment statuses (i.e., employment, unemployment, or inactivity spells) compared with those in a late career stage [9]. In keeping with this pattern, a study of employment patterns among women in Germany showed that younger cohorts followed a trend towards discontinuous and part-time careers, whereas careers involving continuous full-time employment or being a housewife were becoming unusual [10].

Traditionally, for health and health-related outcomes, occupational epidemiology has assessed exposure–outcome association measures, whether simple or accumulated, at one point in time. Few studies have involved longitudinal analyses of the effect of prior working life on health [11–16]. From the standpoint of occupational epidemiology, because a person lives in a multidimensional and multilevel context, an approach from a life-course perspective could elucidate relevant events in a person's working life that manifest and shape health status over time [17]. The extent to which prior labour market participation (LMP) patterns affect risk for future SA remains unexplored [2, 4].

Previous studies have examined sex and age differences in health and health-related outcomes and in LMP [18–21]. The authors of one review found that women have higher short-term SA rates than men, with variations by country and age cohort. Likewise, higher proportions of SA affected the beginning and middle parts of working life among women ages 20–54 years compared to men of the same ages, which could be related to pregnancy-related health problems or psychological distress when employed in occupations where women are underrepresented [19]. Because cohorts reflect exposures to past socioeconomic circumstances and institutional contexts, considering several cohorts may uncover different influences across a life course [22]. For this reason, a separate analysis by sex and by cohort, defined by working life stage, could contribute to disentangling the relationship between LMP and SA over a lifetime.

We hypothesised that prior highly fragmented LMP patterns would be associated with more unfavourable later SA trajectories compared to LMP patterns suggesting more stable employment pathways. We also hypothesised that this relationship might differ across working life stages and by sex. In this analysis, we viewed fragmented LMP patterns as being characterised by multiple transitions from employment to unemployment, either with benefits or without Social Security coverage.

The aim of this study was to investigate the relationship between prior LMP patterns at the early, middle, and late stages of working life and subsequent SA trajectories among individuals who had accumulated more than 15 days of SA in at least one of the quarters during 2012–2014, considering occupational and socioeconomic characteristics and SA medical diagnosis categories as potential confounders.

Methods

Study population

The study population was part of the Spanish WORKing life Social Security cohort (WORKss cohort), an annual random representative sample of 4% of affiliates with the Spanish Social Security system. The sampling has taken place at least one day a year starting in 2004, and the information includes employment history register data from 1981 [23]. The sample is updated annually following an algorithm, which selects the same individuals if they continue affiliated with the Spanish Social Security system. Those lost because of administrative inactivity or death are replaced with members from the target population until the sample again reaches 4%, which ensures sample representativeness. We obtained data related to working life from the WORKss cohort information and SA records for 2012–2014 from the Catalan Institute of Medical Evaluations, which contains data only for people residing in Catalonia. SA records include information on the starting/closure date of SA episodes and medically certified diagnoses coded using the International Classification of Diseases 10th version (ICD-10).

This study was based on a cohort of 11,968 salaried workers living in Catalonia and affiliated with the Spanish Social Security system, who accumulated more than 15 days on SA in at least one quarter during 2012–2014. Their prior working lives from 2002 to 2011 were reconstructed, and they were grouped into three working life stages according to their age in 2002: early working life cohort (WLC; 18–25 years, 33.3%); middle WLC (26–35 years, 37.5%), and late WLC (36–45 years, 29.2%). Approximately 75% of the SA episodes included in these data were shorter than 15 days, mainly represented by acute diagnoses (e.g., infectious and respiratory diseases). The rationale for selecting only workers who accumulated more than 15 days on SA is that SA episodes of this length are more likely to represent severe rather than mild or moderate diagnoses (half of SA episodes lasting longer than 15 days are the result mainly of mental and musculoskeletal disorders) [24]. For this reason, severe SA episodes may better reflect the potentially long-lasting effects of prior LMP patterns. This duration of episode also allows for exclusion of an influence from SA monetary benefits on a person's SA behaviour because long-term SA represents serious illness [25].

Variables

LMP patterns were defined based on weekly transitions among six labour market states: *employment*, *unemployment insurance benefits*, *means-tested unemployment benefits*, *transition*, *without coverage*, and *without long-term coverage*. The Spanish unemployment benefit scheme distinguishes two categories of unemployment, unemployment receiving benefits and means-tested unemployment benefits. Entitlement to unemployment insurance benefits requires previously paid contributions into Social Security of at least one year over the last 6 years. The duration depends on the paid contributions, and the amount is based on the average wage before becoming unemployed and the replacement rate (70% in the first 6 months, 50% afterwards). Means-tested unemployment benefits can be claimed after unemployment insurance benefits are exhausted or when individuals do not fulfil the conditions for receiving entitled benefits. The duration depends on the time contributed, and the amount is lower than the minimum wage [26, 27]. We maintained the separation of the two unemployment categories, with means-tested benefits as the least generous, which may allow for capture in the LMP patterns of situations involving more vulnerable workers. For situations of employment and unemployment receiving unemployment benefits/means-tested unemployment benefits, individuals keep contact with the Social Security system. Periods without records in the Social Security registry were categorised ad hoc into three states. The state *transition* was defined as a period between employment states up 30 days (i.e., administrative transition) [16]. The state *without coverage* refers to periods between employment states longer than 30 days. The state *without long-term coverage* accounts for the first labour market entry or return to work (i.e., left censorship) and/or a labour market withdrawal or a temporary leaving (i.e., right censorship). SA trajectories were based on the sum of days on SA each quarter between 2012 and 2014 of workers who had accumulated more than 15 days on SA any quarter.

Included covariates for the period 2012–2014 were type of contract (permanent and temporary), working time (full-time, part-time 51–99%, and part-time up to 50%), occupational category (skilled non-manual, skilled manual, unskilled non-manual, and unskilled manual), income (average monthly income categorised into quartiles), and SA medical diagnosis (grouped according to the ICD-10). The diagnosis groups included were mental disorders (F00-F99), digestive diseases (K00-K93), musculoskeletal diseases (M00-M99), pregnancy (O00-O99), injuries and poisoning (S00-T98), and others (the remaining codes). Diagnosis groups that included few people or none in the SA trajectories, such as acute (i.e., infections, circulatory diseases, respiratory diseases) or unusual according to their nature (i.e., pregnancies in women from the late WLC and neoplasms) were excluded.

Because workers could transit among different employment conditions and diagnosis groups during the SA trajectory during 2012 to 2014, we assigned them to the category where they spent most of the time for the whole follow-up period. Similarly, because workers had daily labour market states during the prior LMP, 2002–2011, we assigned them to the state where they spent most of the time for each week of the period.

Income was based on the monthly salary and unemployment benefits, subject to legal limits. The average monthly income was the total remuneration a worker received divided by time employed monthly. Additionally, time employed measured in the years 2002–2011 was used as an adjustment variable.

Statistical analyses

All the analyses were performed for each sex and WLC group separately. In a first step, we reconstructed the prior 10 years of LMP patterns by applying sequence analysis based on the six previously defined states. This methodology allowed us to describe individual sets of state sequences [28]. An optimal matching approach supported development of a matrix of distances between each sequence given indels (i.e., insertion and deletion) together with substitution costs. A custom substitution costs matrix was defined according to the characteristics of our data and study population, with a higher weight given to the transitions that were considered less frequent (i.e., from employment to means-tested unemployment benefits, or from employment to without coverage, and vice versa). Then, we used hierarchical cluster analysis to group similar sequences (i.e., LMP patterns) [29]. We based our selection of the optimal number of clusters on the average silhouette width (ASW), which allows for the assessment of clustering validity (ASW > 0.5 indicates reasonably well-separated clusters) (Supplementary Table 1) [30, 31].

In a second step, we identified SA trajectories using latent class growth analysis (LCGA) based on accumulating more than 15 days on SA quarterly (if any) during the 3-year follow-up, specifying a linear functional form. An assumption of LCGA is that individuals within a trajectory are homogeneous, and individuals are assigned into subgroups with similar characteristics, according to a membership probability [32]. The optimal number of trajectories was assessed considering the Bayesian information criterion (lower best fit) and the Lo-Mendell-Rubin adjusted likelihood ratio test and bootstrap likelihood ratio test. A minimum of 1% of the total sample is recommended for each class [33], although this rule depends on the sample size and how meaningful a small group is for the study aim [34]. Additionally, high posterior probabilities (> 0.7) and researcher criteria were applied to determine the final number of trajectories. In cases of similar values for compared goodness-of-fit indices, we selected the one with the highest entropy (near 1.0) (Supplementary Table 2) [34]. We also assessed model adequacy indices using odds of correct classification (> 5 for all groups indicates high assignment accuracy) and mismatch scores (values close to 0 indicate individuals were assigned to groups with high certainty) (Supplementary Table 3) [35].

In a final step, we examined the association between LMP patterns and SA trajectories, using multinomial logistic regression models adjusted for potential confounders. We applied TraMineR package in R for the Sequence Analysis, MPlus v.7 for the LCGA, and Stata v.13© for the multinomial logistic regression analysis.

Results

The analysis identified six LMP patterns (Fig. 1): stable employment (value range: 63.3–81.3% of workers), increasing employment (5.6–22%), without long-term coverage (7.5–8.2%), decreasing employment (4.3–10.5%), fluctuant employment (13.6–14.7%), and steeply decreasing employment (7.4–8.8%), with 3–4 patterns in each sex and WLC group. The stable employment LMP pattern showed a higher proportion of women in the early WLC compared to proportions in the late WLC (76.9% vs 70.7%), whereas the opposite pattern was observed for men (63.3% vs 81.3%). We also identified other different LMP patterns by sex, including a pattern without long-term Social Security coverage in women only, and a steeply decreasing employment pattern only among men.

Regarding the SA trajectories, we identified four (Fig. 2): low stable (82.9–88.1% of individuals), decreasing (5–9.4%), increasing (0.8–11.3%), and high stable (6.7–16.3%), with three trajectories in each sex and WLC group. The mean of accumulated days on SA ranged from 30 to 40 days in the low stable trajectory to 60 to 70 days in the high stable trajectory.

Across SA trajectories, we also found significant differences by type of contract and diagnosis group. Among women, compared to other groups, a higher proportion had temporary contracts in the high stable SA trajectory in the early WLC (28.5%) and the increasing SA trajectory in the middle WLC (26%). The increasing trajectory had the highest proportion of women who accumulated days on SA because of mental disorders in the early and middle WLCs (24.5 and 28%, respectively). The decreasing and increasing SA trajectories showed a similar proportion of workers on SA because of mental disorders among women in the late WLC (20 and 21.1%, respectively) and men in the middle WLC (15.9 and 16.5%, respectively).

Otherwise, the distribution of LMP patterns was mainly homogeneous across SA trajectories. Among women in the middle WLC and men in the early WLC, the increasing SA trajectories showed a higher proportion of workers who had a prior stable employment LMP pattern (78.1 and 71.4%, respectively) compared to other trajectories. For men in the middle WLC, the decreasing SA trajectory showed a lower proportion of individuals with the LMP pattern of increasing employment (8.4%) compared to the low stable (14.7%) and increasing trajectories (14.1%) (Tables 1 and 2).

Adjusted regression models did not show significant associations between the prior 10 years of LMP patterns and subsequent SA trajectories (Table 3). Only men in the early WLC who had an increasing employment LMP pattern showed a significantly lower risk for increased accumulated days on future SA compared to those who had continuous stable employment LMP patterns (adjusted odds ratio: 0.21; 95% confidence interval: 0.04–0.96).

Discussion

Our main finding was that the four SA trajectories (low stable, decreasing, increasing, and high stable) were not related to the six prior 10-year LMP patterns across the three stages of working life considered. More than 80% of workers showed a low stable accumulation of 30 to 40 days on SA on average during the 3-year follow-up.

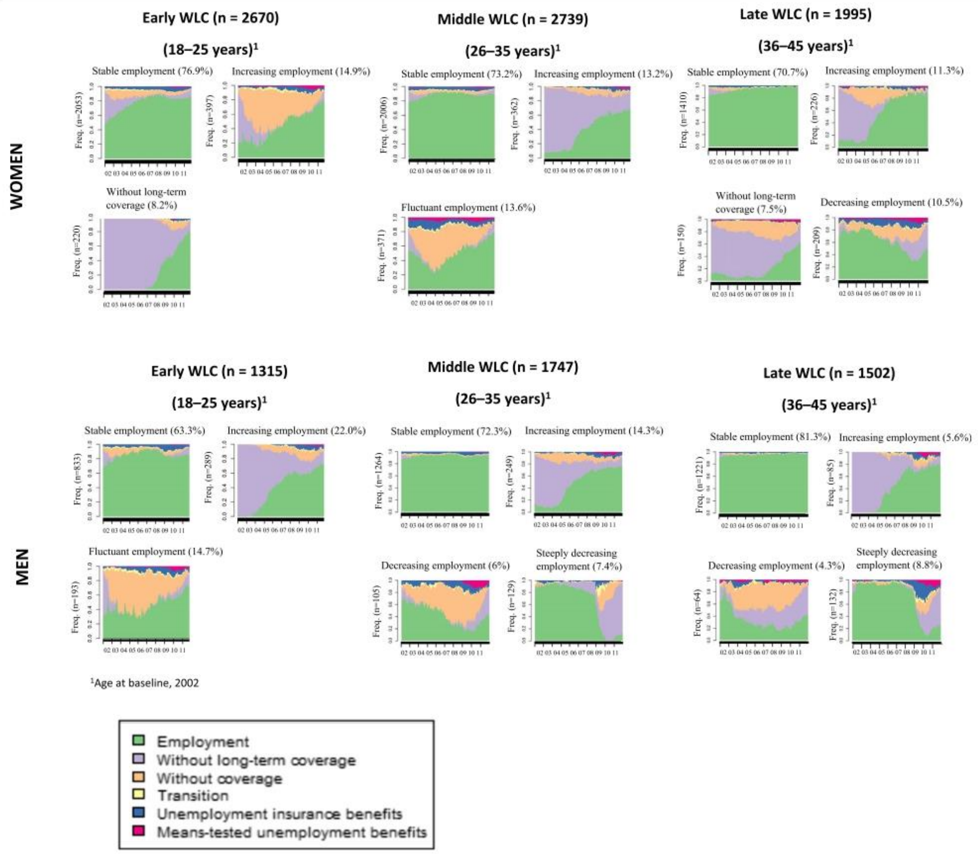


Fig. 1 Labour market participation patterns in salaried workers with future sickness absence (SA >15 accumulated days days on sickness absence per quarter) across working life cohorts (WLC) (*N* = 11,968). Catalonia 2002–2011

The result was unexpected, according to our hypothesis, because it is reasonable to consider that the accumulation of adverse employment status (frequent entries into and exits from the labour market) during a previous working life could be related to an increase in SA days because of more severe or long-lasting pathologies (i.e., chronic diseases such as musculoskeletal and mental disorders). However, the result persists after adjustment for socioeconomic and employment-related factors and medical diagnosis during the SA course, with this last emerging as a leading determinant of the SA trajectory [36].

As far as we know, no previous studies have examined the relationship between prior 10-year LMP patterns and future SA trajectories from a life-course perspective. A Finnish study focused on early exits from employment, identifying and describing 10-year working life participation patterns and determining the cumulative incidence of SA within these patterns. Those authors found that individuals with long-term labour market exit had the highest cumulative incidence of SA because of mental disorders [20]. Similarly, one investigation of the effect of precarious employment on SA in four Nordic countries showed that precarious employment was associated with SA of 7 days or more, and another report on health-related outcomes (including long-term SA) in 28 countries in Europe cited an association with SA of more than 15 days [37, 38]. In both studies, however, the authors measured precarious employment as a multidimensional construct based on indicators obtained from several dimensions (e.g., employment instability, lack of power and rights, reduced salary), which

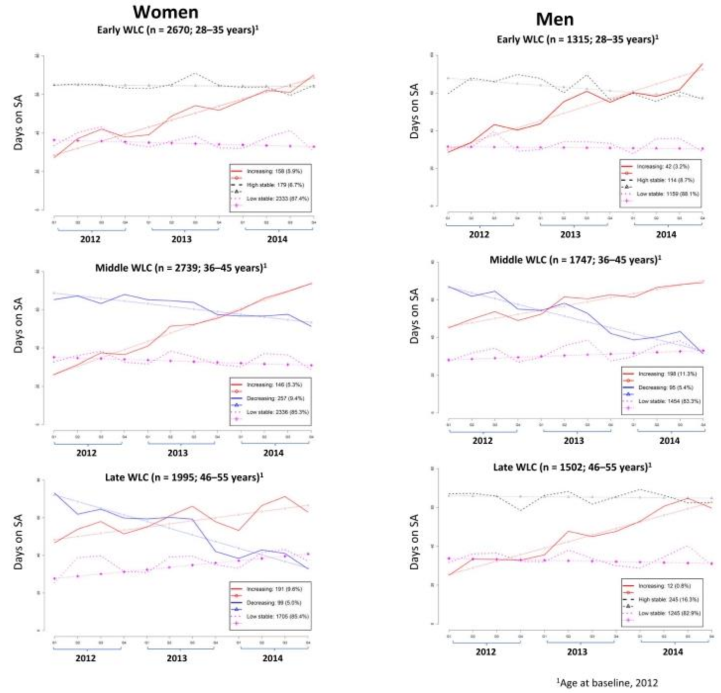
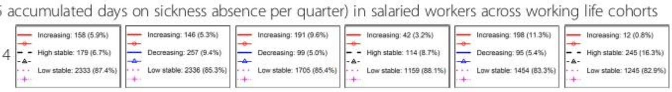


Fig. 2 Sickness absence trajectories (>15 accumulated days on sickness absence per quarter) in salaried workers across working life cohorts (WLCs) (N = 11,968). Catalonia, 2012–2014



captured the accumulation of unfavourable aspects of employment quality [39]. Therefore, the results derived from these studies may not be directly comparable to the current findings from our analyses of LMP patterns based on employment status mobility across different stages of the working life course.

Previous groups also have analysed the possible association between certain labour market situations and several health-related outcomes. One group found in a follow-up of 15 years that unemployment at an early age had a dose-response relationship with increased risk of SA, disability pension, and death [40]. Another study showed that a high number of periods without Social Security coverage was the main predictor of early retirement for permanent disability [41]. In that case, the outcome was the disability pension, which is closely related to SA [42].

In contrast to these previous studies, we found no relationship between the SA course and 10 years of prior transitions in the labour market. A first alternative hypothesis from these findings could be that SA trajectories may be more related to a course that is nearer to labour market transitions (for instance, the previous 2 or 5 years). Furthermore, because a given health-related problem may interfere with an individual's ability to meet current job demands, an imbalanced situation between these two conditions might be more likely to lead to accumulation of more days on SA compared to a prior adverse labour market transition pattern.

A second alternative hypothesis that could explain the results is that we did not measure employment quality during the prior working life. It is possible that studying a more comprehensive set of employment arrangements when defining the LMP patterns, including transitions among types of contract, working time, and occupations, could lead to a more specific LMP pattern that might relate to future SA behaviour. In this vein, one study has shown that working life patterns characterised by long-term exposure to blue-collar occupations, which are

Table 1 Distribution of salaried women from early, middle, and late working life cohorts (WLCs) ($N = 7404$) across sickness absence trajectories (> 15 accumulated days on sickness absence per quarter) by employment conditions, occupational category, diagnosis groups, and the prior 10-year labour market participation patterns. Catalonia, 2012–2014

	Early WLC (N = 2670)				Middle WLC (N = 2739)				Late WLC (N = 1995)			
WOMEN	**Low stable (87.4%)**	**High stable (6.7%)**	**Increasing (5.9%)**	p^a	**Low stable (85.3%)**	**Decreasing (9.4%)**	**Increasing (5.3%)**	p^a	**Low stable (85.4%)**	**Decreasing (5.0%)**	**Increasing (9.6%)**	p^a
	N (%)	N (%)	N (%)		N (%)	N (%)	N (%)		N (%)	N (%)	N (%)	
Type of contract												
Permanent contract	1852 (79.4)	128 (71.5)	125 (79.1)	.045	1935 (82.8)	207 (80.5)	108 (74.0)	.020	1484 (87.0)	85 (85.9)	168 (88.0)	.876
Temporary contract	481 (20.6)	51 (28.5)	33 (20.9)		401 (17.2)	50 (19.5)	38 (26.0)		221 (13.0)	14 (14.1)	23 (12.0)	
Working time												
Full-time	1526 (65.4)	114 (63.7)	101 (63.9)	.984	1528 (65.4)	160 (62.2)	98 (67.1)	.787	1274 (74.7)	72 (72.8)	145 (76.0)	.771
Part-time: > 50% up to 99%	602 (25.8)	49 (27.4)	43 (27.2)		568 (24.3)	66 (25.7)	32 (21.9)		251 (14.7)	14 (14.1)	23 (12.0)	
≤ 50%	205 (8.8)	16 (8.9)	14 (8.9)		240 (10.3)	31 (12.1)	16 (11.0)		180 (10.6)	13 (13.1)	23 (12.0)	
Occupational category												
Skilled non-manual	562 (24.5)	42 (23.8)	31 (20.0)	.305	521 (22.7)	58 (23.3)	42 (28.7)	.556	291 (17.5)	15 (15.5)	28 (15.1)	.759
Skilled manual	327 (14.2)	34 (19.2)	25 (16.1)		351 (15.3)	36 (14.5)	23 (15.8)		285 (17.2)	18 (18.6)	31 (16.8)	
Unskilled non-manual	1248 (54.2)	85 (48.0)	90 (58.1)		1172 (51.1)	127 (51.0)	62 (42.5)		765 (46.0)	41 (42.2)	94 (50.8)	
Unskilled manual	164 (7.1)	16 (9.0)	9 (5.8)		250 (10.9)	28 (11.2)	19 (13.0)		321 (19.3)	23 (23.7)	32 (17.3)	
Income in quartiles												
High	794 (34.1)	50 (27.9)	54 (34.1)	.229	733 (31.3)	69 (27.0)	40 (27.4)	.152	475 (27.9)	26 (26.2)	43 (22.5)	.625
Middle-high	721 (30.9)	51 (28.6)	50 (31.7)		705 (30.2)	78 (30.4)	55 (37.7)		555 (32.6)	28 (28.3)	67 (35.1)	
Middle-low	532 (22.8)	57 (31.8)	36 (22.8)		569 (24.4)	69 (27.0)	39 (26.7)		423 (24.8)	28 (28.3)	54 (28.3)	
Low	284 (12.2)	21 (11.7)	18 (11.4)		328 (14.1)	40 (15.6)	12 (8.2)		251 (14.7)	17 (17.2)	27 (14.1)	
Diagnosis group (ICD-10)												
Mental	252 (11.8)	32 (18.8)	36 (24.5)	<.001	294 (14.9)	52 (22.3)	35 (28.0)	.001	235 (16.8)	15 (20.0)	36 (21.1)	.008
Digestive	83 (3.9)	5 (2.9)	3 (2.0)		131 (6.6)	12 (5.2)	3 (2.4)		99 (7.0)	3 (4.0)	10 (5.8)	
Musculoskeletal	925 (43.3)	44 (25.7)	47 (32.0)		638 (32.4)	68 (29.2)	40 (32.0)		459 (32.6)	28 (37.3)	65 (38.0)	
Pregnancy	327 (15.3)	39 (22.8)	30 (20.4)		195 (9.9)	28 (12.0)	13 (10.4)		–	–	–	
Injuries and poisoning	173 (8.1)	14 (8.2)	8 (5.4)		209 (10.6)	27 (11.6)	13 (10.4)		211 (15.0)	17 (22.7)	32 (18.7)	
Others	377 (17.6)	37 (21.6)	23 (15.7)		505 (25.6)	46 (19.7)	21 (16.8)		403 (28.6)	12 (16.0)	28 (16.4)	
Labour market participation patterns												
Stable employment	1789 (76.7)	143 (79.9)	121 (76.6)	.814	1706 (73.0)	186 (72.4)	114 (78.1)	.701	1214 (71.2)	66 (66.7)	130 (68.1)	.728
Increasing employment	347 (14.9)	25 (14.0)	25 (15.8)		310 (13.3)	37 (14.4)	15 (10.3)		186 (10.9)	12 (12.1)	28 (14.7)	

Table 1 Distribution of salaried women from early, middle, and late working life cohorts (WLCs) ($N = 7404$) across sickness absence trajectories (> 15 accumulated days on sickness absence per quarter) by employment conditions, occupational category, diagnosis groups, and the prior 10-year labour market participation patterns. Catalonia, 2012–2014 *(Continued)*

WOMEN	Early WLC (***N*** = 2670)				Middle WLC (***N*** = 2739)				Late WLC (***N*** = 1995)			
	Low stable (87.4%)	**High stable (6.7%)**	**Increasing (5.9%)**	p^a	**Low stable (85.3%)**	**Decreasing (9.4%)**	**Increasing (5.3%)**	p^a	**Low stable (85.4%)**	**Decreasing (5.0%)**	**Increasing (9.6%)**	p^a
	N (%)	N (%)	N (%)		N (%)	N (%)	N (%)		N (%)	N (%)	N (%)	
Without long-term coverage (early and late)/Fluctuant employment (middle)	197 (8.4)	11 (6.2)	12 (7.6)		320 (13.7)	34 (13.2)	17 (11.6)		127 (7.5)	8 (8.1)	15 (7.9)	
N/A (early and middle)/ Decreasing employment (late)	N/A	N/A	N/A		N/A	N/A	N/A		178 (10.4)	13 (13.1)	18 (9.4)	
Total	2333 (100)	179 (100)	158 (100)		2336 (100)	257 (100)	146 (100)		1705 (100)	99 (100)	191 (100)	

Missing values in the occupational category (OC), income (I), and diagnosis group (DG): N (%) in the early cohort (low stable—OC: 32 (1.37); I: 2 (0.09); DG: 1 (0.04); increasing—OC: 3 (1.90); high stable—OC: 2 (1.12)); middle cohort (low stable—OC: 42 (1.80); I: 1 (0.04); DG: 5 (0.21); decreasing—OC: 8 (3.11); I: 1 (0.39)); and late cohort (low stable—OC: 43 (2.52); I: 1 (0.06); DG: 1 (0.06); decreasing—OC: 2 (2.02); increasing—OC: 6 (3.14)) by sickness absence trajectory in the period 2012–2014. Income in quartiles based on the average monthly income in the early cohort (high: 5063€; middle-high: 1940€; middle-low: 1337€; low: 886€), middle cohort (high: 5315€; middle-high: 2127€; middle-low: 1403€; low: 893€), and late cohort (high: 5577€; middle-high: 2151€; middle-low: 1386€; low: 856€). [a]Chi-squared tests. [b]Fisher's exact tests.

Table 2 Distribution of salaried men from early, middle, and late working life cohorts (WLCs; $N = 4564$) across sickness absence trajectories (> 15 accumulated days on sickness absence per quarter) by employment conditions, occupational category, diagnosis groups, and the prior 10-year labour market participation patterns in Catalonia, 2012–2014

MEN	Early WLC (**N** = 1315)				Middle WLC (**N** = 1747)				Late WLC (**N** = 1502)			
	Low stable (88.1%)	High stable (8.7%)	Increasing (3.2%)	p^a	Low stable (83.3%)	Decreasing (5.4%)	Increasing (11.3%)	p^a	Low stable (82.9%)	High stable (16.3%)	Increasing (0.8%)	p^a
	N (%)	N (%)	N (%)		N (%)	N (%)	N (%)		N (%)	N (%)	N (%)	
Type of contract												
Permanent contract	923 (79.6)	90 (78.9)	31 (73.8)	.652	1228 (84.5)	81 (85.3)	162 (81.8)	.607	1114 (89.5)	212 (86.5)	12 (100.0)	.191
Temporary contract	236 (20.4)	24 (21.1)	11 (26.2)		226 (15.5)	14 (14.7)	36 (18.2)		131 (10.5)	33 (13.5)	0	
Working time												
Full-time	1018 (87.8)	101 (88.6)	35 (83.3)	$.551^b$	1311 (90.1)	84 (88.4)	178 (89.9)	.245	1167 (93.7)	233 (95.1)	10 (83.4)	$.129^b$
Part-time: > 50% up to 99%	66 (5.7)	7 (6.1)	5 (11.9)		72 (5.0)	4 (4.2)	5 (2.5)		33 (2.7)	8 (3.3)	1 (8.3)	
≤ 50%	75 (6.5)	6 (5.3)	2 (4.8)		71 (4.9)	7 (7.4)	15 (7.6)		45 (3.6)	4 (1.6)	1 (8.3)	
Occupational category												
Skilled non-manual	137 (11.8)	7 (6.1)	2 (4.8)	.167	232 (16.0)	14 (14.7)	21 (10.6)	.224	252 (20.3)	46 (18.9)	1 (8.4)	$.161^b$
Skilled manual	514 (44.4)	46 (40.4)	22 (52.3)		599 (41.1)	40 (42.1)	91 (46.0)		502 (40.3)	94 (38.4)	3 (25.0)	
Unskilled non-manual	348 (30.0)	41 (36.0)	10 (23.8)		440 (30.3)	26 (27.4)	68 (34.3)		382 (30.7)	76 (31.2)	4 (33.3)	
Unskilled manual	160 (13.8)	20 (17.5)	8 (19.1)		183 (12.6)	15 (15.8)	18 (9.1)		108 (8.7)	28 (11.5)	4 (33.3)	
Income in quartiles												
Highest	347 (29.9)	28 (24.6)	9 (21.4)	.131	427 (29.3)	24 (25.3)	48 (24.2)	.260	349 (28.1)	55 (22.4)	4 (33.3)	$.314^b$
Third	359 (31.0)	32 (28.1)	11 (26.2)		466 (32.1)	34 (35.8)	56 (28.3)		400 (32.1)	96 (39.2)	5 (41.7)	
Second	290 (25.0)	34 (29.8)	10 (23.8)		344 (23.7)	25 (26.3)	55 (27.8)		324 (26.0)	58 (23.7)	2 (16.7)	
Lowest	163 (14.1)	20 (17.5)	12 (28.6)		217 (14.9)	12 (12.6)	39 (19.7)		172 (13.8)	36 (14.7)	1 (8.3)	
Diagnosis group (ICD-10)												
Mental	151 (14.8)	17 (15.9)	10 (23.8)	.467	146 (11.9)	14 (15.9)	29 (16.5)	.001	107 (10.4)	26 (12.3)	1 (9.1)	$.051^b$
Digestive	94 (9.2)	7 (6.6)	4 (9.5)		188 (15.3)	3 (3.4)	9 (5.1)		184 (17.9)	19 (9.1)	2 (18.1)	
Musculoskeletal	264 (25.9)	27 (25.2)	12 (28.6)		316 (25.7)	21 (23.9)	50 (28.4)		313 (30.5)	76 (36.4)	3 (27.3)	
Injuries and poisoning	297 (29.2)	38 (35.5)	12 (28.6)		333 (27.1)	30 (34.1)	59 (33.5)		149 (14.5)	35 (16.8)	3 (27.3)	
Others	213 (20.9)	18 (16.8)	4 (9.5)		245 (20.0)	20 (22.7)	29 (16.5)		274 (26.7)	53 (25.4)	2 (18.2)	
Labour market articipation patterns												
Stable employment	735 (63.4)	68 (59.7)	30 (71.4)	.309	1045 (71.9)	72 (75.8)	147 (74.2)	.587	1013 (81.4)	197 (80.4)	11 (91.7)	$.923^b$
Increasing employment	258 (22.3)	27 (23.7)	4 (9.5)		213 (14.7)	8 (8.4)	28 (14.1)		69 (5.5)	16 (6.5)	0	
Fluctuant employment (early)/decreasing employment (middle and late)	166 (14.3)	19 (16.7)	8 (19.1)		90 (6.2)	5 (5.3)	10 (5.1)		56 (4.5)	8 (3.3)	0	

Table 2 Distribution of salaried men from early, middle, and late working life cohorts (WLCs; $N = 4564$) across sickness absence trajectories (> 15 accumulated days on sickness absence per quarter) by employment conditions, occupational category, diagnosis groups, and the prior 10-year labour market participation patterns in Catalonia, 2012–2014 *(Continued)*

MEN	Early WLC (**N** = 1315)				Middle WLC (**N** = 1747)				Late WLC (**N** = 1502)			
	Low stable (88.1%)	High stable (8.7%)	Increasing (3.2%)	p^a	Low stable (83.3%)	Decreasing (5.4%)	Increasing (11.3%)	p^a	Low stable (82.9%)	High stable (16.3%)	Increasing (0.8%)	p^a
	N (%)	N (%)	N (%)		N (%)	N (%)	N (%)		N (%)	N (%)	N (%)	
N/A (early)/Steeply decreasing employment (middle and late)	N/A	N/A	N/A		106 (7.3)	10 (10.5)	13 (6.6)		107 (8.6)	24 (9.8)	1 (8.3)	
Total	1159 (100)	114 (100)	42 (100)		1454 (100)	95 (100)	198 (100)		1245 (100)	245 (100)	12 (100)	

Missing values in the occupational category (OC), income (I), and diagnosis group (DG): N (%) in the early cohort (low stable—DG: 1 (0.09); high stable—DG: 2 (1.75)); middle cohort (low stable—DG: 3 (0.21)); and late cohort (low stable—OC: 1 (0.08); DG: 2 (0.16); high stable—OC: 1 (0.41)) by sickness absence trajectory in the period 2012–2014. Income in quartiles based on the average monthly income in the early cohort (high: 5247€; middle-high: 2205€; middle-low: 1560€; low: 1076€), middle cohort (high: 6577€; middle-high: 2724€; middle-low: 1845€; low: 1264€), and late cohort (high: 6339€; middle-high: 3094€; middle-low: 2027€; low: 1419€). [a]Chi-squared tests. [b]Fisher's exact tests.

Table 3 Association between labour market participation patterns and sickness absence trajectories (> 15 accumulated days on sickness absence per quarter) in salaried workers from early, middle, and late working life cohorts (WLCs; N = 11,968). Catalonia (Spain), 2012–2014 (odds ratios [ORs] and 95% confidence intervals [CIs])

WOMEN			Sickness absence trajectories[a]			
	Early WLC (N = 2670)		Middle WLC (N = 2739)		Late WLC (N = 1995)	
	High stable vs low stable	Increasing vs low stable	Decreasing vs low stable	Increasing vs low stable	Decreasing vs low stable	Increasing vs low stable
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Labour market participation patterns						
Crude model						
Stable employment	1	1	1	1	1	1
Increasing employment	0.90 (0.58–1.40)	1.07 (0.68–1.66)	1.09 (0.75–1.59)	0.72 (0.42–1.26)	1.19 (0.63–2.24)	1.41 (0.91–2.18)
Without long-term coverage (early and late) /Fluctuant employment (middle)	0.70 (0.37–1.31)	0.90 (0.49–1.66)	0.97 (0.66–1.43)	0.80 (0.47–1.34)	1.16 (0.54–2.47)	1.10 (0.63–1.94)
N/A (early and middle)/ Decreasing employment (late)	N/A	N/A	N/A	N/A	1.34 (0.73–2.49)	0.94 (0.56–1.58)
Adjusted model [b]						
Stable employment	1	1	1	1	1	1
Increasing employment	0.80 (0.46–1.38)	1.35 (0.77–2.37)	1.07 (0.57–2.01)	1.10 (0.47–2.60)	1.21 (0.37–3.96)	0.92 (0.42–2.02)
Without long-term coverage (early and late) /Fluctuant employment (middle)	0.56 (0.24–1.32)	1.13 (0.46–2.78)	0.89 (0.51–1.55)	1.13 (0.55–2.32)	1.40 (0.21–9.13)	0.56 (0.15–2.06)
N/A (early and middle)/ Decreasing employment (late)	N/A	N/A	N/A	N/A	0.90 (0.31–2.59)	0.70 (0.34–1.45)
MEN	**Early WLC (N = 1315)**		**Middle WLC (N = 1747)**		**Late WLC (N = 1502)**	
	High stable vs low stable	**Increasing vs low stable**	**Decreasing vs low stable**	**Increasing vs low stable**	**High stable vs low stable**	**Increasing vs low stable**
Crude model						
Stable employment	1	1	1	1	1	1
Increasing employment	1.13 (0.71–1.81)	0.38 (0.13–1.09)	0.55 (0.26–1.15)	0.93 (0.61–1.44)	1.19 (0.68–2.10)	–
Fluctuant employment (early)/Decreasing employment (middle and late)	1.24 (0.72–2.11)	1.18 (0.53–2.62)	0.81 (0.32–2.05)	0.79 (0.40–1.55)	0.73 (0.34–1.57)	–
N/A (early)/Steeply decreasing employment (middle and late)	N/A	N/A	1.37 (0.69–2.73)	0.87 (0.48–1.59)	1.15 (0.72–1.84)	0.86 (0.11–6.73)

Table 3 Association between labour market participation patterns and sickness absence trajectories (> 15 accumulated days on sickness absence per quarter) in salaried workers from early, middle, and late working life cohorts (WLCs; N = 11,968). Catalonia (Spain), 2012–2014 (odds ratios [ORs] and 95% confidence intervals [CIs]) *(Continued)*

Adjusted model [b]						
Stable employment	1	1	1	1	1	1
Increasing employment	1.27 (0.58–2.77)	0.21 (0.05–0.96)	0.79 (0.26–2.44)	0.97 (0.46–2.04)	1.73 (0.59–5.03)	–
Fluctuant employment (early) / Decreasing employment (middle and late)	1.20 (0.56–2.59)	0.74 (0.23–2.34)	1.11 (0.30–4.10)	0.78 (0.30–2.01)	1.42 (0.42–4.80)	–
N/A (early)/ Steeply decreasing employment (middle and late)	N/A	N/A	1.81 (0.73–4.47)	0.94 (0.45–1.96)	1.38 (0.74–2.59)	0.76 (0.06–0.34)

The low stable class is the reference group for the multinomial logistic regression analysis; [b]model adjusted for type of contract, working time, occupational category, income in quartiles, diagnosis group during 2012–2014, and time of employment during 2002–2011.

when defining the LMP patterns, including transitions among types of contract, working time, and occupations, could lead to a more specific LMP pattern that might relate to future SA behaviour. In this vein, one study has shown that working life patterns characterised by long-term exposure to blue-collar occupations, which are physically demanding and more subject to work accidents, have an effect on health outcomes that is similar to that of intermittent joblessness [14]. However, it should be considered that including a higher number of employment situations could increase the heterogeneity of patterns, which might attenuate the effect of an association between LMP patterns and health outcomes. Furthermore, as mentioned above, in some studies, the quality of employment was measured in terms of precarious employment using a multidimensional approach, yielding stronger associations with health outcomes than obtained by measuring one dimension [15]. However, most of those studies did not have a longitudinal perspective that could allow for consideration of the cumulative effects of employment quality over time [39].

Another hypothesis could be related to the impact of contextual variables, such as the economic crisis that began in 2008, Social Security coverage, and its relationship with the health system throughout the SA benefit system in the country. The impact of the economic crisis, which implied a general worsening of the labour market context, thus might have influenced the course of future SA, regardless of the individual's employment pathway. Previous studies have focused on how contextual factors such as the unemployment rate or poor local economy affect SA. One such study showed a negative correlation between the unemployment rate and the probability of having long-term SA [8]. Another study showed that a poor local economy in terms of low municipal revenue and high unemployment rate was related to decreased self-certified SA [43]. In both cases, the threat of becoming unemployed because of a high level of unemployment discouraged workers from taking SA. However, the 3-year follow-up in our work could be too short to uncover lasting effects of the Great Recession on SA levels, especially when the most acute phase was in 2013, with an unemployment rate reaching 27% [44].

Finally, as several European studies have shown, differences in the probability of having SA exist according to characteristics of the sickness benefit system, such as the eligibility conditions and the level of generosity of SA compensation (i.e., wage replacement amount and benefit entitlement duration). For example, the probability of being on SA is higher in countries where employees are entitled to receive a full wage replacement in case of illness [45]. In contrast, another study showed a lag effect between levels of SA benefits on SA incidence, so that countries with relatively generous SA benefits show lower levels of SA in the long term. According to those authors, the generosity of SA benefits provided sufficient income support that helped beneficiaries overcome economic hardship and recover health [46]. Spain has specific conditions for access to SA (i.e., 180 days of paid contributions during the prior 5 years), relatively generous benefits (e.g., 60–75% wage replacement from the Social Security budget), and access to medical care provided by the National Health System. The cost of SA in Spain is shared by the employer (4th–15th day) and the Social Security system (16th onwards), unlike other countries where the employer pays the entire cost of SA [47]. However, because our study population was based exclusively on workers who have had SA, they were all entitled to full SA benefits, so our results may not be attributable to the eligibility conditions for access. In the present study, employees who did not accumulate days on SA were not included. Last but not least, a general practitioner grants medical certification from the National Health System, regardless of the Social Security system and companies. In this sense, a possible adverse effect of unstable employment on health may be buffered by the provision of universal health coverage by the National Health System.

Nevertheless, we found that men in their early working life stage who followed a pattern of increasing time in employment were less likely to increase their accumulation of future SA days. This result suggests that a stable transition into employment at the beginning of working life may have a protective effect on future health. However, according to several studies, young workers tend to enter into more insecure and precarious employment compared to older workers [48, 49], and temporary workers report higher job insecurity than those with permanent jobs and show lower SA rates [50]. In line with previous studies, we found that one-third of men at the early working life stage were employed in temporary jobs (Supplementary Table 4). An alternative explanation would be that low levels of SA are a reflection of an earlier return to work that can be stimulated by the loss of financial resources through receiving SA benefits instead of a full salary. This situation may particularly affect temporary workers because their jobs are often more precarious and employment conditions often worse, which could induce them to reduce SA length out of fear of job dismissal and being unable to fulfil their financial needs [50, 51].

One of the main limitations of this study is that workers without SA were excluded, which could have meant exclusion of those with better health status, those who had poor health status but were engaged in presenteeism, or those who did not qualify for SA benefits during the previous period, leading to selection bias. Also, we have classified workers according to their employment condition, medical diagnosis group, and the labour market state where they spent most of the time as a representative of the entire period, which could have led to a potential classification bias. A weekly labour state measure could have led to underestimation of short employment spells because approximately one-fifth of these were less than four days (results not shown). Another limitation comes from the use of two modelling methods based on simplifying assumptions, which may have implications for the robustness and reliability of the results; therefore, any conclusion derived should be considered carefully [17, 52]. In this regard, LMP patterns in the early working life cohorts may not represent homogeneous groups because their global ASW showed lower values than recommended. Likewise, the low stable SA trajectories showed the lowest values of assignment accuracy across WLCs. Nevertheless, the assessment of cluster analysis and latent classes showed adequate values for most of the groups. Also, the results are representative of salaried workers living in Catalonia and require caution with comparisons to other countries because differences in labour market regulations, social security systems (e.g., SA benefit generosity), and sociocultural context could shape SA in a distinct way [47]. Moreover, this study could not account for working conditions (only occupational category as a proxy) or health status before the SA course because the information was not available; therefore, a potential confounding bias might have affected our estimates. Notwithstanding, not controlling for initial health status is less an issue for those workers at early working life stages because bad health increases with age. The decreasing SA trajectories could represent not only workers who reduced accumulated SA days over time but also those who exited the labour market because of permanent disability or retirement, or who died during the 3-year follow-up. Nevertheless, in our study, workers in such situations represented only 4–8% of the population, depending on the trajectory group and working life stage. Furthermore, the administrative registers do not record a worker's status when they are without contact with Social Security. Individuals could be unemployed without benefits and actively seeking a job, jobless and not seeking a job (i.e., outside the labour force or inactive), or in informal employment (i.e., working off the record, without a contract or social protection), and we do not know how these situations affect their health [53].

The study also has some strengths. First, we incorporated a life-course approach into the design. To our knowledge, few studies on occupational epidemiology have examined the relationship between 10 years of prior working life and the course of future health. Prior evidence on this issue has been based mostly on cross-sectional or longitudinal studies without a life-course approach [41, 54, 55]. In practice, the construction of patterns of LMP allows for consideration of the timing, order, and duration of given labour market states. Second, the study population comes from a Spanish workforce cohort (the WORKss cohort) [23], which has a large sample size and comprises high-quality registers. Third, employment history and SA data are register-based and medically certified, which allows for calculation of the exact starting and closing dates for each employment status period and SA episode. Fourth, the SA medical diagnosis certification is issued by a general practitioner from the National Health System, which implies higher validity of the diagnosis than self-reported SA measures [54].

Conclusions

In conclusion, patterns of LMP during a 10-year prior working life are not related to future SA trajectories, regardless of the stage of the working life. Future studies should consider working life transitions closer to the SA course, with an employment quality approach framed with contextual factors, which may help in understanding of this relationship.

Supplementary information

Supplementary information accompanies this paper at https://doi.org/10.1186/s12889-020-09396-9.

Additional file 1: Supplementary Table 1. (clustering quality average silhouette width).

Additional file 2: Supplementary Table 2. (model fit results for latent class growth analysis).

Additional file 3: Supplementary Table 3. (model adequacy assessment for latent class growth analysis).

Additional file 4: Supplementary Table 4. (distribution of salaried workers across labour market participation patterns by covariates).

Abbreviations

SA: sickness absence; LMP: labour market participation; WORKss cohort: The Spanish WORKing life Social Security cohort; ICD-10: International Classification of Diseases 10th version; WLC: working life cohort; LCGA: latent class growth analysis

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Authors' contributors

All listed authors fulfil authorship criteria. JCH, MUL, LSS, and FGB participated in the conception and design of the study. JCH and LSS performed the data management and data analysis. JCH, MUL, LSS, and FGB interpreted the data. JCH drafted the first version of the manuscript, and all authors made subsequent revisions, agreed on the text and findings and approved this final version. The corresponding author certifies that all listed authors meet authorship criteria. LSS is the guarantor.

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Availability of data and materials
The datasets supporting the findings of this study are based on registers from the Spanish Social Security and the Catalan Institute for Medical and Health Evaluations. A record linkage agreement protocol between both institutions and the Centre for Research in Occupational Health ensures the confidentiality of the databases, which are anonymised to the authors and are not publicly available.

Ethics approval and consent to participate
The study is a part of research project number 2017/7398/I entitled "Trayectorias de incapacidad temporal y su relación con las trayectorias laborales. Evidencia de la cohorte WORKss en Cataluña, 2012–2014" ("Trajectories of sickness absence and its relationship with labour trajectories. Evidence from the WORKss cohort in Catalonia, 2012–2014"), which was approved by Parc de Salut Mar Ethics Committee in Barcelona and conducted under the principles of the Helsinki declaration.

Consent for publication
Not applicable.

Competing interests
All authors declare no conflicts of interest.

Author details
[1]Center for Research in Occupational Health (CiSAL), Pompeu Fabra University, Barcelona, Spain. [2]CIBER of Epidemiology and Public Health (CIBERESP), Madrid, Spain. [3]IMIM – Parc Salut Mar, Barcelona, Spain. [4]GRECS-Research Group on Statistics, Econometrics and Health, Faculty of Economics and Business, University of Girona (UdG), C/ Universitat de Girona, 10, 17071 Girona, Spain. [5]Barcelona Institute for Global Health (ISGlobal), Barcelona, Spain.

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References

1. International Labour Organization. The Future of Work We Want: A global dialogue. 2017;:1–19.http://socialprotection-humanrights.org/wp-content/uploads/2017/10/The-Future-of-Work-We-Want_2017.pdf (accessed 8 Jul 2018).
2. Amick BC, McLeod CB, Bültmann U. Labor markets and health: an integrated life course perspective. Scand J Work Environ Health. 2016;42:346–53. https://doi.org/10.5271/sjweh.3567.
3. Kuh D, Ben-Shlomo Y, Lynch J, et al. Life course epidemiology. J Epidemiol Community Heal. 2003;57:778–83. https://doi.org/10.1016/B978-0-08-097086-8.14085-1.
4. Ben-Shlomo Y, Kuh D. A life course approach to chronic disease epidemiology: conceptual models, empirical challenges and interdisciplinary perspectives. Int J Epidemiol. 2002;31:285–93. https://doi.org/10.1093/ije/31.2.285.
5. Allebeck P, Mastekaasa A. Chapter 5. Risk factors for sick leave - general studies. Scand J Public Health. 2004;32:49–108. https://doi.org/10.1080/14034950410021853.
6. de Vries H, Fishta A, Weikert B, et al. Determinants of sickness absence and return to work among employees with common mental disorders: a scoping review. J Occup Rehabil. 2018;28:393–417. https://doi.org/10.1007/s10926-017-9730-1.
7. Head J, Kivimäki M, Martikainen P, et al. Influence of change in psychosocial work characteristics on sickness absence: the Whitehall II study. J Epidemiol Community Heal. 2006;60:55–61. https://doi.org/10.1136/jech.2005.038752.
8. Askildsen JE, Bratberg E, Nilsen ØA. Unemployment, labor force composition and sickness absence: a panel data study. Health Econ. 2005;14:1087–101. https://doi.org/10.1002/hec.994.
9. Malo MA, Muñoz-Bullón F. Employment status mobility from a life-cycle perspective: a sequence analysis of work-histories in the BHPS. Demogr Res. 2003;9:119–62. https://doi.org/10.4054/DemRes.2003.9.7.
10. Simonson J, Gordo LR, Titova N. Changing employment patterns of women in Germany: how do baby boomers differ from older cohorts? A comparison using sequence analysis. Adv Life Course Res. 2011;16:65–82. https://doi.org/10.1016/j.alcr.2011.03.002.
11. Kobayashi LC, Feldman JM. Employment trajectories in midlife and cognitive performance in later life: longitudinal study of older American men and women. J Epidemiol Community Heal. 2019;73:232–8. https://doi.org/10.1136/jech-2018-211153.
12. Lu W, Benson R, Glaser K, et al. Relationship between employment histories and frailty trajectories in later life: evidence from the English longitudinal study of ageing. J Epidemiol Community Health. 2017;71:439–45. https://doi.org/10.1136/jech-2016-207887.
13. McKetta S, Prins SJ, Platt J, et al. Social sequencing to determine patterns in health and work-family trajectories for U.S. women, 1968–2013. SSM - Popul Heal. 2018;6:301–8. https://doi.org/10.1016/j.ssmph.2018.10.003.
14. Devillanova C, Raitano M, Struffolino E. Longitudinal employment trajectories and health in middle life: insights from linked administrative and survey data. Demogr Res. 2019;40:1375–412. https://doi.org/10.4054/DEMRES.2019.40.47.
15. Rönnblad T, Grönholm E, Jonsson J, et al. Precarious employment and mental health: a systematic review and meta-analysis of longitudinal studies. Scand J Work Environ Health. 2019;45:429–43. https://doi.org/10.5271/sjweh.3797.
16. López Gómez MA, Serra L, Delclos GL, *et al.* Employment history indicators and mortality in a nested case-control study from the Spanish WORKing life social security (WORKss) cohort. PLoS One 2017;12:e0178486. doi:10.1371/journal. pone.0178486.
17. Piccarreta R, Studer M. Holistic analysis of the life course: methodological challenges and new perspectives. Adv Life Course Res. 2019;41:100251. https://doi.org/10.1016/j.alcr.2018.10.004.
18. Kerkhofs M, Lindeboom M. Age related health dynamics and changes in labour market status. Health Econ. 1997;6:407–23.
19. Bekker MHJ, Rutte CG, Van Rijswijk K. Sickness absence : a gender-focused review. Psychol Health Med. 2009;14:405–18. https://doi.org/10.1080/13548500903012830.
20. Lallukka T, Kronholm E, Pekkala J, *et al.* Work participation trajectories among 1,098,748 Finns: reasons for premature labour market exit and the incidence of sickness absence due to mental disorders and musculoskeletal diseases. 2019;**19**:1418. doi:https://doi.org/10.1186/s12889-019-7753-6.
21. Alba-Ramirez A, López-Mourelo E. Sickness absence from work in Spain: are there gender differences? *Univ Carlos III Madrid Work Pap* 2017;:17–15.http://hdl.handle.net/10016/25937.
22. Haas SA, Oi K, Zhou Z. The life course, cohort dynamics, and international differences in aging trajectories. Demography. 2017;54:2043–71. https://doi.org/10.1007/s13524-017-0624-9.The.
23. López Gómez MA, Durán X, Zaballa E, et al. Cohort profile: the Spanish WORKing life Social security (WORKss) cohort study. BMJ Open. 2016;6:e008555. https://doi.org/10.1136/bmjopen-2015-008555.
24. Dekkers-Sánchez PM, Hoving JL, Sluiter JK, et al. Factors associated with long-term sick leave in sick-listed employees: a systematic review. Occup Environ Med. 2008;65:153–7. https://doi.org/10.1136/oem.2007.034983.
25. Ziebarth NR. Long-term absenteeism and moral hazard — evidence from a natural experiment. Labour Econ. 2013;24:277–92. https://doi.org/10.1016/j.labeco.2013.09.004.
26. European Commission. Employment. Spain: Social Affairs & Inclusion; 2019. https://ec.europa.eu/social/main.jsp?catId=1129&langId=en (.
27. Ministerio de Trabajo y Economía Social. Prestaciones. 2020. http://www.sepe.es/HomeSepe/Personas/distributiva-prestaciones.html ().
28. Gabadinho A, Ritschard G, Müller NS, *et al.* Analyzing and Visualizing State Sequences in R with TraMineR. *J Stat Softw* 2011;**40**:1–37. doi:https://doi.org/10.18637/jss.v040.i04.
29. Abbott A, Tsay A. Sequence analysis and optimal matching methods in sociology: review and Prospect. Sociol Methods Res 2000;29:3–33. doi: https://doi.org/10.1177/0049124100029001001.
30. Studer M. WeightedCluster Library Manual: A practical guide to creating typologies of trajectories in the social sciences with R. LIVES Work. Pap. 24. 2013. doi:https://doi.org/10.12682/lives.2296-1658.2013.24.
31. Rousseeuw PJ. Silhouettes: a graphical aid to the interpretation and validation of cluster analysis. J Comput Appl Math. 1987;20:53–65.

32. Muthén B, Muthén LK. Integrating person-centered and variable-centered analyses: growth mixture modeling with latent trajectory classes. Alcohol Clin Exp Res. 2000;24:882–91. https://doi.org/10.1111/j.1530-0277.2000.tb02070.x.
33. Jung T, Wickrama KAS. An introduction to latent class growth analysis and growth mixture modeling. Soc Personal Psychol Compass. 2008;2:302–17. https://doi.org/10.1111/j.1751-9004.2007.00054.x.
34. van de Schoot R, Sijbrandij M, Winter SD, et al. The GRoLTS-checklist: guidelines for reporting on latent trajectory studies. Struct Equ Model A Multidiscip J. 2017;24:451–67. https://doi.org/10.1080/10705511.2016.1247646.
35. Nagin DS. Group-Base modeling of development. Harvard University Press. 2005.
36. Ubalde-Lopez M, Hernando-Rodriguez JC, Benavides FG, et al. Trajectories of sickness absence among salaried workers: evidence from the WORKss cohort in Catalonia (Spain), 2012-2014. BMJ Open. 2019;9. https://doi.org/10.1136/bmjopen-2019-029092.
37. Oke A, Braithwaite P, Antai D. Sickness absence and precarious employment: a comparative cross-national study of Denmark, Finland, Sweden, and Norway. Int J Occup Environ Med. 2016;7:125–47. https://doi.org/10.5694/j.1326-5377.1981.tb135504.x.
38. Matilla-Santander N, González-Marrón A, Martín-Sánchez JC, *et al.* Precarious employment and health-related outcomes in the European Union: a cross-sectional study. *Crit Public Health* 2019;:1–12. doi:https://doi.org/10.1080/09581596.2019.1587385.
39. Bodin T, Çağlayan C, Garde A, et al. Precarious employment in occupational health – an OMEGA-NET working group position paper. Scand J Work Environ Health. 2019;28:191–6. https://doi.org/10.5271/sjweh.3860.
40. Helgesson M, Johansson B, Nordqvist T, et al. Unemployment at a young age and later sickness absence, disability pension and death in native swedes and immigrants. Eur J Pub Health. 2012;23:606–10. https://doi.org/10.1093/eurpub/cks099.
41. Benavides FG, Duran X, Gimeno D, et al. Labour market trajectories and early retirement due to permanent disability: a study based on 14 972 new cases in Spain. Eur J Pub Health. 2015;25:673–7. https://doi.org/10.1093/eurpub/cku204.
42. Kivimäki M, Forma P, Wikström J, et al. Sickness absence as a risk marker of future disability pension: the 10-town study. J Epidemiol Community Health. 2004;58:710–1. https://doi.org/10.1136/jech.2003.015842.
43. Virtanen M, Kivima M, Elovainio M, et al. Local economy and sickness absence: prospective cohort study. J Epidemiol Community Heal. 2005;59:973–8. https://doi.org/10.1136/jech.2005.036236.
44. Sanz-de-Galdeano A, Terskaya A. The labor market in Spain, 2002–2016. *IZA World Labor* 2017;**403**:1–12. doi:https://doi.org/10.15185/izawol.403.
45. Chaupain-guillot S. Guillot O. Sickness Benefit Rules and Work Absence : An Empirical Study Based on European Data. 2017;127.
46. Sjöberg O. Positive welfare state dynamics? Sickness benefits and sickness absence in Europe 1997–2011. Soc Sci Med. 2017;177:158–68. https://doi.org/10.1016/j.socscimed.2017.01.042.
47. Gimeno D, Bültmann U, Benavides FG, et al. Cross-national comparisons of sickness absence systems and statistics: towards common indicators. Eur J Pub Health. 2014;24:663–6. https://doi.org/10.1093/eurpub/cku070.
48. Bachmann R, Felder R, Tamm M. Labour market participation and atypical employment over the life cycle: a cohort analysis for Germany. IZA Inst Labor Econ. 2018.
49. Dudel C, López Gómez MA, Benavides FG, et al. The length of working life in Spain: levels, recent trends, and the impact of the financial crisis. Eur J Popul. 2018;34:769–91. https://doi.org/10.1007/s10680-017-9458-9.
50. Virtanen M, Kivimäki M, Elovainio M, et al. From insecure to secure employment: changes in work, health, health related behaviours, and sickness absence. Occup Environ Med. 2003;60:948–53.
51. Benach J, Vives A, Amable M, et al. Precarious employment: understanding an emerging social determinant of health. Annu Rev Public Health. 2014;35:229–53. https://doi.org/10.1146/annurev-publhealth-032013-182500.
52. Mikolai J, Lyons-Amos M. Longitudinal methods for life course research: A comparison of sequence analysis, latent class growth models, and multi-state event history models for studying partnership transitions. *Longit Life Course Stud* 2017;**8**:191–208. doi:https://doi.org/10.14301/llcs.v8i2.415.
53. Montero-Moraga JM, Benavides FG, Lopez-Ruiz M. Association between informal employment and health status and the role of the working conditions in Spain. Int J Health Serv. 2020;50:199–208. https://doi.org/10.1177/0020731419898330.
54. Hensing G. Chapter 4. Methodological aspects in sickness-absence research. Scand J Public Heal Suppl. 2004;32:44–8. https://doi.org/10.1080/14034950410021844.
55. Virtanen P. Labor market trajectories and health: a four-year follow-up study of initially fixed-term employees. Am J Epidemiol. 2005;161:840–6. https://doi.org/10.1093/aje/kwi107.

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DISCUSSION

"*I am I and my circumstance; and, if I do not save it, I do not save myself.*"

-Ortega y Gasset

5. GENERAL DISCUSSION

This doctoral thesis describes LMP patterns and trajectories of accumulated days of SA. Likewise, this thesis provides a novel insight in examining the relationship between LMP patterns across the prior working life and the course of future SA from a life course perspective.

Main findings

- Three and four SA trajectories were estimated in the first and the third study, respectively. In both studies, the low-stable trajectory grouped most of the population.
- We found that SA diagnosis was the main determinant for all SA trajectories. Particularly, mental disorders were strongly related to increased SA days over time among men at the early cohort.
- Employment-related conditions did not determine SA trajectories, except for income, in the first study, and type of contract, in the additional analysis excluded from the third study. Low income was associated with decreasing SA trajectories, while a weaker association for increasing ones at later cohorts. Temporary contracts were positively associated with high/increasing SA trajectories at early/middle working life stages, respectively.

- In general, about 70% of workers who have SA experienced prior ten-year LMP patterns with stable employment. However, workers at early working life stages showed a drop in the proportion of stable employment in the prior two years of LMP.
- During the economic crisis, women had an increasing entry into the labour market, while men left employment massively. However, a higher proportion of women than men showed a pattern of means-tested unemployment benefits over the two-year working life.
- Prior ten-year LMP patterns were not related to the course of future SA across the three working life stages, except for men at the early working life stage. However, prior two-year LMP patterns were related to the course of future SA among women at the early and middle working life stages.

5.1. Sickness absence trajectories and associated determinants

In Study I, three SA trajectories of accumulated days on SA were identified during a 3-year follow-up. Most of the population showed a low-stable trajectory with few SA days on average (7-13 days per quarter), while the other two accumulated most of the days on SA showing decreasing and increasing trajectories. Similarly, Study III found four SA trajectories for individuals who accumulate more than

15 days on SA quarterly. In this case, the low-stable trajectory showed an average of 30-40 days on SA.

The SA behaviour could not be entirely observed by using dichotomous outcomes (i.e. yes/no), including only the initial SA episode and not subsequent ones, or selecting short follow-ups. Therefore, trajectory groups as outcome measure allow a better understanding of the SA phenomenon by capturing the changes in the course of SA over time.

Previous studies have investigated trajectories of annual months on work disability (i.e. SA and disability pension joined), and unemployment among young before and after a health problem occurred such as common mental disorders (103) or acute myocardial infarction (104). Among people with mental disorders, 26% followed trajectories of high levels of work disability compared to the 9% without this condition. The majority of people with acute myocardial infarction had low levels of work disability within two years after the event. Factors such as education and comorbid mental disorders were strong determinants of work disability trajectories in both studies. SA trajectories can be determined by factors such as health status, medical diagnosis, employment and work conditions, socioeconomic position, among others (64,105).

As regards to determinants for the SA course, we found medical diagnosis as the main determinant for all SA trajectories. In particular, mental disorder diagnosis was the strongest determinant for increasing SA trajectories among young men (Study I) and for increasing SA trajectories of more than 15 accumulated days among women at middle working life stages (Appendix Table I, show an additional analysis excluded from Study III).

The prevalence of mental disorders across the European Union (EU) countries is estimated at around 15% in 2017 (106). The burden of mental disorders affects morbidity and mortality, mainly driven by deaths from suicides among men. It entails economic costs that amount to 4% of GDP across the 28 EU countries in 2015 (107). According to a UK study, mental disorders are the leading medical diagnosis of long-term SA, before musculoskeletal disorders (108). Mental disorders have a long-lasting effect on the duration and recurrence of SA (109), and part of people who suffer from them have subsequent trajectories of increasing and continuously high levels of work disability (103,110). The increased risk of increasing days on SA among young men with SA due to mental disorders may be related to the worst employment and working conditions of the jobs found after being massively dismissed due to the economic recession, which may affect their health. In this sense, prior studies have found that adverse working conditions are related to a higher risk of having SA spells due to mental disorders (105,111). Likewise, the higher risk of accumulating more than 15 days on SA among women with SA due to mental disorders could be explained by the challenge of combining family and work-life ("double burden") in a context of stereotyped gender roles (80). Also, women are more likely than men to seek help because of the gender roles and then, a higher willingness to report symptoms of mental health problems to the general practitioner (112). Although our study depicts a broad picture of SA trajectories and accounts for diagnosis groups as determinants, a further step should be adopting a specific diagnosis approach when defining SA trajectories, which could contribute to disentangling the course of SA more accurately.

In contrast, concomitant employment-related conditions, in general, did not determine SA trajectories, except for income and type of contract, in the case of SA trajectories of more than 15 days. For income, we found that women and men with low income levels at late cohorts are more likely to accumulate fewer days on SA over time and less likely to show an increasing future SA trajectory (Study I). Regarding the type of contract, women with temporary contracts at early and middle working life stages had a higher risk of highly stable and increasing SA days over time, respectively (Appendix Table I).

The relationship between low income and decreasing days of SA over time among older workers could be related to the payment regulation of SA benefits. Since taking days on SA implies not receiving a full salary the time on SA and, instead, receiving SA benefits of smaller amount (60% of the salary from the 4th to the 20th day and 75% from the 21st day onwards) (86,87). This loss of economic resources may encourage low income individuals to take SA for fewer days than needed and, therefore, to return to work earlier. Likewise, the context of the economic crisis has exacerbated job insecurity associated with worse employment conditions, which could lead individuals to reduce SA levels for fear of being dismissed and financial loss. Therefore, low SA trajectories among low income workers may reflect the absence of those who did not qualify for SA benefits (i.e. 180 days of paid contributions during the prior five years) or presenteeism (i.e. attending to work while ill) of those out of the study population (65,113). The context of the crisis in Spain has led to high unemployment levels not only in young people (more than 50% in 2012) but even in people between 55-64 years (18% in both women and men in 2012) who by their generation had more stable jobs. This contrast with a lower level of unemployment across the EU-15 during the recession (7.8% men and 6.6% women) and a lower level of long-term unemployment (12 months or more, 4.7% EU-15 and 11% Spain in 2012) (114). Moreover, low income showed a weaker relationship with increasing trajectories among older workers. A possible explanation, as in the previous case, could be presenteeism, since people with low income may delay the onset of SA for a while to maintain their full salary (115). However, as the health problem worsens, they eventually may end up taking a long-term SA. In this regard, a previous study showed that sickness presenteeism is a risk factor for future suboptimal health and SA (116). Another possible explanation could be that low income was associated with unfavourable employment conditions, which can trigger poor health and, therefore, increasing SA days over time (117). Furthermore, one may argue that a higher generosity of SA benefits may be an incentive to extend SA duration. However, a previous study found that generous sickness benefits may help individuals to better recover from illness and leading them to reduce SA in the long term. It, therefore, supports a lack of incentives to extend SA beyond what is strictly necessary for medical reasons (62).

As mentioned above, an additional analysis (excluded in Study III) considering the determinants of SA trajectories of more than 15 days showed similar results as with SA trajectories of any number of days, except for employment-related conditions (Appendix Table I). In this case, temporary contracts were positively associated with hight stable and increasing SA trajectories among early and middle working life stages, respectively. Similarly, this result was in line with a Swedish study that showed that workers with temporary employment had a higher risk for SA compared to full-time employment (118). According to the authors, this finding could be explained by higher psychosocial stress related to insecure employment. In contrast, some studies have shown no association between temporary employment and SA (119,120). These studies suggested several explanations such as short tenure, which might be a disincentive for taking, in this case, work-related SA, or that the difference in the incidence in SA rates was instead explained by firm size and economic activity. Furthermore, other studies have shown a negative association between temporary contracts and SA rates, which may be by explained by job insecurity and presenteeism (65,121).

5.2. Labour market participation patterns

Six LMP patterns were identified during ten years of working life (2002-2011) among people who accumulated more than 15 days on SA in the subsequent three years considering different stages of working life. Overall, about 70% of people followed LMP patterns of stable employment before the SA period under study. Women at early working life stages showed a higher proportion of stable employment than early ones, while the opposite was observed in men. However, during the economic recession, a part of the women at late working life stages experienced an increase in the entry into the labour market, while men left it massively (Study II). Considering two-year LMP patterns (2010-2011) prior to SA trajectories, women and men showed the lowest proportions of stable employment at the earlier working life stages, but also the highest ones at later working life stages. Moreover, women had a higher proportion of means-tested unemployment benefits than men (Appendix Figure I).

A higher proportion of stable employment was observed in women at the beginning of their working life than those at late working life stages. This proportion was even higher than that of men in the early and middle working life stages. One possible explanation is that the economic crisis affected the quality of employment of women at early working life stages in terms of higher precariousness, and worse employment conditions (the share of part-time was four times that of men in 2012) rather than in terms of loss of employment as occurred in men (men lose 12 years of working life expectancy while women lost 7 years between 2006-2008) (114,122,123). The economic recession reduced future employability opportunities and favoured the non-participation in the labour market among young people (36,37,124). In particular, it affected men in the construction industry, a highly masculinised sector (125).

Women of the middle stage of working life and men of the early stage showed fluctuating employment patterns characterised by inflows and outflows between employment, unemployment receiving benefits and without social security coverage spells. These results are in line with a report on employment in young Spanish people aged 16-34, which showed that the probability of moving from employment to unemployment had more than doubled after the economic crisis and showed greater instability. Similarly, the same study showed that the probability of abandonment of the active population during the crisis was higher among the youngest people aged 16-24 than those aged 25-34, even though there was a downward trend between 2005 and 2014. According to the authors, this difference observed in the youngest could be explained by the preference of obtaining higher educational levels, staying in the parents' home or emigrating to find new job opportunities (124).

Patterns without long-term social security coverage were found exclusively on women at the early and late working life stages. This non-participation into the labour market at the beginning of working life could be related to the extension of studies, maternity, abandonment of the job search given the reduced job opportunities (discouraged worker effect) (114,124,126). Likewise, the same LMP pattern was followed by women in their late working life. In this case, there was a negligibly low level of employment before the onset of the economic crisis. The traditional gender roles could mainly explain this LMP pattern. It should be highlighted that women and men in the late working life stages were born between 1957 and 1966, where gender roles were much more widespread in society than in younger cohorts. A stereotypical conception of gender roles considers women the main responsible for reproductive and care work (home-keepers), and men, the primary economic provider (breadwinner). According to this view, it is unusual for women to be in paid work and, in such a case, they are not considered equal partners and their wages are secondary (54,127).

However, a part of women at late working life stages who followed this pattern without long-term Social Security coverage showed increasing transitions to employment coinciding with the beginning of the economic recession. This entry into employment among women at late working life stages could be related to steeply decreasing employment patterns among men in their middle and late working life stages. The latter were found exclusively on men and could represent, on the one hand, temporary labour force exit (e.g. jobless not looking for a job) or unemployed receiving benefits at least during the follow-up. On the other hand, they could represent a definitive exit towards retirement, which is more likely in the later working life stages. In this sense, a Finnish study found that experiencing massive layoff leads to a subsequent weaker career and transitions to early unemployment pension (i.e. system no longer available that allowed retirement after being unemployed for a specific time) than those retained workers (128). Despite the influence of gender-based roles, in the present study, the loss of employment of men at late working life stages jointly with access to moderate wage replacement benefits (if any) could have led to a decrease in income, triggering the entry into the labour market of women at late working life stages to guarantee the economic security of the household (55). In this sense, a study on Spanish workers' retirement decisions during the economic crisis showed a reduction of 27% in the probability to transit from employment to retirement in women aged 50-69 with a non-working partner in order to maintain the household income (129). Furthermore, a study about the length of working life in Spain for the period 2004-2013 found that years of working life expectancy spent in employment decreased during the crisis, particularly among men. In contrast, time spent in unemployment and inactivity increased (123).

Regarding employment-related conditions, in general, there was a higher proportion of women with temporary and part-time jobs compared to men across LMP patterns. There was also a higher temporality in people in the early stages of working life than in the later ones. A study across 15 European countries about the evolution of employment conditions during the economic crisis showed that in Spain the proportion of temporary contracts was slightly higher in women than in men, while this proportion was much higher for part-time work (114). Another study examined the part-time work implications on future employment in women, and according to the authors, in Spain, part-time work is less frequent, it is mostly involuntary, and people take it as secondary employment with temporary contracts. Concerning involuntariness, about two-thirds of the Spanish working population with part-time would prefer to have full-time work. This high percentage of involuntariness is understandable since there is a wage differential between part-time and full-time workers, which was even higher in those with fixed-term contracts compared to those with permanent ones. While it is true that part-time can be a cultural choice in women with permanent contracts (e.g. almost 30% reported to do it for family reasons), this is not necessarily the case for those with temporary contracts (12.5%) (130).

When looking at the two years of LMP patterns prior to SA trajectories, there were different patterns compared to the previous ten-year analysis (Appendix Figure I). First, the lowest proportion of stable employment occurs in early working life stages, both in women and in men, and it increases in later working life stages. This result differs from the ten-year LMP patterns, where working lives in women exhibit the opposite behaviour, having a higher proportion of stable employment at early working life stages than at the latest ones. In the two-year LMP patterns, the lower proportion of stable employment among people at early working life stages may reflect different layers of the segmentation of the labour market beyond the stable and not stable employment dichotomy. This higher labour market segmentation occurred during the economic recession, where inexperienced young workers are more likely to work in temporary jobs and follow patterns with higher levels of unemployment and instability (131). Also, some of them may decide not to be involved in the labour market and instead prefer to attain higher levels of education given the few job opportunities during the economic recession in both sexes (124). Second, the pattern of long-term coverage does not only appear in women, but also in men, which reflects the widespread impact of the economic crisis. Finally, there is a higher proportion of means-tested unemployment benefits compared to unemployment insurance benefits, in both sexes, especially in women at the early and late working life stages with fluctuating and delayed employment patterns, respectively. This unfavourable situation highlights the gender inequalities experienced by women in accessing benefits from the social protection system, which are a consequence of the inequalities they undergo when entering the labour market (lower wages, involuntary part-time, high temporary employment). Women experience more employment interruptions than men due to family life and/or motherhood, which is a reflect of the inequal distribution of domestic tasks with the partner and the lack of legislation promoting the combination of work and family sphere not only for women, but also for their partners (132,133). Therefore, they are at higher risk of labour market exclusion, and less likely to contribute enough to be entitled to unemployment insurance benefits and instead receive means-tested benefits (134). Means-tested benefits require pay contributions to the Social Security system for less than one year, and have a lower benefit amount than the unemployment insurance benefits.

5.3. Labour market participation patterns and their relationship with SA trajectories

Prior ten-year LMP patterns were found not to be related to the course of future SA, regardless of the stage of their working life (Study III). Prior two-year LMP patterns were associated with following SA trajectories, among women at early and middle working life stages (Appendix Table II & III).

To our knowledge, no previous studies have analysed the relationship between LMP patterns and future SA trajectories with a life course perspective. A study focused on premature labour market exit among Finns analysed ten-year LMP patterns and the incidence of concurrent SA and found the highest incidence of SA due to mental disorders among those with patterns of permanent exit from the labour market (79). Likewise, cross-sectional studies conducted in Nordic (117) and European countries (135) investigated the relationship between precarious employment (i.e., job instability, lack of power and rights, and low wages) and days of SA (117,135). The aforementioned Nordic study decomposed precarious employment into a set of indicators and investigated their influence on SA individually. The authors found that the low-household income and sickness presenteeism shown the strongest associations with SA of 7 days or more. The aforementioned European study examined multiple dimensions of precarious employment simultaneously (i.e. multidimensional construct), and found a positive association only with SA of more than 15 days. Other studies have investigated specific employment status such as length of unemployment or number of periods without coverage and found that they were related to various health-related outcomes such as SA, retirement and mortality (75,76).

Our findings show that SA trajectories are not related to the prior ten years of LMP (Study III). This result is not directly comparable to those of the studies mentioned above, since our study measured the exposure differently, considering LMP transitions across three stages of the working life and the subsequent SA course, which avoids incurring in reverse causality. We would expect that the accumulation of unfavourable LMP transitions (e.g., from employment to unemployment or without coverage) over time will increase future days on SA due to more severe and lasting pathologies (i.e., chronic diseases such as musculoskeletal and mental disorders). However, our results do not fully support this hypothesis. A first possible explanation of this finding would be that adverse working and employment conditions associated with the current occupation may have a more immediate impact on accumulating SA days than having experienced an unfavourable LMP history. Therefore, SA trajectories might be more related to closer LMP transitions.

In this regard, two-year LMP patterns (Appendix II Figure I) showed an association with the SA course (Appendix II Figure II) among women at their early and middle working life, but no association among men (Appendix Table III). Women in the early working life stage who showed a "U-shape" employment pattern had a lower risk of accumulating more days in SA in the future. A possible explanation is that, particularly in a context of economic crisis, young women are entering into the labour market in temporary, part-time and low employment quality jobs with less favourable employment conditions and return to work prematurely, incur in presenteeism to keep their full salary or do not qualify for SA (113,114). Another explanation is that young women at the beginning of the working life are less affected by the cumulative effect of adverse employment conditions. Therefore, they are in good health and take fewer days on SA. On the contrary, women in the middle working life stages with patterns of increasing employment and without long-term coverage with the Social Security had a higher risk of accumulating more days in SA. One possible explanation is that women in the middle working life stages found it more difficult to find employment than younger women, particularly those who come from previous experience without coverage. We should take into account that those women may be balancing the peak of their professional careers with the family sphere, which imply invisible unpaid reproductive work (i.e. housework, mothering and caring of children and/or dependents with a disability) (136). Thus, when faced with a health problem, they may incur in presenteeism more often than younger workers, to avoid the threat of unemployment, and interruption of their careers or the withdrawal of the labour market if they do not re-start (133). Therefore, by postponing their health problem, this would lead to longer future SA. Another possible explanation, in the case of women in situations without coverage, is that they already had worse prior health. Therefore, when women enter employment, they take a SA that lasts more days.

A second hypothesis for not finding an association for the ten-year LMP patterns could be related to the fact that the quality of employment (i.e., precariousness) was not measured when defining LMP patterns, and it could have an impact to the development of future SA. A systematic review about the effect of precarious employment on mental health found higher adverse effects on mental health when precarious employment was measured with multiple dimensions jointly (e.g., a combination of past/present unemployment, temporary/permanent employment and perceived job insecurity) compared to those that account for a single one (137). Other studies have investigated LMP considering a comprehensive set of employment status (the type of occupation, contractual agreements) over the working life and its relation to health. They found that long-term exposure to blue-collar occupations, typically more physically demanding, have a similar effect on health than cyclical unemployment (29).

Third and fourth potential explanations refer to contextual factors such as the economic crisis and the SA benefit system, respectively. The third hypothesis is that the economic crisis started in 2008, which led to worsening labour market conditions, could have a potential effect on the subsequent SA course. In Spain, there was an increase in job insecurity (i.e. the threat of job loss) from 16% and 14.5% in 2005 to 25% and 24% in 2010, in women and men, respectively

(114). A literature review found that insecure employment is as detrimental to health as unemployment, although the strongest associations were found with unemployment duration (138). A 6-year follow-up study showed that an increase in the unemployment rate reduced the risk of having a long-term SA (>14 days) (139). According to the authors, this negative association is explained by the behaviour of those who are continuously employed (i.e. insiders) rather than by a labour force composition (i.e. poorer health workers enter the labour force during economic booms and SA increases, while in recessions they are pushed out of the labour force, and SA reduces). Restricting the sample to workers in continuous employment with high employment security, they found lower levels of SA during times of high unemployment (i.e. economic recession), probably explained by the fear of job loss. Nevertheless, it could be thought that the better health status of insiders may partly explain their results. Similarly, a "healthy worker survivor effect" may affect our study population, since the SA follow-up (2012-2014) occurred during the economic crisis started in 2008, this probably had an effect of selecting healthier workers, who "survived" in employment, while those with poor health were more likely to lose their jobs (140–142). We must bear in mind that the healthier workers selected in our study were not so "healthy", since all should have at least one SA episode during the follow-up to be eligible, and among them, we selected those who accumulated more than 15 days of SA any quarter of the follow-up (least healthy). In addition to all these reasons, we are not selecting "healthier workers" because we lack a comparison group without SA or information about prior health status. On the contrary, a study found that after downsizing of Icelandic banks during an economic downturn, retained workers experienced worse health outcomes than those being laid off due to perceived job insecurity and increased job demands (143). Other studies found that in a context of high unemployment rates, job loss may affect equally all persons regardless of their prior health status, since not only those with pre-existing poor health lose their job, but also those with good health (health selection into unemployment) (144,145). Furthermore, maybe the SA follow-up in our study is too short to observe the lasting effects of the crisis (the peak in unemployment was in 2013) (126).

A fourth hypothesis relates to the characteristics of the SA benefit system, in particular, eligibility conditions and generosity of compensation (i.e. wage replacement amount and benefit entitlement duration). The literature shows mixed results in this regard. On the one hand, workers who receive a full salary during sickness were more likely to take more days on SA (146). On the contrary, countries with more generosity in SA showed lower levels of SA in the long term since SA helps to cope with economic adversities and regain health (62). Spain has specific conditions for access to SA (six-month contribution is required in the last five years to be eligible), relatively generous benefits, (60-75% wage replacement) and access to medical care provided by the NHS. However, since our study population does not include all working people who potentially have SA, but exclusively those on SA during the follow-up, our results cannot be attributed to eligibility conditions for access to SA. Last but not least, a general practitioner grants medical certification from the NHS, regardless of the Social Security and companies. In this sense, a potentially adverse effect of unstable employment pathways on health may be buffered by the provision of universal health coverage by the NHS.

A further complementary explanation is that defining many states in the sequence analysis (we defined six LMP states) can increase the heterogeneity of patterns in the association analyses and produce attenuated estimates. However, it would be an unlikely explanation, since a previous study found a positive association between intermittent employment and long-term unemployment and inactivity during 31 years of working life defined by 11 employment states and subsequent poor self-perceived health (29). Furthermore, the effect of LMP patterns on SA trajectories could be attenuated due to the heterogeneity of SA diagnoses included. Although SA trajectories were based on accumulating more than 15 days at any quarter of the follow-up and mostly represented long-lasting and severe diagnosis, SA behaviours could differ according to diagnosis groups or specific pathologies. Therefore, it is possible that defining SA trajectories by diagnosis groups or specific pathologies could better unravel their relationship with prior working life.

Despite the general lack of association shown between prior ten years of LMP patterns and the future SA course, we found that men in the early working life stages with increasing employment patterns had a reduced accumulation of days on SA over time. One explanation could be that increased days in employment over working life would protect against the risk of having future SA. Nevertheless, our study found one-third of young men with temporary jobs. Likewise, prior longitudinal research shows that young workers frequently enter into temporary and insecure jobs (123,147), and had low levels of SA compared to permanent workers (148). Therefore, one could argue that these workers with worse employment conditions and probably more severe health-related problems, avoid accumulating days on SA, leading to an early return to work. Also, low accumulated days of SA over time may reflect presenteeism phenomena. Low levels of SA could reflect the direct effect of earlier return to work and the indirect effect of sickness presenteeism incurred by those out of the study population or the absence of those who do not qualify for SA benefits. In any case, this SA behaviour may be stimulated by the financial loss that supposes receiving SA benefits (partial wage replacement for private-sector workers), or receiving unemployment benefits (if they are entitled to it) in the event of dismissal. Nevertheless, since we examined people who accumulate more than 15 days on SA, the threat of being lay off may not have, to a certain extent, a negative effect on SA behaviour (i.e. disciplining effect) because they are seriously sick. On the contrary, another possible explanation is that men at the beginning of the working life are less affected by the cumulative effect of adverse employment conditions and they are in good health and take fewer days on SA.

5.4. Limitations and strengths

Part of the weaknesses and strengths of this thesis comes from the nature of the two data sources used: the Spanish WORKing life Social Security system cohort (WORKss cohort) and the Catalonia SA records.

The WORKss cohort lacks information about people without affiliation with the Social Security system, who may be unemployed without receiving benefits and actively or not actively seeking work (i.e. out of the labour force or inactive), in informal employment or covered by other social protection systems such as some categories of civil servants (93). Information on health status, health-related behaviours prior to the onset of the SA follow-up was not available, which could lead to a potential confounding bias in our estimates when measuring the association between LMP patterns and SA trajectories. Likewise, information related to working conditions and family structure were not available, which may limit the interpretation of the results. Nor was it possible to construct an occupational social class variable based on the National Classification of Occupations (CNO-2011) because this information was not available (149). Instead, we had an occupational category variable based on the contribution base of the Social Security system, which identified the professional worker category (95).

Regarding SA records, one limitation is that some SA episodes did not report closure date, potentially due to administrative delays on record transfer from the primary care system or missing registers. These SA episodes were not included to draw SA trajectories and, therefore, the accumulated days of SA might be underestimated. Nevertheless, such cases represented only 6% of the total closed SA episodes.

In relation to study design, it may be argued that a limitation of selecting only people on SA to assess their relationship with prior LMP patterns is the lack of an adequate comparison group for the outcome, that is, those without SA. Our definition of the study population only included people who have SA, since we are interested in identifying SA trajectories and their relationship with previous LMP patterns. Those without SA do not have a trajectory (zero days) and were excluded from our definition of the study population. Instead, our outcome reference group were people who followed a low-stable level of accumulated days on SA over time. However, the exclusion of people without SA could have led to a certain selection bias, since those excluded probably are mainly those with better health (to a lesser extent those with poor health but engaged in presenteeism or those who did not qualify for SA benefit).

It could be thought that by including people who accumulate more than 15 days of SA (for one episode or the sum of several) at any quarter of the follow-up, the trajectories could not represent SA episodes of long durations (> 15 days) or more severe diagnoses, but rather short and repeated episodes due to more acute diagnoses. However, people that accumulated more than 15 days on SA had a

50% of SA episodes of durations higher than 15 days, and this percentage was higher in increasing trajectories (range depending on the working life stage: 50%-67.4%). Also, SA trajectories of more than 15 days represented more severe SA diagnosis such as mental disorders. The percentage of people with SA due to mental disorders across SA trajectories of more than 15 days and working life stages (9%-28%) was higher than in those SA trajectories of any number of days on SA (6%-20%). Therefore, SA trajectories of more than 15 days represent longer and more severe SA.

This thesis also presents several strengths. The main one is the adoption of a life course perspective across three working life stages. Prior studies were mostly based on cross-sectional or longitudinal studies without a life course framework. The life course approach investigates the development of biological and social factors not as dichotomous elements, but as interrelated exposures across the life course, and their influence on future health (24). In practice, this approach allows the construction of holistic LMP patterns and analysing their relationship with outcomes such as SA.

The WORKss cohort provides a large representative sample of the Spanish working population, which takes into account individuals affiliated to the Social Security system at any time in each reference year and not only in a specific time such as the Economically Active Population Survey (EPA) of quarterly periodicity. However, both datasets provide similar active population structure of Spain (93). The WORKss cohort provides reliable register-based data based on objective administrative documents such as work contracts, which prevents recall bias (94). The results, based on a subsample of the WORKSss cohort, are representative of salaried workers living in Catalonia.

SA data comes from medical diagnosis (coded according to the ICD-10) certified by a general practitioner from the National Health System, which guarantees a higher validity of the results compared to self-reported SA measures (150).

Another strength is that the selection of these three cohorts according to stages of the working life allow controlling the effect of age and contextual factors on the SA behaviour since each cohort includes people with similar socioeconomic and labour market conditions background.

5.5. Methodological considerations

One of the main methodological challenges to consider is a potential classification bias when grouping workers according to employment-related conditions, SA medical diagnosis group and labour market situation since the category in which they spend most of the time has been assigned as representative of the whole study period. In the latter, the labour market states were assigned per week, which could underestimate short employment spells, since almost one out of five of these were less than four days.

Two different statistical techniques for classification of life course trajectories were applied to obtain LMP patterns and SA trajectory groups, being the former used as an explanatory variable of the latter. According to literature, the use of sequence typologies in combination with inferential analysis should be deeply discussed and justified based on data and theoretically (98,151). In this regard, in this thesis, the assessment of cluster quality and latent classes shows adequate values for most of the groups, which strengthens the results. As an exception, however, LMP patterns in the early working life stages may not represent well-separated and homogeneous groups (ASW < 0.5) and low-stable SA trajectories showed the lowest values of assignment accuracy across WLC (Odds of Correct Classification < 5). Furthermore, when considering an explanatory model for SA trajectories, we have to consider that SA trajectories are not categories observed in individuals, but categories assigned according to an estimated probability. Therefore, any found association should be taken with caution to avoid overinterpreting the results. Moreover, the size of the compared trajectory groups in some cases is tiny, and this could affect the estimates. Nevertheless, they were included because they were meaningful for the aim of the study.

Regarding SA trajectories, the choice of the follow-up time unit may affect the outcome of latent class growth analysis. However, using 12-time points may better represent SA trajectories, since it has been proven that increasing the number of time points per person reduces bias in most parameter estimates (152). Also, choosing too much time points, for example, a monthly measure (i.e. 36-time point) will result in excess of zeros, which will difficult the characterization of the outcome. Furthermore, since we were interested in longer and likely more severe SA, the quarterly measure allows reducing the possibility that SA was due to acute medical diagnoses (it is easier to accumulate more than 15 days in SA for several acute episodes throughout the year than in a quarter).

Affiliated who have had a permanent disability, retired or died before the start of SA follow-up were excluded by study design as they are not at risk for SA. However, in the study population, individuals who had SA during follow-up and who subsequently had a permanent disability, retired or died were included. These latter cases could influence the development of SA trajectories. For example, the decreasing SA trajectory could represent workers not only with reduced accumulated days on SA but those who leave the labour market due to permanent disability or death. Nevertheless, such cases represent between 4% and 8%, depending on the SA trajectory group, sex, and working life stage.

Part-time and full-time employment were not distinguished when defining the labour market state sequences, which could represent those workers with less advantage employment conditions over the life course. However, the type of working time was used to characterise the patterns of working life participation once they were identified. Furthermore, two different unemployment allowances were accounted for the definition of the states: unemployment insurance benefits and means-tested unemployment benefits. The latter provides the least generous benefits, which may allow reflecting situations of more vulnerable workers into the LMP patterns.

5.6. Implications for policy and practice

- Studying SA trajectories may be useful for guiding occupational health professionals in the identification of those workers who need early intervention such as those with mental disorders at early ages who follow increasing accumulated days on SA over time.

- Promoting good mental health in the workplace can reduce both absenteeism and presenteeism. Nevertheless, few policies reach risk groups such as the elderly and the unemployed, which requires more support to encourage social participation and reduce loneliness.

- Policies could be recommended to strengthen the protection of people with temporary employment (e.g. increase the cost of dismissal of temporary jobs) and facilitate their conversion to permanent employment, particularly when they experience a succession of short-term contracts. These measures reduce the risk of exclusion in the labour market since people with SA have less employability than those without SA.

- Policies should enhance employment stability, such as offer high training opportunities to unemployed, and long-term unemployed without benefits.

- The Spanish social protection system through sickness absence benefits and universal healthcare may be buffering the effect of unstable employment on health. The conditions of access to SA in Spain are not the least restrictive, and they could be more favourable and converge with those of Sweden, Finland o Germany. Introducing changes in SA rules such as the not requirement of a prior contribution period to qualify for SA or the possibility to self-certification of short SA (i.e., less than seven days) could potentially benefit even more people who need to take SA, which would affect to the expression of the SA phenomenon.

5.7. Future research

- Future studies should focus on diagnosis when defining SA trajectories, since including all diagnosis causing SA could mask the effect of prior working life on the course of SA due to specific pathologies.
- Research agenda should investigate LMP transitions among young adults and their mental health status when entering the labour market from a life course perspective.
- Future studies should measure several dimensions of employment quality (i.e. workplace rights, wage level, length of contract) when defining working life transitions to capture the accumulation of unfavourable features of job precarity over time and assess its effects on health.
- The following steps may investigate life course trajectories accounting for multiple life domains simultaneously, such as work, partnership, parenthood, and education, which could allow understanding better the relationships between life course exposures and future health outcomes over time.
- Future studies may examine the relationship between SA trajectories and future incidence of permanent disability.
- Subsequent studies about the association between LMP patterns and SA trajectories may be analysed bidirectionally and simultaneously at several points in time.

CONCLUSIONS

"*Truth has nothing to do with the conclusion, and everything to do with the methodology*."

-Stefan Molyneux

6. CONCLUSIONS

1. SA medically certified diagnosis is the strongest determinant for all SA trajectories; in particular, mental disorders exhibit a strong relationship with increased accumulated days of SA over time.

2. Apart from income and type of contract, employment-related conditions did not determine SA trajectories.

3. Most of the workers on SA experienced stable employment during the prior ten years of LMP, while a drop in stable employment was experienced in the prior two years of LMP.

4. Women experienced a growing entry into the labour market, while men left it massively over the ten years of LMP. In contrast, more women than men received means-tested unemployment benefits over the two years of LMP.

5. SA trajectories were generally not related to prior ten-year LMP patterns, while they were related to prior two-year LMP among women.

6. Knowing the evolution of transitions from one employment status to another close to SA could provide useful information to prevent specific SA courses in the future.

REFERENCES

“*If I have seen further it is by standing on the shoulders of Giants*.”

-Isaac Newton

7. REFERENCES

1. Global Comission on the Future of Work. Work for a brighter future. 2019.
2. United Nations. World Population Ageing. 2017. p. 1–40.
3. Instituto Nacional de Estadística. Indicadores de Estructura de la Población [Internet]. [cited 2020 Jun 12]. Available from: https://www.ine.es/jaxiT3/Tabla.htm?t=1488
4. Instituto Nacional de Estadística. Population projection 2018 [Internet]. 2018 [cited 2019 Jul 14]. p. 1–20. Available from: http://www.ine.es/en/prensa/pp_2018_2068_en.pdf
5. Velázquez Fernández M. El envejecimiento de la población trabajadora. (master's dissertation); 2015.
6. Observatorio Vasco sobre Acoso y Discriminación. El envejecimiento de la población trabajadora. 2018. 9–608 p.
7. Esteve A, Devolder D, Blanes A. The Demographic Factor in the Sustainability of Spain's Pension System. Perspect Demogràfiques [Internet]. 2018;(9):1–4. Available from: http://ced.uab.cat/
8. Round A. Extending working lives: A devolved, lifecourse approach to enabling work beyond state pension age [Internet]. Institute for Public Policy Research North. 2017. Available from: http://www.ippr.org/publications/extending-working-lives
9. World Health Organization. World report on ageing and health. 2015.
10. International Labour Organization. ILO Global Estimates on International Migrant Workers Results and Methodology. International Labour Office,

2018;
11. OECD. International Migration Outlook 2019. OECD Publishing, Paris; 2019.
12. Barrientos S, Kabeer N, Hossain N. The gender dimensions of the globalization of production. Geneva, Policy Integration Department, World Commission on the Social Dimension of Globalization, International Labour Office; 2004.
13. Martinez-Fernandez C, Hinojosa C, Miranda G. Greening Jobs and Skills. OECD; 2010.
14. Arntz M, Gregory T, Zierahn U. The risk of automation for jobs in OECD countries: a comparative analysis. OECD Soc Employ Migr Work Pap [Internet]. 2016;(189). Available from: https://www.oecd-ilibrary.org/social-issues-migration-health/the-risk-of-automation-for-jobs-in-oecd-countries_5jlz9h56dvq7-en
15. Benedikt Frey C, Osborne MA. The future of employment: How susceptible are jobs to computerisation? Technol Forecast Soc Change. 2017;114:254–80.
16. International Labour Organization. World Employment and Social Outlook: Trends 2019 [Internet]. Geneva, Switzerland; 2019. Available from: http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_615594.pdf
17. International Labour Organization. Global Wage Report 2018/19: What lies behind gender pay gaps [Internet]. 2018. 1–159 p. Available from: https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_650553.pdf
18. OECD/ILO. Tackling Vulnerability in the Informal Economy [Internet]. Development Centre Studies,

OECD; 2019. Available from: https://www.oecd-ilibrary.org/development/tackling-vulnerability-in-the-informal-economy_103bf23e-en
19. Torns T, Carrasquer P, Moreno S, Borràs V. Career Paths in Spain: Gendered Division of Labour and Informal Employment. Rev Interv économiques [Internet]. 2013;(47). Available from: https://journals.openedition.org/interventionseconomiques/1935
20. Casado-Marín D, García-Gómez P, López-Nicolás Á. Informal care and labour force participation among middle-aged women in Spain. SERIEs. 2011;2(1):1–29.
21. Artazcoz L, Escribà-Agüir V, Cortès I. Género, trabajos y salud en España. Gac Sanit. 2004;18(5):24–35.
22. Burton-Jeangros C, Cullati S, Sacker A, Blane D. A Life Course Perspective on Health Trajectories and Transitions [Internet]. Springer Nature; 2015. Available from: http://www.springer.com/series/10158
23. Amick BC, McLeod CB, Bültmann U. Labor markets and health: an integrated life course perspective. Scand J Work Environ Health. 2016;42(4):346–53.
24. Kuh D, Ben-Shlomo Y, Lynch J, Hallqvist J, Power C. Life Course Epidemiology. J Epidemiol Community Heal. 2003;57(10):778–83.
25. Ben-Shlomo Y, Kuh D. A life course approach to chronic disease epidemiology: conceptual models, empirical challenges and interdisciplinary perspectives. Int J Epidemiol. 2002;31(2):285–93.
26. Bernardi L, Huinink J, Settersten RA. Advances in Life Course Research The life course cube: A tool for studying lives. Adv Life Course Res.

2019;41:100258.
27. Malo MA, Muñoz-Bullón F. Employment status mobility from a life-cycle perspective: A sequence analysis of work-histories in the BHPS. Demogr Res. 2003;9:119–62.
28. Bolano D, Haynes M. Methodological approaches to profiling and modelling disadvantaged employment pathways. An application to employment trajectories in Australia. In: Proceedings of the International Conference on Sequence Analysis and Related Methods. (LaCOSA II); 2016. p. 851–62.
29. Devillanova C, Raitano M, Struffolino E. Longitudinal employment trajectories and health in middle life: Insights from linked administrative and survey data. Demogr Res. 2019;40:1375–412.
30. Nwaru CA, Peutere L, Kivimäki M, Pentti J, Vahtera J, Virtanen PJ. Chronic diseases as predictors of labour market attachment after participation in subsidised reemployment programme: a 6-year follow-up study. J Epidemiol Community Health. 2017;71(11):1101–6.
31. McLeod CB, Reiff E, Maas E, Bültmann U. Identifying return-to-work trajectories using sequence analysis in a cohort of workers with work-related musculoskeletal disorders. Scand J Work Environ Health [Internet]. 2017;44(2):147–55. Available from: http://www.sjweh.fi/show_abstract.php?abstract_id=3701
32. Nwaru CA, Kivimäki M, Pentti J, Vahtera J, Virtanen P. Sickness absence in a re-employment program as a predictor of labor market attachment among long-term unemployed individuals: A 6-year cohort study in Finland. Scand J Work Environ Heal. 2018;44(5):496–502.

33. Pedersen P, Lund T, Lindholdt L, Nohr EA, Jensen C, Søgaard HJ, et al. Labour market trajectories following sickness absence due to self-reported all cause morbidity—a longitudinal study. BMC Public Health [Internet]. 2016;16:337. Available from: http://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-016-3017-x
34. United Nations. Sustainable development goals. Promote inclusive and sustainable economic growth, employment and decent work for all. [Internet]. 2019 [cited 2019 Jun 6]. Available from: https://www.un.org/sustainabledevelopment/economic-growth/
35. European Commission. Access to social protection for all forms of employment: Assessing the options for a possible EU initiative. Luxembourg (Directorate-General for Employment, Social Affairs and Inclusion); 2018.
36. Bentolila S, Dolado JJ. Labour flexibility and wages: lessons from Spain. Econ Policy. 1994;9(18):53–99.
37. Bentolila S, Cahuc P, Dolado JJ, Barbanchon T Le. Two-tier labour markets in the great recession: France Versus Spain. Econ J. 2012;122(562):F155–87.
38. García-pérez JI, Domènech JM. The impact of the 2012 Spanish labour market reform on unemployment inflows and outflows: a regression discontinuity analysis using duration models. Hacienda Pública Española. 2019;(231):157–200.
39. Organisation for Economic Co-operation and Development. The 2012 Labour Market Reform in Spain: A preliminary assessment. OECD Publishing. 2014.
40. Bentolila S, Dolado JJ, Jimeno JF. The New New

Labour Market Reform in Spain: Objectives, Instruments, and Shortcomings. CESifo DICE Rep. 2012;10(2):3–7.
41. OECD. Higher Education in Regional and City Development: Catalonia, Spain. OECD Publishing; 2010.
42. Instituto Nacional de Estadística. Unemployment rates by different age groups, sex and Autonomous Community [Internet]. 2019 [cited 2019 Jul 15]. Available from: http://www.ine.es/jaxiT3/Tabla.htm?t=4247
43. Generalitat de Catalunya. Report on the integration of immigrants in Catalonia 2015. 2015.
44. Belvis Costes FX, Benach de Rovira J. Educació i estabilitat laboral a Catalunya. Mobilitat entre ocupació estable, inestable i no ocupació, 2002–2012. Fundació Jaume Bofill, Barcelona [Internet]. 2014. Available from: https://www.fbofill.cat/publicacions/educacio-i-estabilitat-laboral-catalunya-0
45. López-Andreu M, Verd JM. Employment instability and economic crisis in Spain : what are the elements that make a difference in the trajectories of younger adults ? Eur Soc [Internet]. 2016; Available from: http://dx.doi.org/10.1080/14616696.2016.1207791
46. Serracant P. Changing youth? Continuities and ruptures in transitions into adulthood among Catalan young people. J Youth Stud. 2012;15(2):161–76.
47. Yepes Cayuela L. Trayectorias laborales y redes personales: Un análisis longitudinal en la población joven. (doctoral dissertation); 2018.
48. Eikemo TA, Bambra C, Judge K, Ringdal K. Welfare state regimes and differences in self-perceived health in Europe: a multilevel analysis. Soc Sci Med. 2008;66(11):2281–95.

49. Esping-Andersen G. The three worlds of welfare capitalism. Princeton University Press. 1990.
50. Bambra C. Going beyond The three worlds of welfare capitalism: regime theory and public health research. J Epidemiol Community Heal. 2007;61(12):1098–102.
51. Bambra C. Health status and the worlds of welfare. Soc policy Soc. 2006;5(1):53–62.
52. Navarro V, Muntaner C, Borrell C, Benach J, Quiroga Á, Rodríguez-Sanz M, et al. Politics and health outcomes. Lancet. 2006;368(9540):1033–7.
53. Bambra C, Pope D, Swami V, Stanistreet D, Roskam A, Kunst A, et al. Gender, health inequalities and welfare state regimes: a cross-national study of 13 European countries. J Epidemiol Community Heal. 2009;63(1):38–44.
54. Korpi W, Ferrarini T, Englund S. Egalitarian gender paradise lost? Re-examining gender inequalities in different types of welfare states. Swedish Inst Soc Res. 2009;1–43.
55. Artazcoz L, Cortès I, Puig-Barrachina V, Benavides FG, Escribà-Agüir V, Borrell C. Combining employment and family in Europe: the role of family policies in health. Eur J Public Health. 2013;24(4):649–55.
56. ILO. World Social Protection Report 2017–19: Universal social protection to achieve the Sustainable Development Goals. 2017.
57. Ministerio de Trabajo y Economía Social. Prestaciones [Internet]. 2020. [cited 2020 May 5]. Available from: http://www.sepe.es/HomeSepe/Personas/distributiva-prestaciones.html
58. European Commission. Employment, Social Affairs & Inclusion: Spain [Internet]. 2019 [cited 2020 May

4]. Available from: https://ec.europa.eu/social/main.jsp?catId=1129&langId=en

59. Wikman A, Marklund S, Alexanderson K. Illness, disease, and sickness absence: an empirical test of differences between concepts of ill health. J Epidemiol Community Heal [Internet]. 2005;59(6):450–4. Available from: https://jech.bmj.com/content/59/6/450.citation-tools
60. Esping-Andersen G, Kolberg JE. Decommodification and Work Absence in the Welfare State. Int J Sociol. 1991;21(3):77–111.
61. Marmot M, Feeney A, Shipley M, North F, Syme SL. Sickness absence as a measure of health status and functioning: from the UK Whitehall II study. J Epidemiol Community Heal. 1995;49(2):124–30.
62. Sjöberg O. Positive welfare state dynamics? Sickness benefits and sickness absence in Europe 1997–2011. Soc Sci Med. 2017;177:158–68.
63. OECD. Paid sick leave to protect income, health and jobs through the COVID-19 crisis. 2020;(July):1–25.
64. Allebeck P, Mastekaasa A. Chapter 5. Risk factors for sick leave-general studies. Alexanderson K, Norlund A, editors. Scand J Public Health. 2004;32(Suppl 63):49–108.
65. Virtanen M, Kivimäki M, Joensuu M, Virtanen P, Elovainio M, Vahtera J. Temporary employment and health: a review. Int J Epidemiol. 2005;34(3):610–22.
66. Campos-Serna J, Ronda-Pérez E, Artazcoz L, Moen BE, Benavides FG. Gender inequalities in occupational health related to the unequal distribution of working and employment conditions: a systematic review. Int J Equity Health.

2013;12:57.
67. Michie S, Williams S. Reducing work related psychological ill health and sickness absence: a systematic literature review. Occup Environ Med [Internet]. 2003;60(1):3–9. Available from: http://www.ncbi.nlm.nih.gov/pubmed/12499449%0Ahttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC1740370
68. Delclós J, García S, López JC, Sampere M, Serra C, Plana M, et al. Duración de la incapacidad temporal por contingencia común por grupos diagnósticos. Arch Prev Riesgos Labor [Internet]. 2010;13(4):180–7. Available from: http://dialnet.unirioja.es/servlet/extart?codigo=3326723
69. Arcas MM, Delclos GL, Torá-Rocamora I, Martínez JM, Benavides FG. Gender differences in the duration of non-work-related sickness absence episodes due to musculoskeletal disorders. J Epidemiol Community Heal [Internet]. 2016;70(11):1065–73. Available from: http://jech.bmj.com/lookup/doi/10.1136/jech-2014-204331
70. Laaksonen M, He L, Pitkäniemi J. The Durations of Past Sickness Absences Predict Future Absence Episodes. J Occup Environ Med [Internet]. 2013;55(1):87–92. Available from: http://content.wkhealth.com/linkback/openurl?sid=WKPTLP:landingpage&an=00043764-201301000-00013
71. Sumanen H, Pietiläinen O, Lahelma E, Rahkonen O. Short sickness absence and subsequent sickness absence due to mental disorders - a follow-up study among municipal employees. BMC Public Health [Internet]. 2017;17(1):15. Available from:

http://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-016-3951-7
72. Virtanen M, Ervasti J, Head J, Oksanen T, Salo P, Pentti J, et al. Lifestyle factors and risk of sickness absence from work: a multicohort study. Lancet Public Heal [Internet]. 2018;3(11):e545–54. Available from: http://dx.doi.org/10.1016/S2468-2667(18)30201-9
73. Rocamora IT, Martínez Martínez JM, Clanchet JD, Lliberia JJ, Casas CA, Pujadas CS, et al. Duración de los episodios de incapacidad temporal por contingencia común según regiones sanitarias en Catalunya. Rev Esp Salud Publica. 2010;84(1):61–9.
74. Ziebarth NR. Sickness Absence and Economic Incentives. (doctoral dissertation); 2011.
75. Helgesson M, Johansson B, Nordqvist T, Lundberg I, Vingård E. Unemployment at a young age and later sickness absence, disability pension and death in native Swedes and immigrants. Eur J Public Health. 2012;23(4):606–10.
76. Benavides FG, Duran X, Gimeno D, Vanroelen C, Martínez JM. Labour market trajectories and early retirement due to permanent disability: a study based on 14 972 new cases in Spain. Eur J Public Health. 2015;25(4):673–7.
77. Virtanen P. Labor market trajectories and health: a four-year follow-up study of initially fixed-term employees. Am J Epidemiol. 2005;161(9):840–6.
78. Waenerlund A-K, Gustafsson PE, Virtanen P, Hammarström A. Is the core-periphery labour market structure related to perceived health? Findings of the Northern Swedish Cohort. BMC Public Health [Internet]. 2011 Dec 27 [cited 2017 Jan 18];11(1):956. Available from: http://www.ncbi.nlm.nih.gov/pubmed/22202436

79. Lallukka T, Kronholm E, Pekkala J, Jäppinen S, Blomgren J, Pietiläinen O, et al. Work participation trajectories among 1,098,748 Finns: reasons for premature labour market exit and the incidence of sickness absence due to mental disorders and musculoskeletal diseases. 2019;19:1418.
80. Alba-Ramirez A, López-Mourelo E. Sickness absence from work in Spain: are there gender differences? Univ Carlos III Madrid Work Pap [Internet]. 2017;17–15. Available from: http://hdl.handle.net/10016/25937
81. Bekker MHJ, Rutte CG, Rijswijk K Van. Sickness absence: A gender-focused review. Psychol Health Med. 2009;14(4):405–18.
82. Kerkhofs M, Lindeboom M. Age related health dynamics and changes in labour market status. Health Econ. 1997;6(4):407–23.
83. Haas SA, Oi K, Zhou Z. The Life Course, Cohort Dynamics, and International Differences in Aging Trajectories. Demography. 2017;54(6):2043–71.
84. Ministerio de Empleo y Seguridad Social. Real Decreto Legislativo 1/1994, de 20 de junio, por el que se aprueba el Texto Refundido de la Ley General de la Seguridad Social. 1994;1–156. Available from: https://www.boe.es/buscar/pdf/1994/BOE-A-1994-14960-consolidado.pdf
85. Gimeno D, Bültmann U, Benavides FG, Alexanderson K, Abma FI, Ubalde-López M, et al. Cross-national comparisons of sickness absence systems and statistics: Towards common indicators. Eur J Public Health. 2014;24(4):663–6.
86. Real Decreto Legislativo 8/2015, de 30 de octubre, por el que se aprueba el texto refundido de la Ley General de la Seguridad Social [Internet]. Boletín

Oficial del Estado. 2015 [cited 2017 Feb 28]. p. 103291–519. Available from: http://www.boe.es/boe/dias/2015/10/31/pdfs/BOE-A-2015-11724.pdf
87. Ministerio de Empleo y Seguridad Social. Temporary Disability Benefits. Procedure [Internet]. 2017 [cited 2017 Mar 7]. Available from: http://www.seg-social.es/wps/portal/wss/internet/InformacionUtil/44539/44667?changeLanguage=en
88. Ministerio de Trabajo M y SS. Proyecto de presupuestos Ejercicio 2019 [Internet]. 2019 [cited 2020 Jun 7]. Available from: http://www.seg-social.es/wps/wcm/connect/wss/3aa925cb-ece2-4477-acbf-7e3f853d8977/TOMO+III.-+INFORME+ECONOMICO-FINANCIERO-P.pdf?MOD=AJPERES&CVID=
89. Oliva J, Aranda-Reneo I. Pérdidas laborales ocasionadas por las enfermedades, lesiones y problemas de salud durante el año 2007. Presup y Gasto Público. 2012;68:157–76.
90. Ministerio de Empleo y Seguridad Social. Estadísticas, presupuestos y estudios: Incapacidad Temporal [Internet]. [cited 2020 Jun 7]. Available from: http://www.seg-social.es/wps/portal/wss/internet/EstadisticasPresupuestosEstudios/Estadisticas/EST45/EST46
91. MCVL. Muestra continua de vidas laborales. Guía del contenido. [Internet]. 2018. p. 1–206. Available from: http://www.seg-social.es/wps/portal/wss/internet/EstadisticasPresupuestosEstudios/Estadisticas/EST211/1429
92. López MA, Benavides FG, Alonso J, Espallargues M, Durán X, Martínez JM. La utilidad del uso de datos administrativos en la investigación de salud

pública: la Muestra continua de vidas laborales. Gac Sanit [Internet]. 2014;28(4):334–7. Available from: http://www.sciencedirect.com/science/article/pii/S021391111400051X
93. García Pérez JI. La muestra continua de vidas laborales: una guía de uso para el análisis de transiciones. Rev Econ Apl [Internet]. 2008;XVI(1):5–28. Available from: https://www.redalyc.org/articulo.oa?id=96915822001
94. López Gómez MA, Durán X, Zaballa E, Sanchez-Niubo A, Delclos GL, Benavides FG. Cohort profile: the Spanish WORKing life Social Security (WORKss) cohort study. BMJ Open. 2016;6:e008555.
95. Durán X. Trayectoria laboral e incapacidad permanente: análisis de los años de vida laboral perdidos. Un estudio basado en la Muestra Continua de Vidas Laborales (MCVL) de la Seguridad Social [Internet]. (doctoral dissertation) Universitat Pompeu Fabra; 2013. Available from: http://www.tdx.cat/bitstream/handle/10803/279345/txd.pdf?sequence=1
96. Gabadinho A, Ritschard G, Müller NS, Studer M. Analyzing and Visualizing State Sequences in R with TraMineR. J Stat Softw. 2011;40(4):1–37.
97. Abbott A, Tsay A. Sequence Analysis and Optimal Matching Methods in Sociology: Review and Prospect. Sociol Methods Res. 2000;29(1):3–33.
98. Studer M. WeightedCluster Library Manual: A practical guide to creating typologies of trajectories in the social sciences with R. LIVES working papers, 24. 2013.
99. Muthén B, Muthén LK. Integrating person-centered and variable-centered analyses: growth mixture

modeling with latent trajectory classes. Alcohol Clin Exp Res. 2000;24(6):882–91.

100. Jung T, Wickrama KAS. An introduction to latent class growth analysis and growth mixture modeling. Soc Personal Psychol Compass. 2008;2(1):302–17.

101. Nylund KL, Asparouhov T, Muthén BO. Deciding on the number of classes in latent class analysis and growth mixture modeling: A Monte Carlo simulation study. Struct Equ Model A Multidiscip J [Internet]. 2007;14(4):535–69. Available from: http://www.tandfonline.com/doi/abs/10.1080/10705510701575396

102. van de Schoot R, Sijbrandij M, Winter SD, Depaoli S, Vermunt JK. The GRoLTS-Checklist: Guidelines for Reporting on Latent Trajectory Studies. Struct Equ Model A Multidiscip J. 2017;24(3):451–67.

103. Helgesson M, Tinghög P, Wang M, Rahman S, Saboonchi F, Mittendorfer-Rutz E. Trajectories of work disability and unemployment among young adults with common mental disorders. BMC Public Health [Internet]. 2018;18, 1228. Available from: https://doi.org/10.1186%2Fs12889-018-6141-y

104. Wang M, Vaez M, Dorner TE, Tiihonen J, Voss M, Ivert T, et al. Trajectories and characteristics of work disability before and after acute myocardial infarction. Heart [Internet]. 2018;104:340–8. Available from: http://heart.bmj.com/lookup/doi/10.1136/heartjnl-2017-311950

105. de Vries H, Fishta A, Weikert B, Rodriguez Sanchez A, Wegewitz U. Determinants of Sickness Absence and Return to Work Among Employees with Common Mental Disorders: A Scoping Review. J Occup Rehabil. 2018;28:393–417.

106. Institute for Health Metrics and Evaluation (IHME).

Global Burden of Disease Study 2017 (GBD 2017) Results [Internet]. [cited 2020 Feb 9]. Available from: http://ghdx.healthdata.org/gbd-results-tool
107. OECD/EU. Health at a Glance: Europe 2018: State of Health in the EU Cycle [Internet]. Paris: OECD Publishing; 2018. Available from: https://doi.org/10.1787/health_glance_eur-2018-en
108. Gabbay M, Shiels C, Hillage J. Factors associated with the length of fit note-certified sickness episodes in the UK. Occup Environ Med. 2015;72:467–75.
109. Knudsen AK, Harvey SB, Mykletun A, Øverland S. Common mental disorders and long-term sickness absence in a general working population. The Hordaland Health Study. Acta Psychiatr Scand. 2013;127(4):287–97.
110. Farrants K, Friberg E, Sjölund S, Alexanderson K. Work Disability Trajectories Among Individuals with a Sick-Leave Spell Due to Depressive Episode ≥ 21 Days: A Prospective Cohort Study with 13-Month Follow Up. J Occup Rehabil. 2018;28(4):678–90.
111. Real E, Jover L, Verdaguer R, Griera A, Segalàs C, Alonso P, et al. Factors associated with long-term sickness absence due to mental disorders: A cohort study of 7.112 patients during the Spanish economic crisis. PLoS One. 2016;11(1):e0146382.
112. Doherty DT, Kartalova O'-Doherty Y. Gender and self-reported mental health problems: Predictors of help seeking from a general practitioner. Br J Health Psychol. 2010;15:213–28.
113. Benach J, Vives A, Amable M, Vanroelen C, Tarafa G, Muntaner C. Precarious employment: understanding an emerging social determinant of health. Annu Rev Public Health. 2014;35:229–53.
114. Escribà V, Fons J. Crisis económica y condiciones

de empleo: diferencias de género y respuesta de las políticas sociales de empleo. Informe SESPAS 2014. Gac Sanit [Internet]. 2014;28:37–43. Available from: http://dx.doi.org/10.1016/j.gaceta.2014.01.013

115. Navarro A, Salas-Nicás S, Moncada S, Llorens C, Molinero-Ruiz E. Prevalence, associated factors and reasons for sickness presenteeism: a cross-sectional nationally representative study of salaried workers in Spain, 2016. BMJ Open. 2018;8:e021212.
116. Taloyan M, Aronsson G, Leineweber C, Magnusson Hanson L, Alexanderson K, Westerlund H. Sickness Presenteeism Predicts Suboptimal Self-Rated Health and Sickness Absence: A Nationally Representative Study of the Swedish Working Population. PLoS One. 2012;7(9):e44721.
117. Oke A, Braithwaite P, Antai D. Sickness absence and precarious employment: A comparative cross-national study of Denmark, Finland, Sweden, and Norway. Int J Occup Environ Med. 2016;7(3):125–47.
118. Helgadóttir B, Svedberg P, Mather L, Lindfors P, Bergström G, Blom V. The association between part-time and temporary employment and sickness absence: a prospective Swedish twin study. Eur J Public Health. 2019;29(1):147–53.
119. Tompa E, Scott-Marshall H, Fang M. The impact of temporary employment and job tenure on work-related sickness absence. Occup Environ Med. 2008;65(12):801–7.
120. Zaballa E, Martínez JM, Duran X, Albertí C, Gimeno Ruiz de Porras D, Benavides FG. Incidence of sickness absence by type of employment contract: one year follow-up study in Spanish salaried workers. Arch Public Heal [Internet]. 2016;74(1):40.

Available from: http://archpublichealth.biomedcentral.com/articles/10.1186/s13690-016-0152-x
121. Waenerlund AK, Hammarström A, Virtanen P. Is temporary employment related to health status? Analysis of the Northern Swedish Cohort. Scand J Public Health. 2011;39(5):533–9.
122. Menéndez M, Benach J, Muntaner C, Amable M, O'Campo P. Is precarious employment more damaging to women's health than men's? Soc Sci Med. 2007;64(4):776–81.
123. Dudel C, López Gómez MA, Benavides FG, Myrskylä M. The Length of Working Life in Spain: Levels, Recent Trends, and the Impact of the Financial Crisis. Eur J Popul. 2018;34(5):769–91.
124. Serrano Martínez L, Soler Guillén Á. La formación y el empleo de los jóvenes españoles. Trayectoria reciente y escenarios futuros. Bilbao: Fundación BBVA; 2015.
125. Jimeno JF, Santos T. The crisis of the Spanish economy. SERIEs. 2014;5(2–3):125–41.
126. Sanz-de-Galdeano A, Terskaya A. The labor market in Spain, 2002–2016. IZA World Labor [Internet]. 2017;403:1–12. Available from: https://wol.iza.org/articles/the-labor-market-in-spain
127. Gush K, Scott J, Laurie H. Households' responses to spousal job loss: 'all change' or 'carry on as usual'? Work Employ Soc [Internet]. 2015;29(5):703–19. Available from: https://doi.org/10.1177/0950017014556411
128. Jolkkonen A, Koistinen P, Kurvinen A, Lipiäinen L, Nummi T, Virtanen P. Labour Market Attachment Following Major Workforce Downsizings : A Comparison of Displaced and Retained Workers. 2018;32(6):992–1010.

129. Amuedo-Dorantes C, Borra C. Retirement Decisions in Recessionary Times: Evidence from Spain. BE J Econ Anal Policy. 2017;17(2).
130. Fernández-Kranz D, Rodríguez-Planas N. The part-time pay penalty in a segmented labor market. Labour Econ. 2011;18(5):591–606.
131. Verd JM, Barranco O, Bolíbar M. Youth unemployment and employment trajectories in Spain during the Great Recession: what are the determinants? J Labour Mark Res [Internet]. 2019;53(1). Available from: https://doi.org/10.1186/s12651-019-0254-3
132. Cebrián I, Moreno G. The Effects of Gender Differences in Career Interruptions on the Gender Wage Gap in Spain. Fem Econ [Internet]. 2015;21(4):1–27. Available from: http://dx.doi.org/10.1080/13545701.2015.1008534
133. Musumeci R, Solera C. Women's and men's career interruptions in Europe : the role of social policies. Obs la société Br. 2013;(14):37–72.
134. CCOO. La brecha de género en el sistema de protección social. 2018.
135. Matilla-Santander N, González-Marrón A, Martín-Sánchez JC, Lidón-Moyano C, Cartanyà-Hueso À, Martínez-Sánchez JM. Precarious employment and health-related outcomes in the European Union: a cross-sectional study. Crit Public Health. 2019;1–12.
136. Tilly LA, Scott JW. Women, work and family. Routledge; 2016. 1–282 p.
137. Rönnblad T, Grönholm E, Jonsson J, Koranyi I, Orellana C, Kreshpaj B, et al. Precarious employment and mental health: a systematic review and meta-analysis of longitudinal studies. Scand J Work Environ Health. 2019;45(5):429–43.
138. Kim TJ, Von Dem Knesebeck O. Is an insecure job

better for health than having no job at all? A systematic review of studies investigating the health-related risks of both job insecurity and unemployment. BMC Public Health [Internet]. 2015;15(1):1–9. Available from: http://dx.doi.org/10.1186/s12889-015-2313-1

139. Askildsen JE, Bratberg E, Nilsen ØA. Unemployment, labor force composition and sickness absence: a panel data study. Health Econ. 2005;14(11):1087–101.
140. McMichael AJ. Standardized Mortality Ratios and the "Healthy Worker Effect": Scratching Beneath the Surface. J Occup Med. 1976;18(3):165–8.
141. Li CY, Sung FC. A review of the healthy worker effect in occupational epidemiology. Occup Med (Chic Ill). 1999;49(4):225–9.
142. Shah D. Healthy worker effect phenomenon. Indian J Occup Environ Med. 2009;13(2):77–9.
143. Snorradóttir Á, Tómasson K, Vilhjálmsson R, Rafnsdóttir GL. The health and well-being of bankers following downsizing: a comparison of stayers and leavers. Work Employ Soc. 2015;29(5):738–56.
144. Martikainen P, Mäki N, Jäntti M. The effects of unemployment on mortality following workplace downsizing and workplace closure: a register-based follow-up study of Finnish men and women during economic boom and recession. Am J Epidemiol. 2007;165(9):1070–5.
145. Martikainen PT, Valkonen T. Excess mortality of unemployed men and women during a period of rapidly increasing unemployment. Lancet [Internet]. 1996;348(9032):909–12. Available from: http://www.sciencedirect.com/science/article/pii/S0140673696032916

146. Chaupain-Guillot S, Guillot O. Sickness Benefit Rules and Work Absence: An Empirical Study Based on European Data. 2017;127:1109–37.
147. Bachmann R, Felder R, Tamm M. Labour Market Participation and Atypical Employment over the Life Cycle: A Cohort Analysis for Germany. IZA Inst Labor Econ. 2018;
148. Virtanen M, Kivimäki M, Elovainio M, Vahtera J, Ferrie JE. From insecure to secure employment: changes in work, health, health related behaviours, and sickness absence. Occup Environ Med. 2003;60(12):948–53.
149. Domingo-Salvany A, Bacigalupe A, Carrasco JM, Espelt A, Ferrando J, Borrell C. Propuestas de clase social neoweberiana y neomarxista a partir de la Clasificación Nacional de Ocupaciones 2011. Gac Sanit. 2013;27(3):263–72.
150. Hensing G. Chapter 4. Methodological aspects in sickness-absence research. Scand J Public Health. 2004;32(Suppl 63):44–8.
151. Piccarreta R, Studer M. Holistic analysis of the life course: Methodological challenges and new perspectives. Adv Life Course Res. 2019;41:100251.
152. Coulombe P, Selig JP, Delaney HD. Ignoring individual differences in times of assessment in growth curve modeling. Int J Behav Dev. 2016;40(1):76–86.

APPENDICES

8. APPENDICES

8.1. Appendix I: Tables

8.2. Appendix II: Figures

8.3. Appendix III: Response to reviewers (first manuscript)

8.4. Appendix IV: Response to reviewers (third manuscript)

8.5. Appendix V: Scientific conferences

8.6. Appendix VI: Assessment report stay Karolinska Institutet

8.7. Appendix VII: Ethical approval certificate

8.8. Appendix VIII: Awards

8.1. Appendix I: Tables

Appendix I Table I. Association between type of contract, working time, occupational category, income and diagnosis group, and sickness absence trajectories (> 15 accumulated days on sickness absence per quarter) in salaried workers from early, middle and late working life cohorts (WLCs; N=11,968). Catalonia (Spain), 2012-2014.

Women	Sickness absence trajectories[a]					
	Early WLC (N=2,670)		Middle WLC (N=2,739)		Late WLC (N=1,995)	
	High stable vs Low stable	Increasing vs Low stable	Decreasing vs Low stable	Increasing vs Low stable	Decreasing vs Low stable	Increasing vs Low stable
	ORa (95% CI)	ORa (95% CI)	ORa (95% CI)	ORa (95% CI)	ORa (95% CI)	ORa (95% CI)
Type of contract						
Permanent contract	1	1	1	1	1	1
Temporary contract	1.44 (0.98-2.09)	1.10 (0.70-1.71)	0.99 (0.67-1.45)	1.88 (1.21-2.93)	1.08 (0.52-2.22)	0.90 (0.54-1.51)
Working time						
Full-time	1	1	1	1	1	1
Part-time: > 50% up to 99%	1.04 (0.72-1.52)	1.10 (0.74-1.65)	1.07 (0.76-1.51)	0.91 (0.57-1.46)	0.74 (0.33-1.62)	0.77 (0.45-1.31)
≤ 50%	0.88 (0.46-1.69)	1.04 (0.50-2.15)	1.37 (0.82-2.27)	1.42 (0.73-2.76)	1.21 (0.45-3.29)	1.45 (0.71-2.96)
Occupational category						
Skilled Non-Manual	1	1	1	1	1	1
Skilled Manual	1.22 (0.69-2.18)	1.62 (0.84-3.11)	0.68 (0.39-1.18)	0.84 (0.42-1.65)	1.70 (0.65-4.44)	0.94 (0.47-1.88)
Unskilled Non-Manual	0.82 (0.52-1.30)	1.49 (0.91-2.44)	0.80 (0.53-1.19)	0.59 (0.35-1.00)	1.09 (0.49-2.45)	0.98 (0.55-1.76)
Unskilled Manual	1.21 (0.59-2.50)	1.28 (0.52-3.17)	0.80 (0.43-1.47)	1.10 (0.51-2.34)	1.87 (0.68-5.11)	0.78 (0.37-1.62)
Income in quartiles						
High	1	1	1	1	1	1
Middle-high	1.21 (0.77-1.91)	0.90 (0.57-1.40)	1.28 (0.86-1.91)	1.41 (0.84-2.38)	0.55 (0.26-1.16)	1.26 (0.75-2.13)
Middle-low	1.56 (0.94-2.59)	0.75 (0.44-1.29)	1.41 (0.88-2.26)	1.28 (0.68-2.42)	0.70 (0.30-1.64)	1.37 (0.74-2.51)
Low	1.26 (0.60-2.67)	0.76 (0.34-1.70)	1.24 (0.64-2.40)	0.62 (0.23-1.61)	0.54 (0.16-1.84)	0.86 (0.34-2.14)
Diagnosis group (ICD-10)						
Digestive	1	1	1	1	1	1
Mental	2.80 (0.95-8.19)	3.88 (1.16-12.98)	2.19 (1.07-4.46)	4.98 (1.50-16.56)	2.04 (0.57-7.26)	1.47 (0.70-3.10)
Musculoskeletal	1.08 (0.37-3.10)	1.41 (0.43-4.66)	1.35 (0.67-2.70)	2.66 (0.81-8.76)	1.82 (0.53-6.19)	1.30 (0.64-2.64)
Pregnancy	2.82 (0.97-8.19)	2.42 (0.71-8.20)	1.76 (0.82-3.79)	2.70 (0.75-9.75)	-	-
Injuries and poisoning	1.80 (0.57-5.66)	1.32 (0.34-5.13)	1.67 (0.78-3.56)	2.67 (0.74-9.60)	2.59 (0.74-9.15)	1.50 (0.70-3.19)
Others	2.18 (0.75-6.33)	1.68 (0.49-5.76)	1.15 (0.56-2.35)	1.76 (0.51-6.01)	0.92 (0.25-3.37)	0.62 (0.29-1.34)

[a]The low stable class is the reference group for the multinomial logistic regression analysis. ORa: odds ratio mutually adjusted for all covariates.

Appendix I Table I (continued)

Men	Sickness absence trajectories[a]					
	Early WLC (N=1,315)		Middle WLC (N=1,747)		Late WLC (N=1,502)	
	High stable vs Low stable	Increasing vs Low stable	Decreasing vs Low stable	Increasing vs Low stable	High stable vs Low stable	Increasing vs Low stable
	ORa (95% CI)	ORa (95% CI)	ORa (95% CI)	ORa (95% CI)	ORa (95% CI)	ORa (95% CI)
Type of contract						
Permanent contract	1	1	1	1	1	1
Temporary contract	0.95 (0.56-1.64)	0.88 (0.39-1.97)	0.84 (0.43-1.65)	0.86 (0.54-1.39)	1.49 (0.92-2.44)	-
Working time						
Full-time	1	1	1	1	1	1
Part-time: > 50% up to 99%	0.98 (0.41-2.36)	1.44 (0.48-4.35)	1.10 (0.37-3.29)	0.52 (0.20-1.38)	1.45 (0.62-3.39)	5.71 (0.50-65.22)
≤ 50%	0.63 (0.24-1.67)	0.31 (0.06-1.54)	2.54 (1.00-6.45)	1.18 (0.56-2.51)	0.36 (0.11-1.23)	5.11 (0.43-61.31)
Occupational category						
Skilled Non-Manual	1	1	1	1	1	1
Skilled Manual	1.82 (0.72-4.62)	2.16 (0.45-10.24)	1.21 (0.57-2.56)	1.69 (0.93-3.05)	0.83 (0.51-1.35)	-
Unskilled Non-Manual	2.37 (0.95-5.96)	1.47 (0.30-7.32)	1.16 (0.54-2.46)	1.64 (0.91-2.94)	0.88 (0.55-1.41)	-
Unskilled Manual	2.07 (0.73-5.91)	2.07 (0.37-11.65)	1.84 (0.74-4.60)	0.80 (0.35-1.80)	1.17 (0.60-2.26)	-
Income in quartiles						
High	1	1	1	1	1	1
Middle-high	1.10 (0.62-1.94)	1.09 (0.43-2.79)	1.30 (0.71-2.36)	1.05 (0.67-1.64)	1.67 (1.08-2.58)	0.77 (0.17-3.58)
Middle-low	1.31 (0.71-2.41)	1.24 (0.45-3.36)	1.52 (0.77-3.00)	1.50 (0.92-2.44)	1.19 (0.71-1.98)	0.25 (0.03-1.75)
Low	1.49 (0.66-3.35)	3.28 (1.03-10.49)	1.02 (0.40-2.62)	1.96 (1.02-3.75)	1.43 (0.75-2.73)	0.10 (0.01-2.30)
Diagnosis group (ICD-10)						
Digestive	1	1	1	1	1	1
Mental	1.52 (0.60-3.84)	1.25 (0.37-4.22)	6.68 (1.86-23.94)	4.74 (2.15-10.45)	2.24 (1.17-4.27)	0.72 (0.06-8.94)
Musculoskeletal	1.38 (0.58-3.30)	0.89 (0.28-2.90)	4.32 (1.27-14.73)	3.52 (1.68-7.35)	2.30 (1.34-3.95)	0.90 (0.14-5.89)
Injuries and poisoning	1.77 (0.76-4.13)	0.81 (0.25-2.64)	6.11 (1.83-20.43)	4.07 (1.96-8.47)	2.23 (1.22-4.09)	2.33 (0.36-15.26)
Others	1.17 (0.47-2.92)	0.40 (0.10-1.68)	5.38 (1.57-18.46)	2.70 (1.24-5.87)	1.87 (1.07-3.29)	0.87 (0.12-6.62)

[a]The low stable class is the reference group for the multinomial logistic regression analysis. ORa: odds ratio mutually adjusted for all covariates.

Appendix I Table II. Distribution of salaried women and men from early, middle and late working life cohorts (WLCs) (N=10,237) across sickness absence trajectories (>15 accumulated days on sickness absence per quarter) by labour market participation patterns. Catalonia (Spain) 2012-2014.

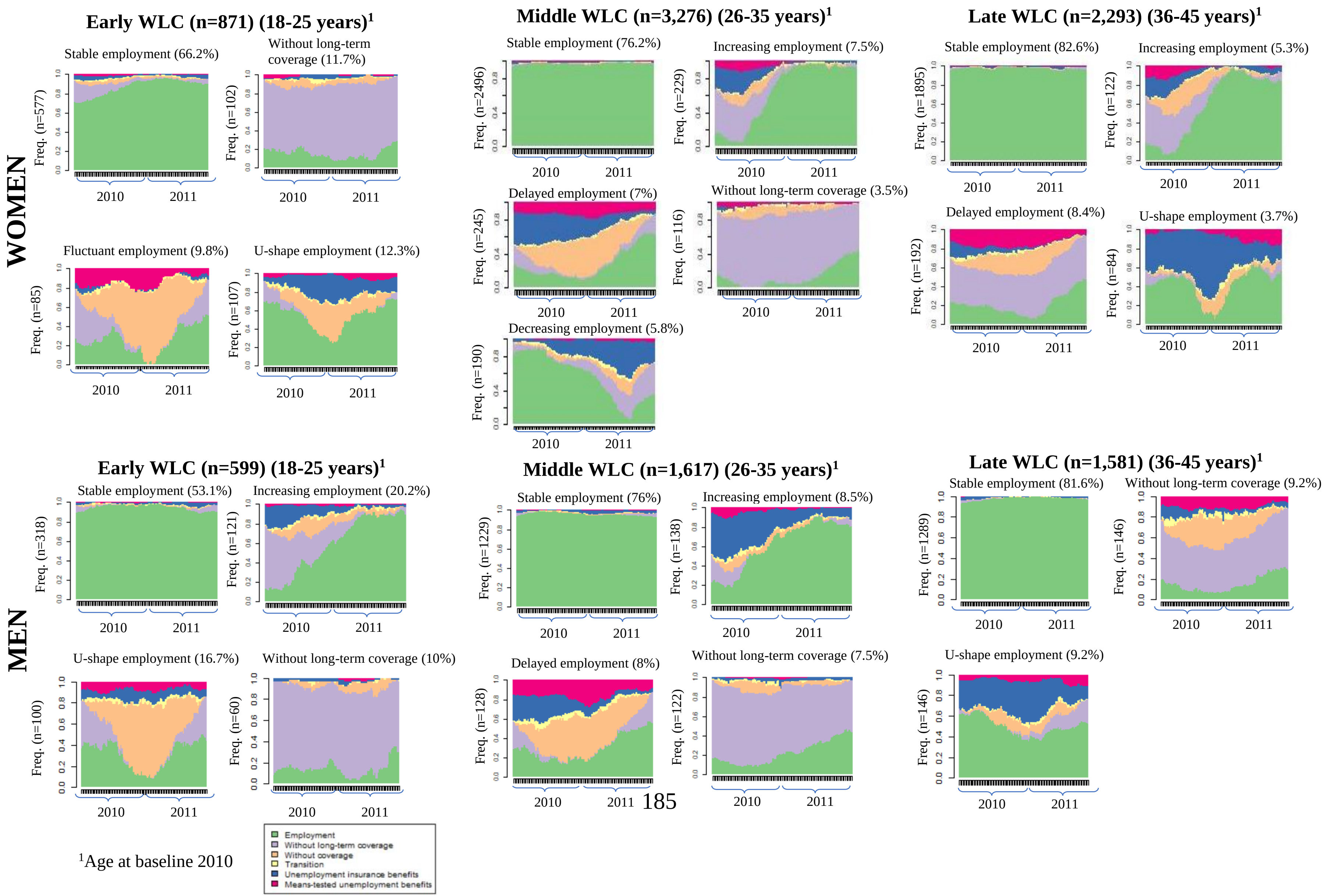
	Early WLC (N=871)				**Middle WLC (N=3,276)**				**Late WLC (N=2,293)**			
WOMEN	**Low stable (76.1%)**	**Decreasing (13.9%)**	**Increasing (10%)**		**Low stable (87.9%)**	**Increasing (5.8%)**	**High stable (6.3%)**		**Low stable (84.2%)**	**Decreasing (9.7%)**	**Increasing (6.1%)**	
	N (%)	N (%)	N (%)	p-value[a]	N (%)	N (%)	N (%)	p-value[a]	N (%)	N (%)	N (%)	p-value[a]
Labour market participation market (2010-2011)												
- Stable employment	434 (65.5)	82 (67.8)	61 (70.1)		2,205 (76.6)	141 (73.4)	150 (73.2)		1,586 (82.2)	185 (83.0)	124 (88.6)	
- Without long-term coverage (early)/Increasing employment (middle & late)	80 (12.1)	13 (10.7)	9 (10.3)		192 (6.7)	17 (8.9)	20 (9.8)		107 (5.5)	12 (5.4)	3 (2.1)	
- Fluctuant employment (early)/Delayed employment (middle & late)	64 (9.7)	11 (9.1)	10 (11.5)	0.883	213 (7.4)	15 (7.8)	17 (8.3)	0.431	167 (8.7)	16 (7.2)	9 (6.4)	0.500
- Decreasing then increasing employment (early & late)/Without long-term coverage (middle)	85 (12.8)	15 (12.4)	7 (8.1)		105 (3.7)	8 (4.2)	3 (1.5)		70 (3.6)	10 (4.5)	4 (2.9)	
- N/A (early & late)/Decreasing employment (middle)	N/A	N/A	N/A		164 (5.7)	11 (5.7)	15 (7.3)		N/A	N/A	N/A	
Total	663 (100.0)	121 (100.0)	87 (100.0)		2,879 (100.0)	192 (100.0)	205 (100.0)		1,930 (100.0)	223 (100.0)	140 (100.0)	
	Early WLC (N=599)				**Middle WLC (N=1,617)**				**Late WLC (N=1,581)**			
MEN	**Low stable (80.6%)**	**Low increasing (12.2%)**	**Increasing (7.2%)**		**Low stable (86.5%)**	**Decreasing (10.1%)**	**Increasing (3.4%)**		**Low stable (85%)**	**Decreasing (2.4%)**	**Increasing (12.6%)**	
	N (%)	N (%)	N (%)	p-value[a]	N (%)	N (%)	N (%)	p-value[a]	N (%)	N (%)	N (%)	p-value[a]
Labour market participation market (2010-2011)												
- Stable employment	257 (53.2)	36 (49.3)	25 (58.1)		1,068 (76.4)	126 (76.8)	35 (63.6)		1,100 (81.9)	32 (84.2)	157 (78.9)	
- Increasing employment (early & middle)/Without long-term coverage (late)	94 (19.5)	19 (26.0)	8 (18.6)		121 (8.7)	11 (6.7)	6 (10.9)		121 (9.0)	4 (10.5)	21 (10.6)	
- Decreasing then increasing employment (early & late)/Delayed employment (middle)	83 (17.2)	11 (15.1)	6 (14.0)	0.897	103 (7.4)	15 (9.2)	10 (18.2)	0.147[b]	123 (9.2)	2 (5.3)	21 (10.6)	0.771[b]
- Without long-term coverage (early & middle)/N/A (late)	49 (10.1)	7 (9.6)	4 (9.3)		106 (7.6)	12 (7.3)	4 (7.3)		N/A	N/A	N/A	
Total	483 (100.0)	73 (100.0)	43 (100.0)		1,398 (100.0)	164 (100.0)	55 (100.0)		1,344 (100.0)	38 (100.0)	199 (100.0)	

Appendix I Table III. Association between labour market participation patterns and sickness absence trajectories (> 15 accumulated days on sickness absence per quarter) in salaried workers from early, middle and late working life cohorts (N=10,237). Catalonia (Spain), 2012-2014. [OR: odds ratio; CI: confidence interval].

	Sickness absence trajectories[a]					
	Early WLC (N=871)		Middle WLC (N=3,276)		Late WLC (N=2,293)	
WOMEN	**Decreasing vs Low stable**	**Increasing vs Low stable**	**High stable vs Low stable**	**Increasing vs Low stable**	**Decreasing vs Low stable**	**Increasing vs Low stable**
	OR (95% CI)	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
Labour market participation patterns (2010-2011)						
Crude model						
- Stable employment	1	1	1	1	1	1
- Without long-term coverage (early)/Increasing employment (middle & late)	0.86 (0.46-1.62)	0.80 (0.38-1.68)	1.53 (0.94-2.50)	1.38 (0.82-2.34)	0.96 (0.52-1.78)	0.36 (0.11-1.15)
- Fluctuant employment (early)/Delayed employment (middle & late)	0.91 (0.46-1.80)	1.11 (0.54-2.28)	1.17 (0.70-1.98)	1.10 (0.64-1.91)	0.82 (0.48-1.40)	0.69 (0.34-1.38)
- U-shape employment (early & late)/Without long-term coverage (middle)	0.93 (0.51-1.70)	0.59 (0.26-1.32)	0.42 (0.13-1.34)	1.19 (0.57-2.49)	1.22 (0.62-2.42)	0.73 (0.26-2.04)
- N/A (early & late)/Decreasing employment (middle)	N/A	N/A	1.34 (0.77-2.34)	1.05 (0.56-1.98)	N/A	N/A
Adjusted model[b]						
- Stable employment	1	1	1	1	1	1
- Without long-term coverage (early)/Increasing employment (middle & late)	1.21 (0.41-3.57)	0.38 (0.11-1.33)	1.57 (0.77-3.19)	2.41 (1.14-5.08)	1.61 (0.57-4.54)	0.25 (0.05-1.29)
- Fluctuant employment (early)/Delayed employment (middle & late)	0.88 (0.32-2.44)	0.85 (0.28-2.57)	1.78 (0.60-5.33)	2.97 (0.89-9.86)	3.09 (0.66-14.42)	0.59 (0.11-3.06)
- U-shape employment (early & late)/Without long-term coverage (middle)	0.93 (0.45-1.93)	0.41 (0.16-1.04)	0.87 (0.17-4.57)	4.61 (1.00-21.33)		2.53 (0.73-8.78)
- N/A (early & late)/Decreasing employment (middle)	N/A	N/A	1.57 (0.70-3.49)	1.84 (0.75-4.51)	N/A	N/A
	Early WLC (N=599)		Middle WLC (N=1,617)		Late WLC (N=1,581)	
MEN	**Low increasing vs Low stable**	**Increasing vs Low stable**	**Decreasing vs Low stable**	**Increasing vs Low stable**	**Decreasing vs Low stable**	**Increasing vs Low stable**
Crude model						
- Stable employment	1	1	1	1	1	1
- Increasing employment (early & middle)/Without long-term coverage (late)	1.44 (0.79-2.64)	0.87 (0.38-2.01)	0.77 (0.40-1.47)	1.51 (0.62-3.67)	1.14 (0.40-3.27)	1.22 (0.74-1.99)
- U-shape employment (early & late)/Delayed employment (middle)	0.95 (0.46-1.94)	0.74 (0.29-1.87)	1.23 (0.70-2.19)	2.96 (1.43-6.16)	0.56 (0.13-2.36)	1.20 (0.73-1.96)
- Without long-term coverage (early & middle)/N/A (late)	1.02 (0.43-2.42)	0.84 (0.28-2.52)	0.96 (0.51-1.79)	1.15 (0.40-3.30)	N/A	N/A
Adjusted model[b]						
- Stable employment	1	1	1	1	1	1
- Increasing employment (early & middle)/Without long-term coverage (late)	1.26 (0.49-3.25)	1.17 (0.34-4.04)	0.67 (0.31-1.45)	0.74 (0.25-2.14)	108.28 (2.62-4,475.76)	2.89 (0.68-12.33)
- U-shape employment (early & late)/Delayed employment (middle)	0.90 (0.23-3.60)	1.25 (0.19-8.26)	0.97 (0.37-2.58)	0.81 (0.22-3.02)	9.25 (0.77-111.56)	2.26 (0.86-5.92)
- Without long-term coverage (early & middle)/N/A (late)	0.82 (0.14-4.87)	1.75 (0.16-19.16)	0.79 (0.27-2.35)	0.28 (0.05-1.42)	N/A	N/A

8.2. Appendix II: Figures

Appendix II Figure I. Labour market participation patterns in salaried workers with future sickness absence (>15 accumulated days per quarter) across working life cohorts (WLCs) (N=10,237). Catalonia 2010-2011.



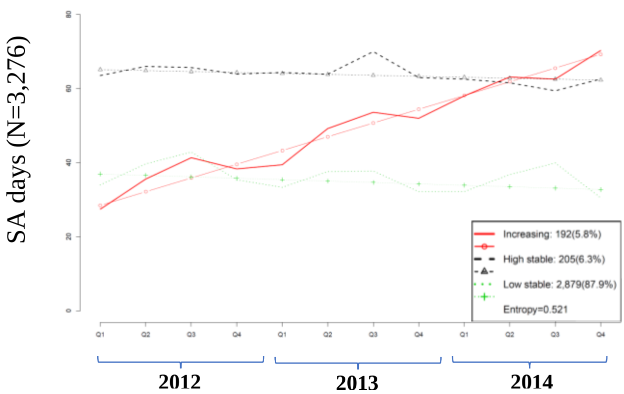
[1]Age at baseline 2010

Appendix II Figure II. Sickness absence trajectories (>15 accumulated days on sickness absence per quarter) in salaried workers across working life cohorts (WLCs) selected in 2010 (N=10,237). Catalonia 2012-2014.

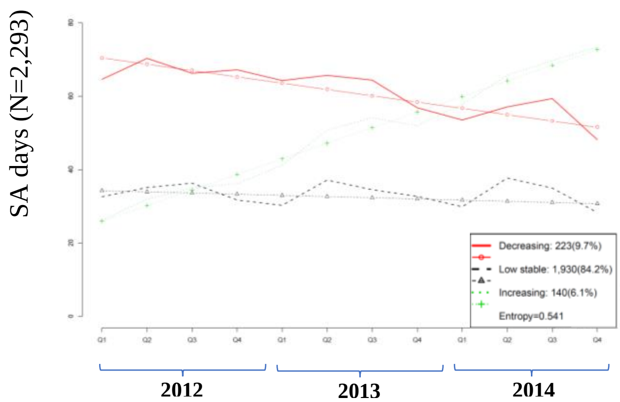
Women

Early WLC (20-27 years)[1]

Middle WLC (28-37 years)[1]

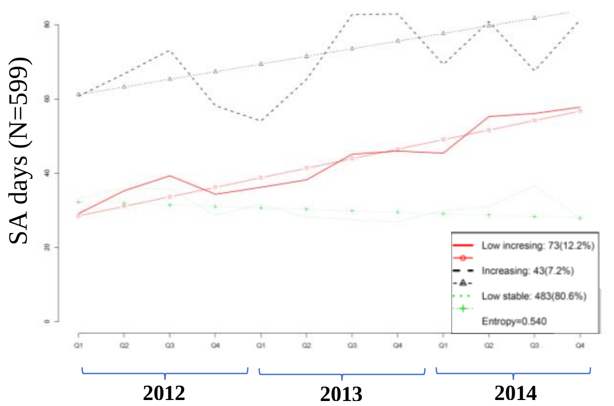


Late WLC (38-47 years)[1]



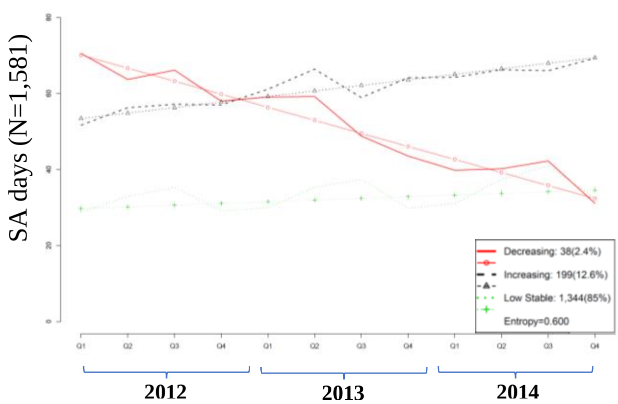
Men

Early WLC (20-27 years)[1]



Middle WLC (28-37 years)[1]

Late WLC (38-47 years)[1]



[1]Age at baseline 2012

8.3. Appendix III: Response to reviewers (first manuscript)

FIRST RESPONSE

Editor Comments to Author:

- Along with your revised manuscript, please include a copy of the STROBE checklist indicating the page/line numbers of your manuscript where the relevant information can be found (https://strobe-statement.org/index.php?id=strobe-home)

We have followed your suggestion and have included a copy of the STROBE checklist for cohort studies, which has been useful for reviewing the entire manuscript.

- Please revise your Patient and Public Involvement statement. It should provide a brief description of any patient involvement in study design or conduct of the study, as well as any plans to disseminate the results to study participants. If patients and or public were not involved, please state this. The see our Instructions for Authors for further details: https://bmjopen.bmj.com/pages/authors/#reporting_patient_and_public_involvement_in_research. The Patient and Public Involvement statement should NOT contain details of participant recruitment, patient consent or ethics approval. This information should be included elsewhere in your methods section. Please see our recent blog for further information regarding PPI: http://blogs.bmj.com/bmjopen/2018/03/23/new-requirements-for-patient-and-publicinvolvement-statements-in-bmj-open/

We have provided a Patient and Public Involvement statement as required.

Reviewer(s)' Comments to Author:

Reviewer: 1
Reviewer Name: Jenni Ervasti
Institution and Country: Finnish Institute of Occupational Health
Please state any competing interests or state ‘None declared’: none declared

COMMENT#1. The manuscript is mostly clear, albeit a language check of a native speaker is recommended. The manuscript is based on large data, with good potential.

However, in its current form, the study is very descriptive. I think there is potential for somewhat more ambitious analysis.

We appreciate the constructive comments on our manuscript. Following the reviewer's suggestion, the manuscript has been edited by a native English speaker.

COMMENT#2. The authors report the results of the trajectory analyses separately in two cohorts and by sex (i.e., trajectories * 4). I don't see particular reason for this, as all analyses produced similar 3 trajectories. This, I suggest that you combine the two cohorts (if you wish, you can show the original 4 trajectory figures as supplementary material). Based on your Figures 1 and 2, I also don't see a reason for sex-stratification (again, the trajectories are similar for men and women). If there is an underlying reasoning for separating between the cohorts and sexes, that should be clearly stated in the introduction.

The reviewer's comment highlights a key point in our analysis strategy that we would like to keep. In order to better justify a separate analysis by sex and birth cohorts, we have added the following paragraph:

"Studies have consistently shown that SA follows different behaviour according to sex and age [10–12]. As women tend to have a higher incidence of SA and duration generally increases with age [13], a separate sex-specific birth cohort analysis would be useful to control for the effect of the study design on assessing the role of other SA determinants." (page 3, introduction, second paragraph)

COMMENT#3. Tables 1-3 present descriptive results of the study population by trajectory membership. After you have combined your data, I suggest that you add frequency information also by sex and age (=cohort). Thus, Table 1 would be one table instead of 3 tables in the current version.

In accordance with our answer above, we have decided to keep Tables 1-3.

COMMENT#4. I also suggest that you analyze your data a bit further and predict trajectory membership with your predictor variables (type of contract, working time, occupational

category, salary, and SA diagnosis). This can be done for example with multinomial logistic regression modelling. Some recent examples: https://www.ncbi.nlm.nih.gov/pubmed/30654267, https://www.ncbi.nlm.nih.gov/pubmed/25916382, https://www.ncbi.nlm.nih.gov/pubmed/28607698, https://www.ncbi.nlm.nih.gov/pubmed/23245998

Taking into account this suggestion, we have included Table 4, which includes the adjusted odds ratio (aOR) for SA trajectories.

We have also added the following sentences:

"The aim of this study was to identify and describe SA trajectories and to assess employment conditions and diagnosis group as determinants." (page 2, abstract, line 4)

"The main difference among SA trajectories was due to diagnosis group, which was strongly associated with all trajectory groups." (page 2, abstract, results section)

"Low salary levels exhibited a strong association with decreased accumulation of SA days over time for older women (aOR: 2.08 [95% CI 1.36-3.18]) and men (aOR: 2.75 [1.77-4.27]). Unskilled manual occupations were associated with increasing trajectories among young women (aOR: 1.36 [1.01-1.84])." (page 2, abstract, results section)

"The aim of this study was to contribute […] and assess the role of employment conditions and diagnosis group as determinants of SA trajectories." (page 3, introduction, third paragraph)

"Finally, the associations between employment conditions or diagnosis and SA trajectories were assessed using a multinomial logistic regression model." (page 5, statistical analysis, second paragraph)

"The multinomial logistic regression analysis showed that diagnosis was the stronger determinant for all SA trajectories obtained. Low salary levels were significantly associated with a higher risk of decreased accumulated days on SA over time compared to the low stable SA trajectory among older women (aOR: 2.08; 95% CI: 1.36-3.18) and men (aOR: 2.75; 95% CI: 1.77-4.27). A similar but weaker association was found among low salary levels and a higher risk of increasing SA trajectories (aOR: 1.51; 95% CI: 1.01-2.26 for women and aOR: 1.56; 95% CI: 1.11-2.19 for men). Unskilled manual occupations were associated with an increasing SA trajectory for young women (aOR: 1.36; 95% CI: 1.01-1.84; Table 4).” (page 6, results, last paragraph)

“We found diagnosis to be the stronger determinant for all SA trajectories. This result is expected, as the SA trajectory is based on accumulated days of SA, which is closely linked to the prognosis of specific diseases [25]. Low salary levels had a higher risk of decreased accumulated days on SA over time and a weaker association for increasing SA trajectories for older women and men, as well as unskilled occupations increasing SA days among young women over time.” (page 7, discussion, first paragraph)

“The association analysis showed that low salary was a determinant for both decreasing and increasing SA trajectory among older workers. A possible explanation for a decreasing number of days of SA, as mentioned above, may be presenteeism (i.e., to attend to work while sick) due to reduced economic coverage of the SA provision. Along these lines, a US study found that more than half of workers went to work sick due to a lack in coverage of paid SA [38]. In addition, presenteeism could affect older workers more because of higher perceived job insecurity, as they know that in the case of job loss their chances of getting a new job are reduced compared to their younger counterparts. On the other hand, increased SA days related to low salary may be explained because workers postpone the onset of the SA episode as much as possible to maintain their full salary, while the existing health problem becomes more severe and the SA becomes longer. Similarly, a comorbidity could arise during an SA, which could lead to a long-term SA, especially in the case of mental or musculoskeletal disorders with one or more co-diagnoses [32]. In addition, it is possible that, to a lesser extent, the replacement rate for long-term SA episodes (representing 75% of the salary from day 21 onwards in Spain) may be an incentive to lengthen the SA. Some studies have shown that increases in the generosity of the SA provision are related to increases in SA duration, and that this increase does not translate into an improvement in employee health [39,40]. However, another study showed that generous SA benefits are related to a decrease in the number of days of SA in the long-term, which supports that no incentive exists to extend SA longer than strictly necessary for medical reasons [4].” (page 8, discussion, second paragraph)

Reviewer: 2
Reviewer Name: Prof Mark Gabbay
Institution and Country: University of Liverpool, UK
Please state any competing interests or state ‘None declared’: I have undertaken research in this field and held grants on behalf of the University of research into this topic (from UK government). Not active currently in this are of research

COMMENT#1. This is a relatively straightforward paper adding further evidence from a different country to a trend observed elsewhere in Northern Europe about increasing sickness absence risk from mental health problems and other risk factors. I was surprised the authors don't refer to more recent work from the UK (Gabby, Shiels, Hillage et al since 2004-2017 building the evidence on the burden of sickness absence and risk factors for prolonged absence in the UK)
Gabbay M, Hillage J, Shiels C Sickness certification for common mental disorders and GP return-to-work advice. Primary Health Care Research & Development 2016; 17 (5): 437-447
Gabbay M, Shiels C, Hillage J. Factors associated with the length of fit note-certified sickness episodes in the UK Occup Environ Med 2015; 72: 467-475 & Online First: 24 February 2015 DOI:10.1136/oemed-2014-102307
for example.

We have considered the reviewer’s suggestion and, following a similar comment from reviewer 1, we have added the following reference in the Introduction:

“Studies have consistently shown that SA follows different behaviour according to sex and age [10-12]. As women tend to have a higher incidence of SA and duration generally increases with age [13], a separate sex-specific birth cohort analysis would be useful to control for the effect of the study design on assessing the role of other SA determinants.” (page 3, introduction, second paragraph)

COMMENT#2. The language would benefit from some editing at times as well.

Following the reviewer's suggestion, the manuscript has been edited by a native English speaker.

COMMENT#3. I think there are more limitations to the dataset and its elements in terms of what is covered by these data and what isn't but overall, I think it does add further evidence about the shift towards mental health problems as the key cause of prolonged absence rather than MSK, and usefully has explored other elements such as salary level

We appreciate the reviewer's comment. We have complemented this argument by adding two new sentences in the Discussion section as follows:

"SAs due to mental health problems have continuously increased in recent years and shown in a UK study to be the main diagnosis group of long-term SA, above musculoskeletal disorders [12]." (page 7, discussion, third paragraph)

"Similarly, information related to working-related conditions, health-related behaviours, healthcare consumption, and family structure that would be worth considering to identify and describe SA patterns were not available. In addition, accounting for the effect of baseline health status prior to the SA follow-up was not possible because of the lack of health-related data and prior SA episodes." (page 9, discussion, third paragraph)

SECOND RESPONSE

Reviewer's Comments to Author:

Reviewer: 1
Reviewer Name: Jenni Ervasti
Institution and Country: Finnish Institute of Occupational Health, Finland
Please state any competing interests or state 'None declared': none declared

COMMENT#1.

The authors have conducted a thorough revision. While I still think it would be more 'economic' to pool the two cohorts, I understand why the authors have decided against it. I also appreciate new multinomial regression analyses, I think they add value to the study. However, the reporting of those results could be improved. For example, you write that diagnosis was the strongest determinant for all trajectories. That does not say much to the reader. You should open the result up for the reader a bit more, particularly as multinomial regression can be difficult to interpret.

We appreciate the positive feedback from the reviewer and the suggestion to make the results more understandable to the reader. Accordingly, we have added the following paragraphs:

"The main characteristic of SA trajectories was the medical diagnosis group. The increasing SA trajectory had a higher proportion of workers with SA due to mental disorders compared to the other trajectories. The association analysis showed diagnosis group strongly associated with all SA trajectories, particularly SA due to mental disorders showed the strongest association with the increasing trajectory among young men (aOR: 42.40; 95% CI: 17.03-105.57)." (page 2, abstract, fourth paragraph)

"Overall, increasing SA trajectories represented to a larger extent long SA spells (median duration range from 25-54 days) rather than repeated short ones (data not shown)." (page 6, results, lines 19-20)

“Compared to episodes due to infectious diseases, individuals who had SA due to mental disorders showed a higher risk to increase accumulated days on SA over time than to develop a low stable trajectory (aOR: 33.52; 95% CI: 16.40-68.51 and aOR: 34.09; 95% CI: 10.74-108.15 for young and old women, respectively; aOR: 42.40; 95% CI: 17.03-105.57 for young men). Among old women, SA due to musculoskeletal disorders was associated with an increasing SA trajectory (aOR: 25.35; 95% CI: 8.07-79.64), while for young men it showed an association with a decreasing SA trajectory (aOR: 34.83; 95% CI: 11.06-109.73).” (page 6, results, lines 22-28)

“SA due to mental disorders with increasing SA trajectories among young men.” (page 7, discussion, line 9)

COMMENT#2.

As a minor note, there are still some language issues, for example the degree of comparison: “..diagnosis was the strongest determinant..” NOT “—the stronger determinant”.

We thank the reviewer for pointing it out, in response to this comment we have reviewed the manuscript proofreading and editing.

8.4. Appendix IV: Response to reviewers (third manuscript)

FIRST RESPONSE

Technical Comments:

Editor Comments:

We operate a policy of open peer review for this journal, which means that you will be able to see the names of the reviewers who provided the reports via the online peer review system. We encourage you to also view the reports there, via the action links on the left-hand side of the page, to see the names of the reviewers.

Reviewer reports:
Reviewer 1: The MS number PUBH-D-20-01188 entitled: "Sickness absence trajectories following labour market participation patterns: a cohort study in Catalonia (Spain), 2012-2014" is an interesting and potentially important effort to examine the effect of long-term accumulation of adverse employment statuses during a previous working life on possible future increase in sickness absence days. However, I some comments/suggestions for the authors' consideration in order to further improve the MS.

1. Introduction

1.1.) In the introduction section the authors state: "…very few studies have analysed the effect of prior working life on health longitudinally (11-15)." The relevance of these references here, where they should verify the authors' argument, is not clear to me. Ref 11 is a methodological article discussing strength and weaknesses of different approaches to study trajectories in their entirety. Also references 12-14 seem to have nothing to do with the authors' argument. They provide description of the WORKss cohort and the Spanish Social Security system. Ref 15 seems to be a relevant one. But surely there are more than one original previous study analysing "the effect of prior working life on health longitudinally". Are there?
As a minor comment: for ref 11 has been given a wrong doi:10.1016/j.alcr.2019.04.005 it should be

doi:10.1016/j.alcr.2018.10.004

Thank you for pointing this out. We have amended as suggested:

“Traditionally, for health and health-related outcomes, occupational epidemiology has assessed exposure–outcome association measures, whether simple or accumulated, at one point in time. Few studies have involved longitudinal analyses of the effect of prior working life on health [11–16].” (Background, line 83, page 4)

Also, we have amended the wrong doi in reference 11 (in the newly revised manuscript the ref. 11 becomes 17).

2. Methods: Study population

The study population belongs to the Spanish WORKing life Social Security cohort (WORKss cohort), which is an annual random representative sample of 4% of affiliates with the Spanish Social Security system at least one day a year starting in 2004. This study examined a cohort of 11968 salaried Catalonian workers, who accumulated more than 15 days on sickness absence (SA) at least in one quarter of the period 2012-2014. For statistical analyses the sample was stratified by age and gender.

I have the following comments/questions in regard to the study population:

2.1.) Was there any intentional reason to restrict the study population into a <12000 individuals from originally > one million individuals' cohort?

The reason why we restricted the study population to <12000 is that SA records were only available between 2012 and 2014 for the population residing in Catalonia (a region of Spain) and not for all the people who are part of the Spanish WORKss cohort. This information has been clarified in the text as follows:

“We obtained data related to working life from the WORKss cohort information and SA records for 2012–2014 from the Catalan Institute of Medical Evaluations, which contains data only for people residing in Catalonia.” (methods, line 120, page 6)

2.2.) The most important decision in this study is to restrict the study population to consist only from those individuals who have >15 days on SA at least in one quarter of the period 2012-2014. In other words, permanently healthy individuals were excluded from the study population. Why was that decision made? When the aim of the study is to examine the association between prior labour market participation patterns and SA trajectories from a life course perspective, it remains unclear why the obvious reference group, the healthy ones, was excluded. Would the authors describe the justification of this decision?

We thank the reviewer's comment that highlights a crucial point in our analysis strategy. We have defined our study population considering only people who have had SA since we are interested in identifying different SA trajectory groups and how they might be related to previous labour market participation patterns. The reference group is established when comparing SA trajectories, in our case, it is the low-stable group. Those without SA do not have a trajectory (cero days) and were excluded from our definition of study population.

Approximately 75% of the SA episodes are shorter than 15 days, mainly represented by acute diagnoses (e.g., infectious and respiratory diseases). The decision to include only people accumulate more than 15 days in SA in any quarter of the 2012-2014 period was intended to reflect SA trajectories that accumulate days due to more long lasting and/or severe diagnoses. In fact, the percentage of long-term SA episodes (spells longer than 15 days) in people who accumulate more than 15 days in SA any quarter of the period 2012-2014 was 50%, while taking any number of accumulated SA days it was 25%.

The justification was mentioned in the first version of manuscript at the end of the discussion section. However, in the revised manuscript, it has been moved to the methods section as follows:

"Approximately 75% of the SA episodes included in these data were shorter than 15 days, mainly represented by acute diagnoses (e.g., infectious and respiratory diseases). The rationale for selecting only workers who accumulated more than 15 days on SA is that SA episodes of this length are more likely to represent severe rather than mild or moderate diagnoses (half of SA episodes lasting longer than 15 days are the result mainly of mental and musculoskeletal disorders) [24]. For this reason, severe SA episodes may better reflect the potentially long-lasting effects of prior LMP patterns. This duration of episode also allows for exclusion of an influence from SA monetary benefits on a person's SA behaviour because long-term SA represents serious illness [25]." (methods, line 131, page 6).

3. Methods: LMP patterns

There are two operationalisations of prime importance. First, labour market participation (LPM) patterns representing the grouping of individuals according their prior work history events between 2002 and 2011 (i.e. during 10 years). LMP patterns reflect weekly transitions between six states: employment, unemployment benefits, unemployment subsidy, transition, without coverage and without long-term coverage. Based on these variables LMP patterns were reconstructed by applying sequence analysis. Individual sets of state sequences were described and a matrix of distances between each sequence produced. After that a hierarchical cluster analysis was applied to produce patterns of similar sequences, in other words, LMP pattern groups were defined. As a result seven different LMP patterns were obtained: stable employment, increasing employment, without long-term coverage, decreasing employment, fluctuant employment, steeply inflow into unemployment, and steeply labour market exit. LMP patterns are depicted visually in Figure 1.

I have the following comments/concerns in regard to the LMP operationalisation:

3.1.) Social security systems differ from each other between different countries. It seems to me that, as it is currently described in the method section, the reader should know the Spanish system in order to fully understand the logic of this operationalisation. I would like to ask the authors to explain more explicitly the Spanish system and the logic of their LMP operationalisation and its justification so that also readers

from other countries can fully understand how and why this operationalisation has been created.

We appreciate the reviewer's comment. The Spanish Social Security system includes paid employees, unemployed receiving benefits, unemployed receiving means-tested benefits and pensioners.

The main characteristics of the Spanish unemployment benefit scheme is described below:

- Spanish workers who are unemployed are entitled to contributory unemployment benefits (also known as unemployment insurance benefits) if they are registered with the Social Security, registered as a job seeker and have paid social security contributions at least one year over the last six years. The duration of the benefits ranges between four months and two years depending on the paid contributions into the Social Security, and the amount of the benefit is based on the average salary before becoming unemployed and the replacement rate (the first six months is 70% and then 50%).

- Unemployed who have not paid enough social security contributions (at least one year) or have exhausted these contributory benefits can access to the non-contributory unemployment benefits (also known as means-tested unemployment benefits or unemployment subsidy). It is required having a monthly income of less than 75% of the minimum wage or, in other words, having less than 712.50€ monthly (the minimum wage was 950€ in 2020 according to the Spanish Royal Decree 231/2020). Also, it is required to have paid contributions for at least three months in case of having family responsibilities or for at least six months in case of not having family responsibilities. The duration of the means-tested benefits will be the same as the time contributed, with exceptions. The amount is the 80% of the Public Indicator of Multiple Effects Income (IMPREM, 537.84€ monthly in 2020), that is, 430.27€.

For this study, we have defined three labour states that account situations of contact with the Social Security system (employment, unemployment insurance benefits and means-tested unemployment benefits). In addition, we have considered a situation without contact with the Social Security due to inactivity that has been categorised "ad hoc" into three types of states to capture some slight differences (transition, without coverage and without long-term coverage). If the period between two employment states was up 30 days was defined as a transition state (i.e. administrative transition). If the period was longer than 30 days, it was defined as a without coverage state. If the period without contact with the Social Security System occurred at the start and/or the end of the follow-up (length undetermined because of left/right censorship), it was defined as a without long-term coverage. Censorship on the left could represent a delay in the first entry into the labour market or a return to work after a period of employment before follow-up. In contrast, censorship on the right could be the consequence of the definitive labour market withdrawal or a temporary leaving if there was a period of employment after the follow-up.

Accordingly, we have explained the Spanish social security unemployment benefits system and we have added the following text:

“The Spanish unemployment benefit scheme distinguishes two categories of unemployment, unemployment receiving benefits and means-tested unemployment benefits. Entitlement to unemployment insurance benefits requires previously paid contributions into Social Security of at least one year over the last 6 years. The duration depends on the paid contributions, and the amount is based on the average wage before becoming unemployed and the replacement rate (70% in the first 6 months, 50% afterwards). Means-tested unemployment benefits can be claimed after unemployment insurance benefits are exhausted or when individuals do not fulfil the conditions for receiving entitled benefits. The duration depends on the time contributed, and the amount is lower than the minimum wage [26,27].” (methods, line 144, page 7)

“For situations of employment and unemployment receiving unemployment benefits/means-tested unemployment benefits, individuals keep contact with the Social Security system.” (methods, line 156, page 7)

“Periods without records in the Social Security registry were categorised ad hoc into three states. The state transition was defined as a period between employment states up 30 days (i.e., administrative transition) [16]. The state without coverage refers to periods between employment states longer than 30 days. The state without long-term coverage accounts for the first labour market entry or return to work (i.e., left censorship) and/or a labour market withdrawal or a temporary leaving (i.e., right censorship).” (methods, line 158, page 7)

3.2.) It remains unclear to me what is the rationale behind disuniting of the two categories of unemployment. The authors refer here to the Spanish legal framework and give two references: 13 and 14. However the URL addresses of these references seem to the same. So would it be better to give the reference only once? More importantly, the web page seems to be in Spanish and when I tried to have a look at it, it turns out to be impossible resulting in "pagina no encontrada"? Could it be possible to describe the rationale of this distinction between these two states of unemployment more accurately in English?

We have followed the reviewer’s suggestion, and we have replaced these two references for the Spanish social protection system for just one in Spanish and another one in English.

References:

- Prestaciones, Ministerio de Trabajo y Economía Social, 2020.

- Employment, Social Affairs & Inclusion, European Commission, 2019.

The rationale to separate unemployment into two categories is because means-tested unemployment benefits provides less generous benefits than unemployment insurance benefits, and this distinction may allow reflecting situations of more vulnerable workers into the LMP patterns.

This justification has been added in the text as follows:

“We maintained the separation of the two unemployment categories, with means-tested benefits as the least generous, which may allow for capture in the LMP patterns of situations involving more vulnerable workers.” (methods, line 153, page 7)

3.3.) The state transition: It is unclear to me what is meant by the expression "affiliates who have lost contact with the Social Security system"? How can that happen? In my country each

citizen has a unique social security number and therefore a person will never be "lost" from the system.

We thank the reviewer's comment. The same occurs in Spain. When a salaried worker is employed for the first time, is assigned a unique social security number for all worker's life (i.e. affiliation number), regardless of changes between keeping or not contact with the Social Security after being affiliated. What we mean when we say "lose contact" is the time elapsed without contact with the social security, since our study population is not lost from the system. We have changed the expression "lose contact" for "without registered contact" to avoid ambiguities as follows:

"Periods without records in the Social Security registry were categorised *ad hoc* into three states." (methods, line 158, page 7)

3.4.) The LMP patterns are illustrated in Figure 1. Its X -axis covers 10 years period (from 2002 to 2011). The authors have stated that the LMP patterns reflect weekly transitions between six labour market states. Does this mean that there are 520 time points in X -axis? (52 weeks/year x 10 years = 520 weeks).

The reviewer is right, Figure 1 represents the distribution of states at each time unit, being an aggregate pattern instead an individual longitudinal pattern. Thus, it shows the evolution of the cross-sectional state distribution at successive time points, in this case, each week during the 10-year period.

3.5.) As stated by Piccarreta & Studer (ref 11) the results of sequence analysis depend on the dissimilarity measure, see ref 11 p.3. What was that criterion chosen by the authors and what is its justification?

First of all, no dissimilarity measure dominates the others, and the choice depends on the research objectives since some measures are more focus on specific dimensions of timing, duration and sequencing and others consider a mix of dimensions simultaneously (Studer and Ritschard, What matters in differences between life trajectories: A comparative review of sequence dissimilarity measures, 2016). We chose the optimal matching (OM) because it has been proven to be valuable accounting duration and sequencing differences. Also, OM is a flexible measure that accounts not only indels (i.e. insertion and deletion) but also substitution costs. Also, OM allows defining a custom substitution costs matrix to penalise more those transitions that we consider less frequent (more costly) according to the nature of the Spanish labour market. For example, transitions from a situation without coverage to employment or means-tested unemployment benefits to employment (or vice versa). In Spain, employability and the unemployment rate are less favourable than European countries (Sanz-de-Galdeano and Terskaya, The labor market in Spain, 2002–2016, 2017). Therefore, we thought that setting substitution costs may reflect the Spanish employment status mobility better since it helps to establish hierarchical order of states. However, the cost specification could be to a certain extent subjective (Aisenbrey, New life for old ideas: the "second wave" of sequence analysis bringing the "course" back into the life course, 2010).

Accordingly, the text has been modified as follows:

"An optimal matching approach supported development of a matrix of distances between each sequence given indels (i.e., insertion and deletion) together with substitution costs. A custom substitution costs matrix was defined according to the characteristics of our data and study population, with a higher weight given to the transitions that were considered less frequent (i.e., from employment to means-tested unemployment benefits, or from employment to without coverage, and vice versa). Then, we used hierarchical cluster analysis to group similar sequences (i.e., LMP patterns) [29]." (methods, line 190, page 9)

3.6.) In cluster analysis clustering quality is decisive. The authors stated that they evaluated clustering quality by using the average silhouette width as a criterion. However, as stated in ref 11, "a good global partition does not necessarily imply high levels of internal cohesion for all clusters". And therefore it is recommended to evaluate also the quality of each cluster separately. Have the authors done that?

Thank you for this comment. Yes, we have taken into account the quality of the global partition in order to select the number of clusters, but we have also measured the ASW for each cluster separately. This data has not been shown and now it is added as a Supplementary Table 1 (see Additional File).

The following text have been added in the manuscript:

“In this regard, LMP patterns in the early working life cohorts may not represent homogeneous groups because their global ASW showed lower values than recommended. Likewise, the low stable SA trajectories showed the lowest values of assignment accuracy across WLCs. Nevertheless, the assessment of cluster analysis and latent classes showed adequate values for most of the groups.” (Discussion, line 405, page 25)

4. Methods: SA trajectories

The second operationalisation of prime importance is sickness absence (SA) trajectories. They are based on sum of days on sickness absence per annual quarter between 2012 and 2014 of workers who had accumulated more than 15 days on SA each quarter (if any). SA trajectories were identified using latent class growth analysis (LCGA) based on accumulating more than 15 days on SA quarterly (if any) during the three year follow-up. Selection of the final models (in age and gender stratified samples), in other words, defining the optimal number of trajectories, was based on the Bayesian Information Criteria (BIC), the Lo-Mendell-Rubin adjusted LRT test and the bootstrap likelihood ratio test. The prevalence of the latent classes (trajectories), the average posterior probability of assignment (APPA), and entropy were also considered. The graphical illustrations of the four selected final models stratified by age and gender are shown in the Figure 2.

I have the following comments/concerns in regard to the SA operationalisation

4.1.) The description of the dependent variable is insufficient. If I understood right, the dependent variable is continuous (number of quarterly SA days) with 12 time points. Consequently, the link function between dependent variable and time is censored normal. Am I right? Further, it is left censored so that the minimum value is 15 days? Now, the distribution of the dependent variable should be given. I would also like to see the justification of the specification for the follow-up time unit. In other words, why it is defined to be

three months? This is important because the number of time points has an effect on class-enumeration.

SA trajectories were estimated based on the number of accumulated days on SA at least one quarter for the period 2012-2014 (12 time points). Those quarters in which individuals had zero days on SA or did not have information on SA due to a delayed entry or an early departure from the cohort were considered as missing value. The models were based on a linear functional form. This has been added to the text:

"[…] more than 15 days on SA quarterly (if any) during the 3-year follow-up, specifying a linear functional form." (Methods, line 202, page 9)

The dependent variable is left censored with a minimum value of 16 days. The distribution of the dependent variable each quarter (if any) of the period 2012-2014 is shown below (see Additional file, Supplementary Table 6, not shown in the manuscript). Also, we present you a summary description and two histograms of the dependent variable for the entire period 2012-2014 among women and men (see Additional file, Supplementary Table 7 and histogram, not shown in the manuscript). According to the histograms, we can observe that the outcome follows a Gamma distribution.

Regarding the follow-up time unit, we agree that the choice may affect class-enumeration. For example, it is not the same to depict a trajectory of a person that accumulates 16 and 18 days on SA the first and the second quarter of 2012 and 20 days the first quarter of 2014 than the same accumulation of days annually (32 days in 2012 and 20 days in 2014). In the first case (12-time points) the person could be classified in an increasing SA trajectory, while in the second case (3-time points), it could be classified in a decreasing SA. However, using 12-time points may better represent SA trajectories, since it has been proven that increasing the number of time points per person reduce bias in most parameter estimates (Coulombe, Ignoring individual differences in times of assessment in growth curve modeling, 2016). Also, choosing to much time points, for example, a monthly measure (i.e. 36-time point) will result in an excess of zeros, which will difficult the characterization of the outcome. Furthermore, since we were interested in longer and likely more severe SA, the quarterly measure allows reducing the possibility that SA was due to acute medical diagnoses (it is easier to accumulate more than 15 days in SA for several acute episodes throughout the year than in a quarter).

4.2.) The most intricate thing in LCGA is the definition of the final model i.e., the "right" number of latent trajectories (class-enumeration). It is not only based on different goodness-of-fit indices and model adequacy indices but is always also a subjective decision of a researcher based on his/her research question and interpretation of the given model. However, the information concerning the comparisons between different competing models is currently completely lacking in the MS. The reader is not able to evaluate herself/himself whether the decisions of the authors are justified. The reader is not even aware what kind of competing models were compared. The authors simply state that they selected four trajectories and the reader must take it on faith that the decision is right. In the MS the authors refer to suggested guidelines for reporting on latent trajectory studies by van de Schoot et al., 2017. I would suggest that according to this publication the authors would add the information on comparisons between competing models. If this information takes too much space in the MS, it could be published as a supplementary info. Every point enumerated by van de Schoot and coworkers is not needed. However, I would like to see, in addition to already mentioned criteria/procedures by the authors, also the information concerning G2, odds of correct classification and mismatch between estimated and assigned group probabilities.

We completely agree with the reviewer. Now, we have mentioned in the methods section the model adequacy assessment. Also, we have added the supplementary tables 1 and 2 with the comparison of models and the model adequacy assessment, respectively (see the additional file attached). Also, we showed these tables and the text modified in the manuscript below:

“In cases of similar values for compared goodness-of-fit indices, we selected the one with the highest entropy (near 1.0) (Supplementary Table 2) [34]. We also assessed model adequacy indices using odds of correct classification (>5 for all groups indicates high assignment accuracy) and mismatch scores (values close to 0 indicate individuals were assigned to groups with high certainty) (Supplementary Table 3) [35].” (methods, line 210, page 9)

“In this regard, LMP patterns in the early working life cohorts may not represent homogeneous groups because their global ASW showed lower values than recommended. Likewise, the low stable SA trajectories showed the lowest values of assignment accuracy across WLCs. Nevertheless, the assessment of cluster analysis and latent classes showed adequate values for most of the groups.” (Discussion, line 405, page 25)

(see Additional file, Supplementary Tables 2 and 3)

5. Results and their interpretation

5.1.) In my comments above I have emphasised the methodological aspects of the present MS. The reason for that is that the results of the current study are, as the authors state it, "unexpected". The four sickness absence trajectories were not related to the seven prior 10-year labour market participation patterns. The authors had hypothesised that the accumulation of adverse employment statuses during a previous working life could be related to an increase in sickness absence days. Unexpectedly, the results do not support that hypothesis. The authors discuss different alternative interpretations and methodological weaknesses of the study which could have led to biased results. In my comments I have tried to show some additional and possible points where the MS could be improved in order to increase the reliability of the results. Otherwise, the conclusion from this study, remains indefinite and the importance of it unclear.

Thank you for such a valuables comments that undoubtedly have contributed to a better understanding of the results and, therefore, improve the quality of the manuscript. Particularly we have clarified certain methodological aspects such as the rationale behind the time unit we used to measure the outcome and why we included individuals who accumulate more than 15 days on SA. Also, we believe that providing the goodness of fit indices, the model adequacy assessment and cluster quality scores contributes to the transparency of the research and improves the reliability of the results. We expect now that the new version present clear results and useful interpretation.

Reviewer 2: This is a study based on register data on 11986 individuals, showing that prior labour market participation pattern were not associated with SA trajectories.

Major remarks:
Thanks for the opportunity to review such an interesting study, I really like the idea of using sequence analysis clusters as exposure and SA trajectories as outcome. This is a novel method, and further elaboration on the merits of the chosen method would be a relevant addition. Further a general check of the language is necessary to improve readability.

We thank very much that you have appreciated the novelty of the methods used in this research. We also appreciate the constructive comments on our manuscript and following the reviewer's suggestion the manuscript has followed an external English proofreading and editing review (we attach a certificate as the language revision has been carried out).

The analyses are made on very rich data, and this question could be explored in very many ways using these data. The way used here needs to be further explained, justified, and clarified, as it is very difficult to follow right now.
As I understand when looking at the figures, the analyses are made separately for each WLC/sex group, this for example needs to be both justified, apparent (which it is not now) as well as further clarified in the text.

We have followed the reviewer's suggestion, and we have justified why we separate the analysis by sex and working life cohort as follows:

"Previous studies have examined sex and age differences in health and health-related outcomes and in LMP [18–21]. The authors of one review found that women have higher short-term SA rates than men, with variations by country and age cohort. Likewise, higher proportions of SA affected the beginning and middle parts of working life among women ages 20–54 years compared to men of the same ages, which could be related to pregnancy-related health problems or psychological distress when employed in occupations where women are underrepresented [19]. Because cohorts reflect exposures to past socioeconomic circumstances and institutional contexts, considering several cohorts may uncover different influences across a life course [22]. For this reason, a separate analysis by sex and by cohort, defined by working life stage, could contribute to disentangling the relationship between LMP and SA over a lifetime." (Background, line 88, page 4)

Since the analyses are made separately and there are different clusters/trajectories in the different groups it is hard to compare between the groups. Is there any way that more direct comparisons could be made, as this would be highly interesting information? Perhaps an analysis for the whole study population could add value and make comparisons easier. And/or a stepwise stratification also showing some descriptive variables for example all women and all men. This could also help making the justification of the final group stratifications more straight forward. I'm hesitant to accept that the lack of significant results (that the author points out as the main findings) and the wide CIs, is not due to the lack of power. Is it really necessary to divide the analyses on WLC? Is it enough to stratify on sex or on WLC, to gain more power? At least these steps could be shown as well.

We thank the reviewer's comment that highlight a key point in our analysis strategy that we would like to keep, since we think that to analyse the previous working life across cohorts at different stages of working life adds value to the lifecourse. The lifecourse approach highlights the importance of place and time (Amick, BC, Labor markets and health: an integrated life course perspective, 2016) and, in occupational epidemiology, emphasizes how the working life and the social context affects the relationship between the labour market and health trajectories. Said that, we think that considering three working life cohorts adds context about the past socioeconomic conditions and earlier circumstances in life shared by the individuals within the cohorts, which may contribute to shape the relationship of extended labour market participation and future sickness absence trajectories (Haas, SA, The life course, cohort dynamics, and international differences in aging trajectories, 2018).

Here follow some further minor comments/suggestions:
The abbreviations aOR and CI are not stated among the other abbreviations.
The CI in the abstract does not correspond to the CI in the table.

Thank you for the reviewer's comment. Following the suggestion of the reviewer the aOR and the CI in the abstract have been stated without abbreviations. Also, values of CI have been checked in the abstract and should be the same as reported in the table, therefore, we have amended this error.

By the way, the aOR in Table 2 have been replaced by OR, since the values below not necessarily refer to the adjusted model, but also to the crude model (this is detailed in the first column above the name of the clusters).

The text in the abstract have been modified as follows:

"[…] (adjusted odds ratio: 0.21; 95% confidence interval: 0.05–0.96)." (abstract, line 47, page 3)

Row 67: Concerning the sentence: Alike, the proportion of women with a housewife or full-time dominated careers decrease, and the proportion of women with discontinuous or part-time careers increase, particularly in younger cohorts. Unclear formulation, please rephrase

Following the suggestion of the reviewer, we have rephrased the sentence as follows:

"In keeping with this pattern, a study of employment patterns among women in Germany showed that younger cohorts followed a trend towards discontinuous and part-time careers, whereas careers involving continuous full-time employment or being a housewife were becoming unusual [10]." (Background, line 75, page 4)

Row 90: It is stated that the WORKss cohort started in 2004, but that data was collected from WORKss at the year 2002. Could you please explain this?

This cohort was extracted for the first time in 2004, and we had employment history registers dating back in 1981. Now, we have added this information in the manuscript:

“The sampling has taken place at least one day a year starting in 2004, and the information includes employment history register data from 1981 [23].” (methods, line 115, page 5)

Row 98: Why only include the individuals with more than 15 days of SA?

Since Reviewer 1 has asked us a similar question, the full answer can be found in comment 2.2. from the text above.

The justification was mentioned in the original manuscript at the end of the discussion section. However, in the revised manuscript has been moved to the methods section as follows:

“Approximately 75% of the SA episodes included in these data were shorter than 15 days, mainly represented by acute diagnoses (e.g., infectious and respiratory diseases). The rationale for selecting only workers who accumulated more than 15 days on SA is that SA episodes of this length are more likely to represent severe rather than mild or moderate diagnoses (half of SA episodes lasting longer than 15 days are the result mainly of mental and musculoskeletal disorders) [24]. For this reason, severe SA episodes may better reflect the potentially long-lasting effects of prior LMP patterns. This duration of episode also allows for exclusion of an influence from SA monetary benefits on a person’s SA behaviour because long-term SA represents serious illness [25].” (methods, line 131, page 6).

Row 106: Concerning the sentence: We distinguished between two categories of unemployment because they have different requirements to be eligible, different amount and duration according to the Spanish legal framework. Unclear formulation, please rephrase.

The same question has been raised by the previous reviewer in the comments 3.1 and 3.2 about the Spanish unemployment benefit scheme and the reason why we use two categories of unemployment.

We have re-write the sentence to clarify the justification of using two categories of unemployment benefits as follows:

“We maintained the separation of the two unemployment categories, with means-tested benefits as the least generous, which may allow for capture in the LMP patterns of situations involving more vulnerable workers.” (methods, line 153, page 7)

Row 109: Weekly data, based on periods of 30 days, is all these 30 days covered in that state or just the days after the 30th day?

The transition state was obtained by calculating the difference between the registration date of the next affiliation record and the end date of the previous affiliation record. When this difference was up to 30 days, it was called “transition”; if it was more than 30 days, it was called “without coverage”. Once the type of transition state was identified, the calendar date that corresponded to the days it was in transition was added, and then it was converted to weekly states (if more than one state coincided in the same week, we chose the one that accumulated the most days in that week).

Row 113: Are the individuals included the whole follow-up or just the quarter they had SA above 15 days? In the first case, the 'each' on row 114 should be an 'any'?

Individuals are included the whole follow-up. We have modified the sentence as:

“SA trajectories were based on the sum of days on SA any quarter between 2012 and 2014 of workers who had accumulated more than 15 days on SA any quarter.” (methods, line 163, page 7).

Row 119: State the groups and the ICD10 codes in each group.

The diagnosis groups for medically certified sickness absence were: mental disorders (F00-F99), digestive diseases (K00-K93), musculoskeletal diseases (M00-M99), pregnancy (O00-O99), injuries and poisoning (S00-T98), others (included the rest*).

*This category included: blood diseases (D50-D89), metabolic diseases (E00-E90), nervous system diseases (G00-G99), eye diseases (H00-H59), ear diseases (H60-H95), skin diseases (L00-L99), genitourinary system diseases (N00-N99), perinatal diseases (P00-P96), congenital malformations (Q00-Q99), other symptoms (R00-R99), external causes (V01-Y98) and factors influencing health status and contact with health services (Z00-Z99).

The diagnosis groups infectious (A00-B99), circulatory system diseases (I00-I99), respiratory system diseases (J00-J99) and those diagnosis unusual according to their nature such as pregnancy (O00-O99) (only in the late cohorts) and neoplasms (C00-D48). All of them had very few SA episodes and were excluded for the purpose of the study.

(Reference: https://icd.who.int/browse10/2019/en#/XX)

We state the diagnosis groups as follows:

“The diagnosis groups included were mental disorders (F00-F99), digestive diseases (K00-K93), musculoskeletal diseases (M00-M99), pregnancy (O00-O99), injuries and poisoning (S00-T98), and others (the remaining codes). Diagnosis groups that included few people or none in the SA trajectories, such as acute (i.e., infections, circulatory diseases, respiratory diseases) or unusual according to their nature (i.e., pregnancies in women from the late WLC and neoplasms) were excluded.” (methods, line 170, page 8)

Row 128: Make clear that the analyses are for each WLC/sex group separately. E.g. state in the results that 3-4 patterns per WLC/sex group were obtained. And equally, in row 163, three trajectories in each WLC/sex group.

Following the reviewer’s suggestion, the text have been modified accordingly:

“All the analyses were performed for each sex and WLC group separately.” (methods, line 187, page 9).

“[…] steeply decreasing employment (7.4%-8.8%), with 3-4 patterns in each sex and WLC group.” (results, line 225, page 10)

“[…] with three trajectories in each sex and WLC group.” (results, line 238, page 11)

Row 285: () -> [] ?

Thank you for pointing this out, since there was an error when reporting the reference that we have amended.

“[…] (16th onwards), unlike other countries where the employer pays the entire cost of SA [47].” (discussion, line 372 page 23)

Row 324: Concerning the sentence: Furthermore, individuals without Social Security coverage could be in a situation of inactivity (i.e. unemployed without benefits seeking or not a job) or in informal employment. Unclear formulation, please rephrase.

Thank you for the reviewer’s comment. We have rephrased the sentence as follows:

“Furthermore, the administrative registers do not record a worker’s status when they are without contact with Social Security. Individuals could be unemployed without benefits and actively seeking a job, jobless and not seeking a job (i.e., outside the labour force or inactive), or in informal employment (i.e., working off the record, without a contract or social protection), and we do not know how these situations affect their health [53].” (discussion, line 421, page 25)

Figure 1. The labels are hard to read, so are the axes and the frequencies. The x-axis is missing explanation. Why different 'names' on the clusters 'steeply inflow into unemployment' and 'steeply labour market exit', e.g. 'steeply decreasing employment'. To also show the representative sequences could be a good complement.

We have increased the font size of the labels in figure 1 to make it easier to read. We put different names on the clusters “steeply inflow into unemployment” and “steeply labour market exit” because in the first case, the inflow was into unemployment and in the second case, the inflow was into without long-term coverage. However, it is true that the overall behaviour of both clusters is a steeply decreasing employment closed to the onset of the economic crisis of 2008, so we have changed the names of the clusters in the tables and in the text and we have replaced them according to the reviewer’s suggestion as follows:

“Results The analyses yielded six LMP patterns: stable employment (63%–81%), increasing employment (5%–22%), without long-term coverage (7%–8%), decreasing employment (4%–10%), fluctuant employment (13%–14%), and steeply decreasing employment (7%–9%).” (abstract, line 40, page 2)

“The analysis identified six LMP patterns (Fig. 1): stable employment (value range: 63.3%–81.3% of workers), increasing employment (5.6%–22%), without long-term coverage (7.5%–8.2%), decreasing employment (4.3%–10.5%), fluctuant employment (13.6%–14.7%), and steeply decreasing employment (7.4%–8.8%), with 3-4 patterns in each sex and WLC group.” (results, line 222, page 10)

“[…] a steeply decreasing employment pattern only among men.” (results, line 229, page 10)

Figure 2. The green lines are barely visible, the resolution in the axes and the labels need to be better.

Thank you for the suggestion, we have modified the colors to make more visible the trajectories.

Tables: Suggestion to make the supplementary table into an ordinary table, and to combine table 1 and 2 into the same table. Also, an interesting table could be a table as the supplementary table, but instead of the trajectories use the sequences.

Thank you for the reviewer’s comment. We agree with the reviewer’s point and we have combined table 1 (no longer supplementary) and 2 into the same table (Table 1). Regarding the descriptive table with the sequences it was already attached in the first submission of the manuscript as a “Supplementary Table 2” in the additional file (now it is renamed as “Supplementary Table 4”, since the Supplementary tables 1 to 3 corresponds to the clustering quality, goodness of fit and model fit assessment, respectively).

SECOND RESPONSE

Technical Comments:

Editor Comments:

We operate a transparent peer review process for this journal where reviewer reports are published with the article but the reviewers are not named (unless they opt in to include their name).

Reviewer reports:

Reviewer 1: The authors have comprehensively handled all my remarks. They have clearly and successfully defended their choices and decisions so that the reader has now possibility to assess their strengths and weaknesses. Therefore, I have no more remarks or questions.

Thank you very much, we appreciate the positive feedback from the reviewer.

Reviewer 2: The authors have addressed most of my comments adequately

Although, from a theoretical perspective I completely agree with importance of life course perspective. Since no or very small effects were observed, I would encourage the authors to dig deeper. Perhaps by increasing the power of the analyses by combining groups and try to disentangle the associations.

We agree with this remark and have further explored the associations only separating our analyses on sex to gain more statistical power.

The results of the new analysis show no association between any labour market participation pattern and subsequent sickness absence trajectories. Therefore, we can rule out that the lack of association is related to lack of statistical power. However, it should be borne in mind that the quality of some clusters is low and, therefore, could influence the results obtained in the association analyses, which are based on these clusters as the explanatory variable.

The new figures, fit indices and results of the association analysis have been added in the additional file (Supplementary Figures 1-2 and Supplementary Tables 7-9).

See also some minor comments below:

Row 39: add: "value range:", for the first () occurrence

Thank you for spotting this. It has been corrected.

"[…] stable employment (value range: 63%–81%)." (abstract, line 39, page 2).

Row 42: remove: "value range:", not needed here if added at line 39.

Thank you for spotting this. It has been corrected.

"[…] We also identified four SA trajectories: low stable (83%–88%)." (abstract, line 42, page 2).

Row 106: "accumulated more than 15 days of SA during 2012-2014" is this correct or is it "accumulated more than 15 days of SA in at least one of the quarters during 2012-2014"

Thank for spotting that. Yes, we refer to the last phrase indicated by the reviewer.

"individuals who had accumulated more than 15 days of SA in at least one of the quarters." (introduction, line 106, page 5).

Row 129: Look over the parentheses they might be misplaced?

The parenthesis is corrected, since it contains the abbreviation of "working life cohort" for the first time it appears in the text, apart from the information of the age range and percentage of individuals.

Row 163: The first any should be an each? "SA trajectories were based on the sum of days on SA each quarter between 2012 and 2014 of workers who had accumulated more than 15 days on SA any quarter."

Thank you, we agree with the reviewer, in this case we referred to "each" instead of "any". It has been corrected.

“sum of days on SA each quarter between 2012 and 2014 of workers who had accumulated.” (methods, line 163, page 7).

Figure 2: Labels; I see that the same type of trajectories has the same colour, is it possible to also have the same line type (line, dashed, dotted)?

Thank you, we have modified the line type of trajectories as suggested by the reviewer and the legends correspondingly, in the “figures” file and the “main manuscript” file (pages 33-34).

THIRD RESPONSE

Your manuscript "Sickness absence trajectories following labour market participation patterns: a cohort study in Catalonia (Spain), 2012-2014" (PUBH-D-20-01188R2) has been assessed by our reviewers. Based on these reports, and my own assessment as Editor, I am pleased to inform you that it is potentially acceptable for publication in BMC Public Health, once you have carried out some essential revisions:

1. We have noted that the authors, FGB and MUL, are missing in the listed authors' contributions. The individual contributions of all authors to the manuscript should be specified in the Authors' Contributions section. Guidance and criteria for authorship can be found here: http://www.biomedcentral.com/submissions/editorial-policies#authorship

Thank you to the editor for this comment. When referring to all the authors, the contributions of FGB and MUL were included. However, it is true that before using a generic term, its initials should be explicitly stated, at least the first time they appear in the text. Accordingly, the paragraph of authorship contributions has been completely revised and rewritten as follows:

"Author's contributors: All listed authors fulfil authorship criteria. JCH, MUL, LSS, and FGB participated in the conception and design of the study. JCH and LSS performed the data management and data analysis. JCH, MUL, LSS, and FGB interpreted the data. JCH drafted the first version of the manuscript, and all authors made subsequent revisions, agreed on the text and findings and approved this final version. The corresponding author certifies that all listed authors meet authorship criteria. LSS is the guarantor". (Declarations section, line 436, page 23).

2. At this stage, please upload your manuscript as a single, final, clean version that does not contain any tracked changes, comments, highlights, strikethroughs or text in different colours. All relevant tables/figures/additional files should also be clean versions. Additional files should remain uploaded as

separate files. Please ensure that all figures, tables and additional/supplementary files are cited within the text.

We thank the editor for the instructions, that we carefully addressed.

Technical Comments:
Editor Comments:
We operate a transparent peer review process for this journal where reviewer reports are published with the article but the reviewers are not named (unless they opt in to include their name).

Reviewer reports:
Reviewer 2: The authors have comprehensively handled all my remarks. Therefore, I have no more remarks or questions.

Thank you very much, we appreciate the positive feedback from the reviewer.

8.5. Appendix V: Scientific conferences

XXXV Annual Scientific Meeting of the Spanish Society of Epidemiology (SEE). Date: 6-8 Sept. 2017. Barcelona, Spain. Oral communication: ¿El riesgo de mortalidad es mayor en los desempleados que reciben prestación por desempleo comparado con los que están en empleo? Evidencia de la cohorte WORKss (Are unemployed receiving benefits at higher risk of mortality compared to fully employed? Evidence from the Spanish WORKss cohort) The previous version of the title, which appears in the "Appendix VIII: Awards" was: The effect of receiving unemployment benefits on mortality: evidence from the Spanish WORKss cohort.

Hernando-Rodríguez JC, Serra Saurina L, López Gómez MA, Ubalde-Lopez M, Benavides FG

CERTIFICADO DE COMUNICACIÓN ORAL

El Comité Científico de la XXXV Reunión Anual de la Sociedad Española de Epidemiología (SEE) y XII Congresso da Associação Portuguesa de Epidemiologia (APE), celebrada en Barcelona los días 6 al 8 de septiembre de 2017, certifica que

JULIO CÉSAR HERNANDO RODRÍGUEZ

ha presentado la **comunicación oral** titulada

¿EL RIESGO DE MORTALIDAD ES MAYOR EN LOS DESEMPLEADOS QUE RECIBEN PRESTACIÓN POR DESEMPLEO COMPARADO CON LOS QUE ESTÁN EN EMPLEO? EVIDENCIA DE LA COHORTE WORKSS

cuyos autores son

JC. Hernando-Rodríguez, L. Serra Saurina, MA. López Gómez, M. Ubalde-Lopez, F. G Benavides

Y para que así conste, se expide el presente certificado en Barcelona a 8 de septiembre de 2017.

Silvia De Sanjosé
Presidenta del Comité Científico

XXXVI Annual Scientific Meeting of the Spanish Society of Epidemiology (SEE). Date: 11-14 Sept. 2018. Lisbon, Portugal. Poster: La incapacidad temporal en dos cohortes de nacimiento (1949-1969 y 1970-1990) en Cataluña, 2012-2014 (Sickness absence in two birth cohorts (1949-1969 and 1970-1990) in Catalonia, 2012-2014).

Hernando-Rodríguez JC, Serra Saurina L, Ubalde-Lopez M, Benavides FG.

CERTIFICADO DE PÓSTER ELECTRÓNICO CON DEFENSA

El Comité Científico del **XXXVI Reunión Anual de la Sociedad Española de Epidemiología (SEE) y XIII Congresso da Associação Portuguesa de Epidemiologia (APE)**, celebrado en Lisboa los días 11 al 14 de septiembre de 2018, certifica que

JULIO CÉSAR HERNANDO RODRÍGUEZ

ha presentado el **póster electrónico con defensa** titulado

LA INCAPACIDAD TEMPORAL EN DOS COHORTES DE NACIMIENTO (1949 -1969 Y 1970-1990) EN CATALUÑA, 2012-2014

cuyos autores son

JC. Hernando-Rodríguez, L. Serra Saurina, M. Ubalde-Lopez, F. G Benavides

Y para que así conste, se expide el presente certificado en Lisboa a 14 de septiembre de 2018.

Comité Científico
XXXVI Reunión Anual de la Sociedad Española de Epidemiología (SEE) y XIII Congresso da Associação Portuguesa de Epidemiologia (APE)

La incapacidad temporal en dos cohortes de nacimiento (1949-1969 y 1970-1990) en Cataluña, 2012-2014

Hernando-Rodríguez, JC[a,b,c], Serra Saurina, L[a,b,c], Ubalde-Lopez, M[a,b,c], Benavides, FG[a,b,c]

[a]CIBER de Epidemiología y Salud Pública, España, [b]IMIM – Parc Salut Mar, España, [c]Centro de Investigación en Salud Laboral, Universitat Pompeu Fabra, España

Antecedentes

Según la OIT, cambios demográficos y tecnológicos están influyendo en la configuración del mercado laboral dando lugar a formas de empleo que podrían incrementar las desigualdades sociales y generar un impacto negativo en la salud.
Ante este escenario, la prestación por incapacidad temporal es un elemento clave para la protección de la población trabajadora frente a la pérdida de salud.

El objetivo de este estudio es describir la incidencia y duración de los episodios de incapacidad temporal por contingencia común (ITcc) en Cataluña, entre 2012-2014, según tipo de contrato, cohorte de nacimiento (1970-1990 y 1949-1969) y sexo.

Métodos

•**Diseño:** estudio longitudinal basado en dos fuentes de datos:

- La Muestra Continua de Vidas Laborales de la Seguridad Social española.
- Registros de episodios de ITcc del Instituto Catalán de Evaluaciones Médicas (ICAM) para 2012 (n=26.653), 2013 (n=24.053) y 2014 (n=24.723).

•**Población de estudio:** 120.110 personas residentes en Cataluña, nacidas entre 1949 y 1990 y afiliadas a la Seguridad Social en situación de alta laboral entre 2012 y 2014.

•**Variables:**
- Dependiente: Incidencia y duración de la incapacidad temporal.
- Independiente: Tipo de contrato (mayor tiempo acumulado).

•**Análisis:** se estima la tasa de incidencia y la duración de los episodios de ITcc en percentiles: p50 (p25, 75)

Resultados

Figura 1. Incidencia y duración de la ITcc, en mujeres y hombres nacidos en **dos cohortes de nacimiento (1970-1990 y 1949-1969)**, 2012-2014.

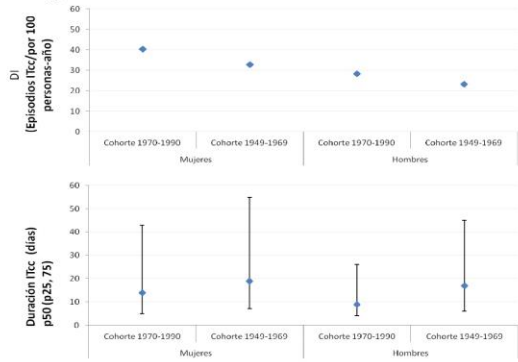
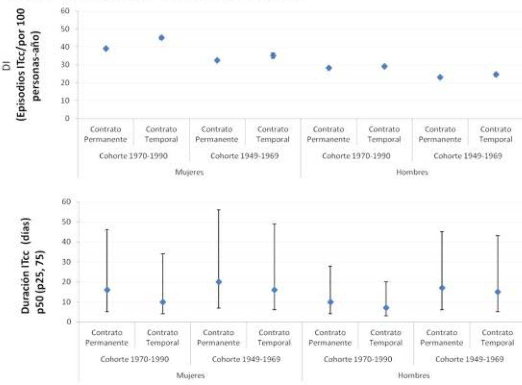


Figura 2. Incidencia y duración de la ITcc, **según tipo de contrato** en mujeres y hombres nacidos en dos cohortes de nacimiento (1970-1990 y 1949-1969), 2012-2014.



Conclusiones

Las personas que acumulan más tiempo en contrato temporal muestran una mayor incidencia y una menor duración de ITcc con respecto al contrato permanente, especialmente en las mujeres jóvenes.

La prestación social por ITcc, como muestran otros estudios, protege a las personas trabajadoras con independencia de su tipo de contrato.

Agradecimientos: al Instituto Catalán de Evaluaciones Médicas-ICAM y la Dirección General de Ordenación de la Seguridad Social por el acceso a los registros analizados.

No hay conflicto de intereses

XVII Spanish Biometric Conference held together with the VIIth Ibero-American Biometric Meeting in Valencia. Date: 19-21 June 2019. Oral communication: Labour market participation patterns as predictors for sickness absence trajectories.

Hernando-Rodriguez JC, Serra-Saurina L, Benavides FG, Ubalde-Lopez M.

This is to certify that

JULIO CESAR HERNANDO RODRIGUEZ (NIF 53335688E)

Has presented the work:

Labour market participation patterns as predictors for sickness absence trajectories

Authors: Julio C. Hernando Rodríguez, Laura Serra Saurina, Fernando G. Benavides, Mònica Ubalde López

As a/an Conference in the:

XVII Spanish Biometric Conference and the VII Ibero-American Biometric Meeting - CEB-EIB 2019

Held in Valencia from 19th to 21st June 2019

Valencia, 25th June of 2019

SIGNED, *Carmen Armero Cervera,*
President of the Scientific committee.

XXXVII Annual Scientific Meeting of the Spanish Society of Epidemiology (SEE). Date: 3-6 Sept. 2019. Oviedo, Spain. Oral communication: Patrones de participación en el mercado laboral y su asociación con el curso de incapacidad temporal (Labour market participation patterns and their relationship with the course of sickness absence).

Hernando-Rodriguez JC, Serra-Saurina L, Benavides FG, Ubalde-Lopez M.

CERTIFICADO DE COMUNICACIÓN ORAL

El Comité Científico de la XXXVII Reunión Anual de la Sociedad Española de Epidemiología (SEE), XIV Congresso da Associação Portuguesa de Epidemiologia (APE) y XVIII Congreso de la Sociedad Española de Sociedad Española de Salud Pública y Administración Sanitaria (SESPAS), celebrada en Oviedo los días 3 al 6 de septiembre de 2019, certifica que

JULIO CÉSAR HERNANDO RODRÍGUEZ

ha presentado la **comunicación oral** titulada

PATRONES DE PARTICIPACIÓN EN EL MERCADO LABORAL Y SU ASOCIACIÓN CON EL CURSO DE INCAPACIDAD TEMPORAL

cuyos autores son

JC. Hernando-Rodriguez, L. Serra-Saurina, F. G Benavides, M. Ubalde-Lopez

Y para que así conste, se expide el presente certificado en Barcelona a 6 de septiembre de 2019.

Comité Científico
XXXVII Reunión Anual de la Sociedad Española de Epidemiología (SEE), XIV Congresso da Associação Portuguesa de Epidemiologia (APE) y XVIII Congreso de la Sociedad Española de Sociedad Española de Salud Pública y Administración Sanitaria (SESPAS)

European Public Health Conference in Marseille, France. Date: 20-23 Nov 2019. Poster Walks: Sickness absence trajectories following labour market participation patterns in Catalonia, 2012-2014. European Journal of Public Health, 29 (Supplement_4), ckz187-108.

Hernando-Rodriguez JC, Serra-Saurina L, Benavides FG, Ubalde-Lopez M.

EUROPEAN PUBLIC HEALTH CONFERENCE

12th European Public Health Conference

Building bridges for solidarity and public health

20 - 23 November 2019

Marseille, France

Certificate of Attendance

This is to certify that

Mr Julio Cesar Hernando Rodriguez

has attended and presented at the 12th European Public Health Conference

Building bridges for solidarity and public health

Marseille, France, between the 20-23 November 2019

Yves Charpak

Chair of the European Public Health Conference 2019

The 12th European Public Health Conference has been approved by the European Accreditation Council for Continuing Medical Education (EACCME) and 16 European CME credits (ECMEC) have been awarded for this attendance.

Sickness absence trajectories following labour market participation patterns in Catalonia, 2012-2014

Julio Cesar Hernando Rodriguez

JC Hernando-Rodriguez[1,2,3], *L Serra-Saurina*[1,2,3], *FG Benavides*[1,2,3], *M Ubalde-Lopez*[1,2,3]

[1]Experimental and Health Sciences, Universitat Pompeu Fabra, Center for Research in Occupational Health, Barcelona, Spain
[2]IMIM - Parc Salut Mar, Barcelona, Spain
[3]CIBER of Epidemiology and Public Health, Madrid, Spain
Contact: juliocesar.hernando01@estudiant.upf.edu

Background:
Working life is characterized by transitions between different employment status which could affect future health status. Previous studies on sickness absence (SA) have focused on risk factors in the workplace; however, there is scarce evidence regarding labour market participation (LMP) patterns. The aim of this study is to examine the association between prior LMP patterns and the course of SA.

Methods:
Cohort study based on a sample of 11,968 salaried workers affiliated with the Spanish Social Security system, living in Catalonia, who accumulated more than 15 days on SA at least in one quarter during 2012-2014, from three working life cohorts according to the working life stage in 2002: early (18-25 years), middle (26-35 years) and late (36-45 years). Sequence analysis was used to identify LMP patterns (2002-2011). Latent class growth analysis was applied to identify SA trajectories (2012-2014). Finally, crude and adjusted odds ratios (aOR) were estimated using multinomial logistic regression models.

Results:
Overall, four SA trajectories were identified: low stable (83%-88% of the workers), decreasing (5%-9%), increasing (5%-11%) and high stable (7%-16%) accumulated days on SA, for men and women. Similarly, seven LMP patterns were obtained: stable employment (63%-81%), increasing employment (5%-22%), delayed employment (7%-8%), decreasing employment (4%-10%), varying employment (13%-14%), steeply decreasing employment (9%), and steeply labour market exit (8%). No significant associations were observed among LMP patterns and SA trajectories, except for young men, where an increasing employment pattern was significantly associated with a lower risk to increase days on SA over time (aOR: 0.21 [95% CI: 0.04-0.96]).

Conclusions:
A prior 10 years of LMP pattern does not seem to show an effect on the course of SA. A closer working life to the SA course could be considered to assess this relationship.
Funding: Grants FIS PI17/00220 and PI14/00057

Key messages:
- A longitudinally approach is warranted to evaluate the relationship between working life and sickness absence.
- Extended prior working lives are not related to the course of future sickness absence.

I Virtual Scientific Meeting of the Spanish Society of Epidemiology (SEE). Dates: 21-23 and 29-30 Oct. 2020. Recorded video: Trayectorias de incapacidad temporal en mujeres y patrones de participación laboral en los dos años previos (Sickness absence trajectories in women and labour market participation patterns in the prior two years). Accepted communication.

Hernando-Rodriguez JC, Serra-Saurina L, Benavides FG, Ubalde-Lopez M.

531. Trayectorias de incapacidad temporal y patrones de participación laboral en los dos años previos
JC. Hernando-Rodriguez, L. Serra-Saurina, FG. Benavides, M. Ubalde-Lopez

533. ESTUDIO DEL RECONOCIMIENTO DE LA ENFERMEDAD PROFESIONAL EN UNA SERIE DE CASOS DEL PSMAR EN BARCELONA
A. Pelegrí, C. Palma-Vásquez, C. Serra, JM. Ramada, O. Martínez, A. Taus, R. Belmonte, E. Balcells, FG. Benavides

588. Síntomas de desordenes musculoesqueléticos en un grupo de ortodoncistas y sus factores relacionados
KA. Ramírez-Sepúlveda, MY. Gómez-Arias, DM. Ramírez-Ossa, AA. Agudelo-Suárez

687. Estado serológico frente a parotiditis del personal sanitario en el Departamento de Salud de Vinalopó J. Fornieles García, P. García Peral, N. Boubeta Lemos, E. Martínez Martínez-Carrasco, L. Aleo Giner , V. García Román, JL. Mendoza García, I. Tenza Iglesias, JL. Duro Torrijos

688. Estado inmunológico frente al sarampión del personal sanitario en el Departamento de Salud de Vinalopó
F. Lajara Navarro, JL. DuroTorrijos, E. Martínez Martínez-Carrasco, N. Boubeta Lemos, JL. Mendoza García, P. García Peral, V. García Román, EM. Ronda Pérez, MC. Leal López

721. Informalidad y desigualdades en salud: una comparación entre países y estados de bienestar en América Latina y el Caribe
F. Martínez Botías, M. Silva Peñaherrera, M. Utzet Sadurní, F. García Benavides

861. IDENTIFICACIÓN Y RECONOCIMIENTO DE ENFERMEDADES PROFESIONALES EN ESPAÑA, PROYECTO CEPS
C. Palma-Vásquez, C. Serra, J. Delclòs, R. Carreras, JM. Ramada, X. Orpella, I. Taboada, T. del Campo, FG. Benavides

CP07 Salud en las distintas etapas de la vida / Saúde nas diferentes etapas da vida

81. Vigilancia epidemiológica de desnutrición aguda y moderada en niños y niñas de 0 a 59 meses por clasificación antropométrica del estado nutricional y valoración clínica en Resguardo indígena de Coayare, Guainía, Colombia, 2019
DP. Bocanegra Horta, AE. Morales Rivera

83. LA DIABETES MELLITUS Y EL ESTANCAMIENTO DE LA ESPERANZA DE VIDA DEL ADULTO MAYOR EN MÉXICO
MG. Vega-López, GJ. González-Pérez

225. Actigraphic Sleep and Dietary Macronutrient Intake in Children Aged 6–9 Years Old: A Pilot Study
S. Coronado Ferrer, I. Peraita-Costa, A. Llopis-Morales, Y. Picó, JM. Soriano, FJ. Nieto, A. Llopis-González, M. Morales-Suarez-Varela

226. Burnout Syndrome Risk in Child and Adolescent Tennis Players and The Role of Adherence to the Mediterranean Diet
I. Peraita-Costa , A. Llopis-Morales, S. Marí-Bauset, A. Marí-Sanchis, S. Marí-Sanchis, M. Morales-Suárez-Varela

323. ASOCIACIÓN DEL USO DE PANTALLA CON LA SALUD MENTAL DE LOS NIÑOS ESPAÑOLES DE ENTRE 4 Y 14 AÑOS
À. Cartanyà Hueso, C. Lidón Moyano, A. González Marrón, JC. Martín Sánchez, F. Amigo, JM. Martínez Sánchez

329. Opiniones y actitudes de los padres sobre el uso de Smartphones en una escuela de Cataluña
F. Amigo, C. Lidón Moyano, A. Cartanyà Hueso, A. Díez Izquierdo, L. Jovell, A. González Marrón, JC. Martín Sánchez, JM. Martínez Sánchez

355. CRIBADO PRENATAL CON ADN FETAL COMO PRUEBA CONTINGENTE: ESCENARIOS Y ANALISIS DE COSTE-EFECTIVIDAD
I. Portillo, JC. Bayon, M. García-Barcina, E. Orruño, J. Asua

8.6. Appendix VI: Assessment report stay Karolinska Institutet

Department of Clinical Neuroscience
Division of Insurance Medicine

Assessment

The PhD student Julio César Hernando has spent three months at our Division of Insurance Medicine, Karolinska Institutet as a guest pre-doctorial researcher, from 17 September to 15 December 2018. He has from the beginning been eager to learn from our work and has all the time taken active part in discussions, seminars, etcetera. When he arrived we agreed on goals and time lines for what he was to achieve during the stay and he fulfilled all those that were possible to reach. His scientific competence (knowledge, skills, and attitudes) has clearly developed in several aspects. He has also had new insights on sickness absence research due to his involvement in the seminars, presentations, and social activities organized at the Division.

Also, as a result of the stay, he has improved interpersonal skills such as communicating effectively with colleagues, he has gained intercultural approaches and he has strengthened cross-national networks.

His stay here has also been valuable to us, increasing our understanding of the social security system in Spain, of research regarding this area in Spain and about the methods used for such research in Spain. We hope for further collaborations regarding this research area, with Julio César Hernando as well as with his colleagues!

Yours sincerely,

Kristina Alexanderson
Professor, Research group leader
Karolinska Institutet; a medical university

Address
Karolinska Institutet
Division of Insurance Medicine
SE-171 77 Stockholm
Sweden

Visiting address
Berzelius väg 3, 6th floor, Solna

Telephone
+46 8 524 832 00 (Direct)
E-mail
Kristina.alexanderson@ki.se

Web
www.ki.se/im

8.7. Appendix VII: Ethical approval certificate

Parc de Salut Barcelona MAR

Informe del Comité Ético de Investigación Clínica

Doña Mª Teresa Navarra Alcrudo Secretaria del Comité Ético de Investigación Clínica Parc de Salut MAR

CERTIFICA

Que éste Comité ha evaluado el proyecto de investigación clínica nº 2017/7398/I titulado *"Trayectorias de incapacidad temporal y su relación con las trayectorias laborales. Evidencia de la cohorte WORKss en Cataluña, 2012-2014"* propuesto por el Dr. FERNANDO GARCÍA BENAVIDES, del Centro de investigación en Salud Laboral (CiSAL) de la Universidad Pompeu Fabra – UPF.

Y que considera que:

Se cumplen los requisitos necesarios de idoneidad del protocolo en relación con los objetivos del estudio y están justificados los riesgos y molestias previsibles para el sujeto.

La capacidad del investigador y los medios disponibles son apropiados para llevar a cabo el estudio.

El alcance de las compensaciones económicas que se solicitan está plenamente justificado.

Y que éste Comité acepta que dicho proyecto de investigación sea realizado en la UPF por el Dr. Julio César Hernando Rodríguez como investigador principal tal como recoge el ACTA de la reunión del día 13 de Junio de 2017.

Lo que firmo en Barcelona, 14 de Junio de 2017

COMITÈ ÈTIC D'INVESTIGACIÓ CLÍNICA
CEIC - PARC DE SALUT MAR

Firmado: ....
Doña Mª Teresa Navarra Alcrudo

CEIC – Parc de Salut MAR
Dr. Aiguader, 88 | 08003 Barcelona | Telèfon 93 316 06 77 | Fax 93 316 06 36
ceic-psmar@imim.es | www.parcdesalutmar.cat

8.8. Appendix VIII: Awards

SOCIEDAD
ESPAÑOLA DE
EPIDEMIOLOGÍA

CERTIFICADO

II EDICIÓN PREMIO SEE A LAS MEJORES COMUNICACIONES PRESENTADAS POR PERSONAS QUE ASISTEN POR PRIMERA VEZ A LA REUNIÓN ANUAL DE LA SEE

La Sociedad Española de Epidemiología reconoce como una de las 10 mejores comunicaciones presentadas por personas que asisten por primera vez a la XXXV Reunión Científica SEE, la comunicación titulada:

THE EFFECT OF RECEIVING UNEMPLOYMENT BENEFITS ON MORTALITY: EVIDENCE FROM THE SPANISH WORKSS COHORT

Primer autor/a:

JULIO CÉSAR HERNANDO RODRÍGUEZ

Carmen Vives Cases
Presidenta

Juan Pablo Alonso
Secretario

Barcelona, 8 de septiembre de 2017

SOCIEDAD ESPAÑOLA DE EPIDEMIOLOGÍA

ciberesp

Centro de Investigación Biomédica en Red
Epidemiología y Salud Pública

CERTIFICADO

PREMIO SEE-CIBERESP A LAS MEJORES COMUNICACIONES PRESENTADAS POR PERSONAL INVESTIGADOR JOVEN

La Sociedad Española de Epidemiología reconoce como una de las 10 mejores comunicaciones presentadas por personal investigador joven, en la XXXVII Reunión Científica SEE, la comunicación titulada:

PATRONES DE PARTICIPACIÓN EN EL MERCADO LABORAL Y SU ASOCIACIÓN CON EL CURSO DE INCAPACIDAD TEMPORAL

Primer autor/a:

JULIO CÉSAR HERNANDO RODRÍGUEZ

Pere Godoy García
Presidente

Federico Arribas Monzón
Secretario

Oviedo, 5 de septiembre de 2019