OECD Health Working Papers No. 86

The Labour Market Impacts of Obesity, Smoking, Alcohol Use and Related Chronic Diseases

Marion Devaux,

Franco Sassi

https://dx.doi.org/10.1787/5jrqcn5fpv0v-en

OECD

Unclassified **DELSA/HEA/WD/HWP(2015)9**

Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development

English text only

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DELSA/HEA/WD/HWP(2015)9
Unclassified

Health Working Papers

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THE LABOUR MARKET IMPACTS OF OBESITY, SMOKING, ALCOHOL USE AND RELATED CHRONIC DISEASES

Marion DEVAUX* and Franco SASSI*

JEL Classification: I12 I15 I18 J24 J26

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ACKNOWLEDGEMENTS

This work has benefited from contributions of OECD interns and colleagues over the past three years. The authors would like to thank Paolo Barbieri, Chiara Capobianco, Jean-Benoit Eyméoud, and Sebastian Sandoval Olascoaga for their contributions to the analyses and the literature reviews. In addition, they are grateful to Christopher Prinz, Shruti Singh and Robin Risselada from DELSA/EAP division for their valuable inputs.

The authors would also like to thank all the Experts who participated in the meetings of the OECD Expert Group on Prevention held in Paris in October 2013 and October 2014 on behalf of OECD member countries. They also thank country Delegates and BIAC and TUAC representatives who participated in the discussion of this paper at the June 2015 Health Committee meeting. The authors are also grateful to Francesca Colombo and Mark Pearson for comments provided at different stages, and Judy Zinnemann for her editorial assistance. The authors remain responsible for any errors and omissions.

The OECD Public Health Programme is partly funded through regular contributions from OECD Member Countries and voluntary contributions from selected Member Countries. The Programme has also been supported by several grants from the Directorate General for Health and Consumers of the European Commission. The contents of this paper do not necessarily reflect the views of the European Commission, the OECD, or their Member Countries.

SUMMARY

This paper examines the labour market impacts of lifestyle risk factors and associated chronic diseases, in terms of employment opportunities, wages, productivity, sick leave, early retirement and receipt of disability benefits. It provides a review of the evidence of the labour market outcomes of key risk factors (obesity, smoking and hazardous drinking) and of a number of related chronic diseases, along with findings from new analyses conducted on data from a selection of OECD countries.

Overall, the evidence suggests that chronic diseases and associated risk factors have potentially large detrimental labour market impacts, but with mixed findings in some areas. Obesity and smoking clearly impair employment prospects, wages and labour productivity. Cardiovascular diseases and diabetes have negative impacts on employment prospects and wages, and diabetes, cancer and arthritis lower labour productivity. Alcohol use, cancer, high blood pressure and arthritis have mixed effects on employment and wages, and are not always linked with increased sickness absence (e.g. cardiovascular diseases and high blood pressure). Finally, this paper stresses the importance of these findings for the economy at large, and supports the use of carefully designed chronic disease prevention strategies targeting people at higher risk of adverse labour market outcomes, which may lead to substantial gains in economic production through a healthier and more productive workforce.

RESUME EN FRANCAIS

Ce document examine les impacts sur le marché du travail des facteurs de risque liés aux modes de vie et des maladies chroniques associées, en termes d'opportunités d'emploi, de salaire, de productivité, de congés maladie, de retraite anticipée et de prestations d'invalidité. Il fournit une revue de la littérature des impacts sur le marché du travail des principaux facteurs de risque (obésité, tabagisme et consommation à risque d’alcool) ainsi que d'un certain nombre de maladies chroniques associées, et présente également les résultats de nouvelles analyses empiriques pour une sélection de pays de l’OCDE.

Ce travail a révélé que généralement, les maladies chroniques et les facteurs de risques associés ont des impacts néfastes sur le marché du travail potentiellement importants, mais avec des effets mixtes dans certains cas. L’obésité et le tabagisme nuisent clairement à la probabilité d'emploi, aux salaires et la productivité du travail. Les maladies cardiovasculaires et le diabète ont des impacts négatifs sur la probabilité d'emploi et les salaires, et le diabète, le cancer et l'arthrite réduisent la productivité au travail. La consommation à risque d'alcool, les cancers, l'hypertension artérielle et l’arthrite ont des effets mixtes sur l'emploi et les salaires, et ne sont pas toujours liés à une augmentation de l'absentéisme (par exemple, les maladies cardiovasculaires et l'hypertension artérielle). Enfin, ce document souligne l'importance de ces résultats pour l'Économie au sens large, et soutient la mise en place de stratégies de prévention des maladies chroniques, soigneusement conçues, ciblant les personnes les plus vulnérables sur le marché du travail, qui peuvent conduire à des gains importants de production économique grâce à une main-d'œuvre en meilleure santé et plus productive.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS 3

SUMMARY 4

RESUME EN FRANCAIS 4

INTRODUCTION 6

SECTION 1. CHRONIC DISEASES AND RISK FACTORS HAVE DETRIMENTAL LABOUR MARKET IMPACTS. 8

1.1. Obesity has clear negative labour market impacts, reducing employment prospects, wages and labour productivity. 10
1.2. Alcohol use has different labour market effects depending on levels and patterns of drinking. 10
1.3. Tobacco smoking has a negative impact on wages and labour productivity but smoking cessation can improve labour market outcomes. 11
1.4 Chronic diseases have negative labour market outcomes through reduced worked hours and wages, and increase social inequalities. 12

SECTION 2. NEW EVIDENCE OF LABOUR MARKET IMPACTS FROM OECD ANALYSES 16

2.1 Data and Methods 16
2.1. Strong evidence for detrimental labour market outcomes emerges. 18
2.2. Mixed effects are found for the labour market impacts of alcohol use and a few chronic diseases. ..19
2.3. Contrasting findings should be viewed carefully in the light of the national context and other study features. 20

SECTION 3. PREVENTION POLICIES CAN INFLUENCE THE ECONOMY AT LARGE 21

Prevention policy can limit or reduce the costs of health care, but not to a major degree. 23
Prevention policy can improve labour productivity through reducing absenteeism and presenteeism. 23
Prevention policy can save money by avoiding sickness absence and reducing the payment of disability benefits in working-age population. 25
Prevention policy can reduce unemployment benefit expenses and increase revenues by maintaining people economically active. 25
Prevention policy can reduce health inequalities and improve social welfare. 26

CONCLUSION 26

REFERENCES 27

ANNEXES 35

ANNEX A – THREE TYPES OF STATISTICAL APPROACH 35

Fixed effect model and instrumental variables technique 35
Dynamic analysis 35
Propensity score matching 36

ANNEX B – SURVEY DATA DESCRIPTION 37

ANNEX C: RESULTS 41

INTRODUCTION

1. Chronic diseases and the behavioural risk factors associated with them, such as smoking, harmful use of alcohol, unhealthy diets and physical inactivity, affect people's employment prospects, wages, and labour productivity. They are a cause of recurrent sick leave, including long-term absence from work, and they increase the probability of an early exit from the labour force. This often results in increased welfare payments for disability, unemployment or early retirement.

2. Given the higher prevalence of chronic diseases and behavioural risk factors in people with less education and lower socioeconomic status, the labour market consequences of those diseases and behaviours are likely to exacerbate social inequalities. The social costs associated with the labour market impacts of chronic diseases are often estimated to be larger than the health care costs incurred for the treatment of those diseases.

3. Addressing chronic diseases through prevention and appropriate health care may lead to substantial gains in economic production through a healthier and more active workforce. Policies designed to tackle key behavioural risk factors such as obesity, smoking and alcohol consumption, as well as chronic diseases, have the potential to increase employment and labour productivity, and to reduce social disparities in health. Tackling chronic diseases and their behavioural risk factors is a key issue for health policy but also for labour and social policies. OECD governments have a major role to play in preventing chronic diseases and their behavioural risk factors, in order to achieve better health, labour, and social welfare outcomes.

4. This document presents a review of the evidence of the labour market outcomes of chronic diseases such as diabetes, cardiovascular disease, cancer, musculoskeletal diseases, and mental health conditions, and of the main risk factors associated with them, such as obesity, tobacco and harmful alcohol use. Section 2 presents a comprehensive review of existing studies of the impacts of chronic diseases and their risk factors (obesity, smoking and harmful alcohol use) on labour market outcomes. Section 3 presents the main findings of OECD's own analyses of the labour market outcomes of chronic diseases. Section 4 provides a discussion of the potential for prevention policies to generate benefits for the economy at large.

5. The ultimate goal of the analyses presented in this paper is to contribute to assesssing whether chronic diseases and the risk factors associated with them may cause losses in economic production. However, the evidence reviewed and the data analysed, alone, do not (and could not) provide an exhaustive assessment of lost production. Rather, they provide measures of intermediate labour market outcomes, which may be viewed as proxies for lost production. This paper focuses on four such outcomes, in particular: employment, labour productivity (including both sick leave and productivity while at work), wages and early exit from the labour force (i.e. early retirement).

6. Adverse labour market outcomes may or may not translate into losses in economic production, depending on labour markets' ability to absorb extra labour supply, or depending on the efficiency of mechanisms in place to compensate for the effects of labour turnover, absence from work, and reduced productivity at work by sick workers. However, the implicit (sometimes explicit) assumption in most existing studies is that production losses would follow from adverse labour market outcomes, and that

current (average) labour costs reflect the value of time lost from work, e.g. due to sick leave, early exit from the labour force, premature mortality etc.

7. Adverse labour market outcomes, and the production losses that may be associated with them, represent a cost for society, as an aggregation of several cost components. The largest component is costs borne by people with chronic diseases and risk factors, in terms of forgone income. Governments will lose fiscal revenues from reduced employment, with possible welfare costs linked with forgone public expenditures. Employers will bear staff turnover and temporary replacement costs, which may make them less competitive in the marketplace. Some of the diseases and risk factors addressed in this paper (e.g. harmful alcohol use) are linked with further adverse labour market outcomes, such as work-related injuries, which involve additional costs for employers as well as workers.

SECTION 1. CHRONIC DISEASES AND RISK FACTORS HAVE DETRIMENTAL LABOUR MARKET IMPACTS.

8. The link between health and work is complex and difficult to explore through data analyses. On one hand, poor health and health-related behaviours that increase people's risk of developing chronic diseases may cause adverse labour market outcomes. On the other hand, people's labour market position and socioeconomic circumstances influence their health in a number of ways (see discussion in Box A). The work presented in this paper is primarily aimed at measuring the former effects, but without adequately controlling for the reverse causal link between labour market position and health it is not possible to establish the causal nature of the effects of poor health on adverse labour impacts, and draw policy-relevant conclusions. This constitutes a major methodological challenge, which existing analyses have been able to address with varying degrees of success.

9. Some, but not all, of the studies discussed in this section are based on statistical approaches that enable an assessment of the causal nature of the associations between health and labour market outcomes. Other studies simply explore statistical correlations. The following review does not provide a detailed account and discussion of the methods adopted in each study, but it is safe to say that all of the main findings of the review are supported by at least one econometrically sound analysis supporting the causal nature of the links assessed (e.g. for wage penalties associated with obesity and smoking; wage differentials for people with different levels of alcohol consumption, employment gaps for the obese, heavy drinkers and smokers; etc.).

10. The present literature review covers behavioural risk factors (obesity, alcohol and tobacco use) as well as chronic diseases (any chronic conditions, diabetes, cancer, musculoskeletal diseases and mental ill-health). It focused on how risk factors and chronic diseases affect employment, wages, labour productivity and early exit from the labour market. It also provides an insight into the value of production potentially lost from illness and from adverse labour market outcomes. The valuation of potential production losses due to diseases may vary across studies, as it varies not only with the perspective taken for the economic assessment, depending on the objectives of the decision-makers, but also with data availability and quality (see Annex A for the valuation methods). The evidence presented herein comes from various studies using different definitions and different valuation methods; our review tries to be precise as much as possible to recall the findings with accuracy.

11. Table 1 summarizes the labour market impacts of main behavioural risk factors and selected chronic diseases. Evidence is further detailed in the following sections.

Table 1. Summary of the labour market outcomes of main behavioural risk factors and selected chronic diseases

	Employment	Wages	Absenteeism
Obesity	Lower probability of employment (causal) (Morris, 2007; Tunceli et al, 2006)	Larger wage penalties (causal) (Lundborg et al. 2010)	More sickness absences, especially for women (causal) (Finkelstein et al, 2005; Cawley et al, 2007)
Alcohol Use	Long-term light drinkers have better employment opportunities (Jarl et al 2012)	Moderate drinking positively associated with wages (Hamilton and Hamilton 1997)	Absences 20% higher among abstainers, former and heavy drinkers (causal) (Vahtera et al 2002)
Smoking	Heavy smokers more likely to be unemployed (causal) (Jusot et al. 2008)	Smokers earn 4-8% less than non-smokers (causal) (Levine et al. 1997)	Smokers 33% more likely to be absent from work than non-smokers (causal) (Weng et al. 2012)
Diabetes	Lower probability of employment (Latif, 2009, Seuring et al., 2014, Tunceli et al., 2005)	Diabetics earn less (Minor, 2013; Ng et al, 2001)	Diabetes causes more work-loss days (causal) (Tunceli et al, 2005, Ng et al, 2001)
Cancer	Lower employment probability (Bradley et al 2007; Candom, 2014)	No strong evidence	Increased work absence (causal) (Drolet et al., 2005; Moran et al, 2011)
Musculoskeletal diseases	People with arthritis more likely to exit employment (causal) (Oxford Economics, 2010)	No strong evidence	Lost productive times around 5 hours per week (causal) (Stewart el al., 2003a)

Box A. Health and Word: a two-way causal link.

The relationship between health and work is characterised by a two-way causal link in which effects run not only from health to work (the main focus of this paper), but also from work to health. A comprehensive review of European studies shows that various dimensions of work such as employment (e.g. employment status, working hours) and working conditions (e.g. job decision latitude, job demand, and job strains) have an impact on physical and mental health (Barnay, 2015). Evidence from several countries shows that non-employment and poor working conditions have detrimental effects on health (Debrand and Langagne, 2007; Datta Gupta and Kristensen, 2008, Llena-Nozal, 2009). Negative health impacts may also originate from a lack of control over the amount of time devoted to work (Bassanini and Caroli, 2014). The effects described have the potential to confound analyses of the labour market impacts of chronic diseases and of the health-related behaviours that contribute to causing them. Appropriate statistical approaches are required, as described in section 2.1, to disentangle the causal effects of health conditions on labour outcomes, net of any reverse causal effects.

1.1. Obesity has clear negative labour market impacts, reducing employment prospects, wages and labour productivity.

12. Evidence in the literature supports that obesity negatively influences employment and wages, especially in women (but not exclusively) (Morris, 2007; Tunceli et al., 2006; Mosca, 2013; Caliendo & Lee, 2013; Lundborg et al., 2010). Although the association between obesity and labour market outcomes varies with gender and job characteristics (private/public sector, jobs requiring social skills or contact with clients, education level and type of occupation of the individual), evidence can be summarised as follows:

- Obese people are less likely to be employed than normal-weight persons.
- Obese people earn (up to 18%) less than non-obese, even when they have equivalent positions and discharge the same tasks.
- Obese people are less productive due to more days of sick leave, longer work absence, and reduced performance while at work.

13. Overweight or obesity increases the likelihood of worker absence (Howard & Potter, 2012; Burton et al., 1998), especially in women (Finkelstein et al., 2005; Cawley et al., 2007). Moderately and severely obese manufacturing workers report reduced labour productivity because they experience greater difficulties with job-related physical tasks and in completing work demands on time than normal-weight workers. Presenteeism for overweight employees, compared to normal weight people, is 10% higher and for obese employees 12% higher (Goetzel et al., 2010).

14. In addition to direct (medical) cost, obesity has significant indirect (non-medical) costs that are associated with absenteeism, disability, premature mortality, presenteeism (i.e. being at work while sick, resulting in reduced performance) and workers' compensations. A review of 31 studies (Trogdon et al., 2008) estimates the indirect costs of obesity from $77 to $1033 per obese person per year depending on level of obesity.

15. The cost of productivity potentially lost due to obesity is high. US obese workers cost an estimated $42.3 billion in lost productive time, an excess of $11.7 billion compared with normal-weight workers (Ricci and Chee, 2005). Existing estimates suggest that the loss of productivity associated with presenteeism is even larger than that associated with absenteeism, accounting for up to two thirds of the monetary value of total productivity losses (Ricci and Chee, 2005; Gates et al., 2008).

1.2. Alcohol use has different labour market effects depending on levels and patterns of drinking.

16. The impact of alcohol consumption on labour market outcomes depends on the quantity consumed and pattern of consumption. Besides, the effects of problem drinking on employment appear to vary over the life cycle (Mullahy and Sindelar, 1993). Although the relationship between problem alcohol drinking and employment is complex (as lack of employment in turn may be a cause of alcohol problems) (Stuckler et al., 2009; Marchand et al., 2011), findings from the literature can be summarised as follows:

- Heavy alcohol users have reduced employment opportunities, while light drinkers are more likely to be in work.
- Moderate drinking is positively associated with wages; moderate drinkers have a better health and better job performance than heavy drinkers and abstainers.
- Heavy alcohol drinkers are less productive due to more sickness absences and reduced performance at the workplace.

17. Long-term light drinkers have better employment opportunities than any other group, including former drinkers, former abstainers, long-term heavy drinkers and abstainers (Jarl and Gerdtham, 2012). On the other hand, heavy drinking reduces the probability of being in employment for both men and women (Booth and Feng, 2002; MacDonald and Shields, 2004; Johansson et al., 2008), although a number of studies found no significant relationship between alcohol abuse and employment (Feng et al, 2001; Asgeirsdottir and McGeary, 2009).

18. Moderate drinkers have higher wages than heavy drinkers and abstainers (Hamilton and Hamilton, 1997; Barret, 2002; Peters, 2004; Lee, 2003; MacDonald and Shields, 2001; Ziebarth and Grabka, 2009). Moderate drinkers spend more time with their colleagues out of work and they tend to be in good health, which influences positively their wages. They have a higher degree of life satisfaction than abstainers and have stronger social networks. Social and networking skills are important factors in the labour market and determine wages to a high degree.

19. In Finland, medically certified absences were 20% higher among lifetime abstainers, former and heavy drinkers compared with light drinkers (Vahtera et al., 2002), with similar other studies (Salonsalmi et al., 2009; Jarl and Gerdtham, 2012).

20. A review of 22 studies from different countries observed a substantial economic burden of alcohol on society (Thavorncharoensap et al., 2009). In the United Kingdom, nearly 11 million working days were lost by alcohol-dependent workers in 2001, and the total cost of absenteeism due to alcohol was estimated to be £1.2 billion (UK Cabinet Office, 2003). In the European Union, alcohol accounted for an estimated €59 billion worth of potential lost production through absenteeism, unemployment and lost working years through premature death in 2003 (Anderson and Baumberg, 2006).

21. Potential production losses were found to be an important part of alcohol-related costs in Scotland, France and Canada (Rehm et al., 2009), in Ireland (Byrne, 2010) and in the Unites States (Harwood, 2000). In particular, in the United States, lost productivity represented 72.2% of the total economic cost of excessive drinking. The bulk of the value of lost productivity was attributable to impaired productivity at work (46%) and premature mortality (40%), while absenteeism accounted for 2.6% of the total value (Bouchery et al., 2011).

1.3. Tobacco smoking has a negative impact on wages and labour productivity but smoking cessation can improve labour market outcomes.

22. Smoking is likely to affect employment status because of the well-known adverse health effects, however, the negative effect of smoking on the probability of employment is found to be small (Schunck and Rogge, 2012; Neumann, 2013) except for heavy smoking (Jusot et al., 2008). But, smokers are a source of higher costs in particular due to lost productive time associated with illness and smoking breaks, higher insurance premiums, increased accidents during work time, increased fires and fire insurance costs, negative effect on non-smokers colleagues, and early retirement (Bunn et al., 2006; Parrott et al., 2000). Overall, the effect of smoking on labour market outcomes can be summarised as:

- Smoking is not clearly linked to reduced employment opportunities, but is clearly related to higher costs for employers.
- Smokers earn 4-8% less than non-smokers.
- Smokers are less productive due to more frequent sickness absences and more breaks during office hours.

23. Several studies have found wage penalties for smokers (Auld, 2005 for Canada; Lee, 1999 for Australia; van Ours, 2004 for Netherlands), with wage differential around 4-8% (Levine et al. 1997). The relationship between tobacco use and wage gaps among workers is often explained by the smokers' lower labour productivity such as frequent smoking breaks, sickness absences and poorer health, resulting in lower wages (Berman et al., 2013).

24. Smoking increases both the risk and the duration of work absenteeism, up to 8-10 days more for current smokers compared to never smokers (Lundborg, 2007). In a meta-analysis, current smokers are found to be 33% more likely to be absent from work than non-smokers (Weng et al., 2012). Among non-smokers, never-smokers are less at risk of absenteeism compared to ex-smokers. Furthermore, a comparison between current smokers and ex-smokers showed that quitting smoking would reduce the risk of work absence (Weng et al., 2012). Smoking cessation was also found to have positive impacts on wages (Anger and Kvasnicka, 2006, 2010; Brune 2007; Grafova and Stafford, 2009). Smoking cessation can increase workers' productivity through reduced absenteeism and enhanced performance at work (Halpern et al., 2001).

25. Smoking imposes a significant burden on society through increased costs in the health care system and the productivity loss (Wacker et al., 2013; Welte et al. 2000). In particular, the total direct costs (prescribed drugs, outpatient care, acute hospitalization and rehabilitation) were estimated to 4735 million euros while the costs of work-loss days and early exit from work (i.e. early retirement) were respectively 3458 and 4905 million euros (Welte et al. 2000).

26. Presenteeism due to smoking is more tangible (compared to other behaviours) because smokers need to have breaks during office hours and they lose concentration when they cannot satisfy their need. Bunn et al. (2006) found that ex-smokers and current smokers have more unproductive time at work than non-smokers. They further estimated the costs of the productivity loss and found that presenteeism costs more than half as much as absenteeism.

1.4 Chronic diseases have negative labour market outcomes through reduced worked hours and wages, and increase social inequalities.

27. The literature on the labour market outcomes of chronic diseases is vast and includes epidemiological as well as economic studies. This review focuses on five main labour outcomes (employment, worked hours, wages, sick days, and early retirement), and points out the most recent studies for a wide geographical coverage. As the literature on diabetes, cancer, musculoskeletal diseases and mental ill-health is richer, four specific subsections are dedicated to these diseases below.

28. Many studies have revealed the negative impact of longstanding illness and disability on labour market outcomes (Van der berg et al, 2010; Schuring et al, 2007; Schofield et al., 2008). Chronic diseases reduce worked hours and wages. For instance, men and women with chronic diseases work 6.1% and 3.9% fewer hours than healthy people, and they earn 5.6% and 8.9% less (Pelkowski et al., 2004).

29. A meta-analysis found that chronic disease was a risk factor for transition from employment into disability pension (the relative risk (RR) of receiving a disability pension associated with chronic disease is 2.11 with a 95% confidence intervals (CI) ranging from [1.90-2.33]) or unemployment (RR 1.31 [1.14-1.50]), but not for the labour-force exit through early retirement (van Rijn et al, 2013). Dwyer et al (1999) studied the effect of chronic diseases on early retirement among men in the United States, and found that CVD decreases the planned age of full retirement by 0.7 years, hypertension by 1 year, musculoskeletal disease by 0.5 years, whereas diabetes and cancer have no significant effect.

30. Negative labour market outcomes of chronic diseases exaggerate social inequalities, since women, people with a low education level and blue collar workers are more affected by the negative outcomes of chronic diseases on employment (Duguet and Le Clainche, 2012; Saliba et al., 2007). Lower autonomy and higher job demands increased the association of several chronic health problems (mental illness, circulatory diseases, MSD, diabetes) with sickness absence (Leijten et al., 2013).

Diabetes is associated with a lower probability of employment, lower wages, lower labour productivity but no clear association with early retirement.

31. Diabetes is associated with a lower probability of employment in Australia (Harris, 2008), in Canada (Kraut et al., 2001; Latif, 2009), in Mexico (Seuring et al., 2014), in the United States (Brown et al., 2005; Tunceli et al., 2005; Fletcher et al., 2012; Minor, 2013), and in European countries (Rumball-Smith et al., 2014). An international study shows that diabetes is significantly associated with a 30% increase in the rate of labour-force exit across the 16 countries studied, and at the national level, this association is significant in 9 of 16 countries (Rumball-Smith et al., 2014). The association between diabetes and employment varies by disease gravity. Diabetes with complications causes heavier limitations and has a stronger effect on employment probability compared to diabetes without complications (Kraut et al., 2001).

32. Diabetic people earn less than non-diabetics (Minor, 2013; Ng et al, 2001). Diabetes may affect the number of worked hours and the choice of full/part-time work (Pelkowski et al., 2004; Saliba et al., 2007). Diabetes causes more work-loss days. Evidence on US data shows that diabetes increases the number of work-loss days by 2 days per year in women (Tunceli et al, 2005), and up to 3.2 days within a 2-week period for diabetes with complications (Ng et al, 2001).

33. The relationship between diabetes and early retirement is not clear. Whereas a US study showed that from 1992 to 2000, diabetes was responsible for $4.4 billion in lost income due to early retirement (Vijan et al, 2009), another US study failed to find evidence for a causal relationship between diabetes and the age of full retirement (Dwyer et al., 1999).

Cancer has a negative impact on employment probability, worked hours, and work absence, while no clear association with early retirement.

34. Cancer has a negative impact on employment probability, worked hours, and work absence. The strength of the effect of cancer on labour market outcomes depends on individual characteristics and disease characteristics. The negative effect of cancer on employment seems to have a longer lasting impact in younger people while it has a short-term effect for older people (Bradley et al, 2005a, 2005b, 2007). Lower education levels and lower SES worsen the effect of cancer on employment (Heinesen et al., 2013; INCa, 2014; Carlsen et al., 2008). The size of the effect of cancer on employment varies at different timing after diagnosis (Candom, 2014).

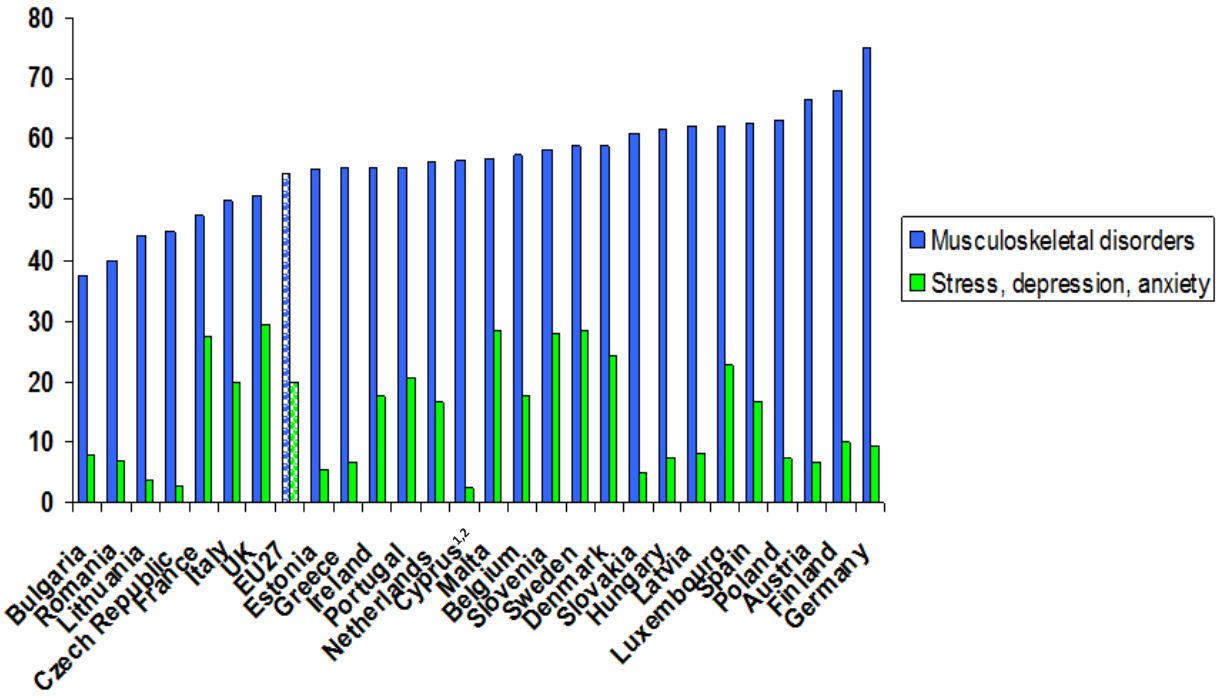
35. The number of worked hours is also affected by cancer diagnosis. People with cancer who remain in the labour force, work from 3 to 7 hours less per week then cancer-free people (Bradley et al, 2005a; Moran et al, 2011). Cancer increases work absence. In Canada, 85% of women diagnosed with breast cancer were absent from work for a 4-week or longer period compared to 18% of healthy women (Drolet et al., 2005).

36. The link between cancer and early retirement is not clear. Dwyer et al (1999) found no significant impact of cancer on the age of full retirement in the United States.

Musculoskeletal diseases are related to lower employment rates and lower labour productivity.

37. Musculoskeletal diseases (MSDs) (such as arthritis, back and neck pain) are the most common health problem in the EU working population, and the second most important cause of disability worldwide (Bevan et al, 2009). About 60% of people with work-related health problems identified musculoskeletal problems as their most serious work-related health problem as shown in Figure 1. MSDs cost €240 billion each year in lost productivity and sickness absences at the EU level.

Figure 1. Proportion of people reporting their most serious work-related health problem in the past 12 months, European countries, 2007



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The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

Source: EU Labour Force Survey 2007

38. People with MSDs had lower employment rates, were less likely to become employed, and were more likely to leave employment, compared with people without MSDs, as highlighted in a US study (Yelin et al., 2001). Evidence shows a positive relationship between being out of the labour force and having back problems (Odds Ratio (OR): 3.59 with 95% confidence interval [2.98–4.33]) and arthritis (OR: 3.06 [2.98–4.33]) in Australia (Schofield et al., 2008). A cohort study in the United Kingdom provides evidence for a causal link showing that a third of people who showed symptoms of arthritis had left work due to ill health (Oxford Economics, 2010).

39. MSDs are linked to lower productivity. Workers who report arthritis or back pain have mean lost productive times of 5.2 hours per week in the United States (Stewart el al., 2003a). Another US study showed arthritis to be associated with a 0.9 hour work loss per day (Goetzel et al., 2004). In the United Kingdom, musculoskeletal problems accounted for 30.6 million days lost, which represented almost a quarter of the total days lost due to sickness absences in 2013 (Office for National Statistics, 2014).

Mental ill-health reduces employment prospects and labour productivity, increases sickness absence and early exit from work, and it costs around 3.5% of GDP.

40. Mental illness is responsible for a significant loss of labour supply, high rates of unemployment, a high incidence of sickness absence and reduced productivity at work (OECD, 2015a). At the same time, transitions from paid work to unemployment or inactivity lead to poorer mental health as well (OECD, 2008; Thomas et al., 2005).

41. People with mental health problems face a considerable employment disadvantage, they are much less likely to be employed and they face much higher unemployment rates than people without mental health problems. The employment rates of people with severe mental disorders are falling behind by 30 percentage points and the rates of those with mild-to-moderate mental health problems by 10-15 percentage points (OECD, 2012). Unemployment rates of people with severe mental health problems are three to four times larger than those for people with no mental disorder. For people with mild-to-moderate disorders this rate is on average almost two times the rate for people with no mental disorder (OECD, 2012).

42. Poor mental health affects workers' productivity by reducing workers' marginal productivity when they are at work (presenteeism) and increasing the rate of absence or reducing the numbers of hours worked (sickness absence). Workers lose an average of one hour per week owing to depression-related absenteeism and four hours per week due to depression-related presenteeism (Stewart et al., 2003b).

43. Mental health problems are a predictor of both short-term and long-term sickness absence, increasing the probability of short-term leave by 10% and that of long-term leave by 13% for severe disorders and 6% for mild-to-moderate disorders (OECD, 2012). Also, depression symptoms have a significant and large effect on sick-leave duration, since they account for an additional 7 days of annual sick leave (Knebelmann, 2014). This is problematic since long-term absence acts as the main pathway into disability benefits (e.g. Karlström et al., 2002; OECD, 2010).

44. Long-term mental health problems are a major reason for labour market exit, including early retirement and entering disability schemes (ILO, 2000; OECD, 2010). In Germany, mental health problems are the leading cause of early retirement since 1996 (McDaid et al., 2008). Across European countries, depression increases the odds of labour market exit by 30%, after controlling for other factors (Knebelmann, 2014). This is the case especially for older people with more severe depression symptoms who are more than twice as likely to exit employment within four years. There is no significant difference between the impact for men and women.

45. The total costs of mental illness for society at large are estimated at 3-4% of GDP in the European Union (ILO, 2000; Gustavsson et al., 2011). Most of these costs are caused by people with mild-to-moderate mental illness and the majority of them are employed. The large bulk of these costs are not direct costs borne by the health sector and related to medical treatments, but indirect costs due to a loss of productivity and potential output, sick pay and long-term inactivity – costs which are borne by the employer and the benefit system (Sobocki et al., 2006).

SECTION 2. NEW EVIDENCE OF LABOUR MARKET IMPACTS FROM OECD ANALYSES

46. Most studies found in the literature show evidence of significant associations between chronic diseases (and associated risk factors) and negative labour market outcomes. As more data (especially from longitudinal surveys) and linkages between administrative and survey data have become available, opportunities for assessing the causal impacts of chronic diseases and risk factors on labour market outcomes have increased. Some of the published studies provide evidence of a causal link, and consistently point to negative labour market outcomes.

47. The evidence base provided by the existing literature has two potential limitations. First, discrepancies in data and methodology used in these different studies may limit the cross-country comparability of results. An international dimension is often lacking in the existing literature, and comparisons across national studies are difficult because of differences in study settings (e.g. variables of interest, population covered) and differences in methodology. Second, the possibility of a "publication bias" might contribute to explaining why existing studies consistently report negative labour market outcomes. Our analysis contributes to this research and aims to assess the labour market outcomes of chronic diseases and related risk factors, by using longitudinal data in a number of OECD countries and by harmonising the methodology used.

48. The study aims to assess the labour market outcomes of chronic diseases and related risk factors, by using longitudinal data in a number of OECD countries and by harmonising the methodology used. The study carries out a comparative analysis of how chronic diseases and related risk factors may impact labour market outcomes in 14 OECD countries.

2.1 Data and Methods

49. Two sorts of survey data were available for the analysis: longitudinal health and retirement surveys of people aged 50+, and longitudinal employment surveys of the general population. Both population groups are of interest for the study. The senior population group is of relevance since people age 50+ are more likely to develop chronic diseases than younger people. However the study of labour transition in this population is restricted to people between age 50 and the national retirement age. On the contrary, the general population surveys offer larger sample sizes and wider possibilities for the analysis, although with a smaller prevalence of diseases.

50. The analysis relies on longitudinal data from 13 countries: Australia (Household, Income and Labour Dynamics in Australia (HILDA) 2001-2011), Germany (German Socio-Economic Panel (G-SOEP) 1984-2012), Mexico (Mexican Family Life Survey (MxFLS) 2002-2012), the United States (Panel Study of Income Dynamics (PSID) 1970-2007 and Health and Retirement Survey (HRS) 1992-2010), and Austria, Belgium, Denmark, France, Germany, Italy, Netherlands, Spain, Sweden, and Switzerland (Survey on Health and Retirement in Europe (SHARE) 2004-2010). An additional analysis was carried out on a cross-sectional dataset for England (Health Survey for England 2002-11). Annex B describes the range of national surveys that were used in the analysis, and provides an overview of key variables for the analysis.

51. The objective of this analysis is to assess and quantify the causal effects of chronic conditions and risk factors on four main labour market outcomes: employment status, wages, productivity, and early retirement (defined here as early exit from the labour force).

52. The assessment of the relationship between health and labour market outcomes is challenging because of the endogeneity of behaviours and health status, particularly because of reverse causal effects which make it difficult to discern what the actual impact of lifestyles and chronic diseases may be on labour market outcomes, net of the influence that such outcomes may in turn play on lifestyles and health status.

53. Generally speaking, endogeneity issues may arise if unobserved characteristics (e.g. genetic factors, time preferences, individual choice) that affect both health (or health behaviours) and employment status and wages are not taken into account. Another form of endogeneity may arise if people who are not part of the labour force tend to report poor health to justify their non-participation. Besides, it may be difficult to isolate the causal relationship from health to labour market outcomes because of the reverse causality of the link (from labour market to health). For instance, obesity may cause poor labour market outcomes through lower productivity (e.g. because of related illness) leading to lower wages and poor employment prospects. Conversely, lower wages and unemployment may make obesity more likely, because a lower income is associated with the consumption of cheaper food, more likely to be high in calories and low in essential micronutrients. If not taken into account, endogeneity and reverse causality may bias the estimation of the causal relationship between chronic diseases (and their risk factors) and labour market outcomes.

54. To address endogeneity issues, several approaches were used to study the causal relationship between health and labour, depending on data availability. Three types of statistical analyses were undertaken (see further details in Annex A):

a) A fixed effects analysis of longitudinal data with instrumental variables;

b) A dynamic analysis of longitudinal data;

c) A propensity score matching approach applied to cross-sectional data.

55. OECD analyses show predominantly negative labour market outcomes of chronic diseases and risk factors, and in some cases mixed results as described in the two sections below. Table 2 summarises the results of OECD analyses.

Table 2. Summary of results

Health effects on labour		Labour Market Outcomes			
		Employment	Wages	Sick leave	Early retirement
Risk factors	Obesity	Negative effect, strong evidence	Negative effect, limited evidence	Positive effect, limited evidence	Mixed findings
	Smoking	Negative effect, strong evidence	Negative effect, limited evidence	Positive effect, limited evidence	Positive effect, strong evidence
	Harmful alcohol use	Mixed findings	Mixed findings	Mixed findings	Mixed findings
Chronic Diseases	Cardiovascular diseases	Negative effect, strong evidence	Negative effect, limited evidence	Mixed findings	Mixed findings
	Diabetes	Negative effect, limited evidence	Negative effect, strong evidence	Positive effect, limited evidence	Mixed findings
	Cancer	Mixed findings	n.s.	Positive effect, limited evidence	Positive effect, strong evidence
	High blood pressure	Mixed findings	Mixed findings	Mixed findings	n.s.
	Arthritis	Mixed findings	Mixed findings	Positive effect, limited evidence	n.s.

Note: n.s. means not significant

Source: Sources: OECD analyses based on national survey data; details in Annex C.

2.1. Strong evidence for detrimental labour market outcomes emerges.

Obesity and smoking have negative impacts on employment, wages, and labour productivity.

56. OECD analyses show strong evidence of the negative effects of obesity and smoking on employment, consistently across countries (see Table 2 in Annex C). OECD analyses for Australia, Germany, and the United States suggest that negative effects of obesity and smoking on wages, but results based on another US (PSID) data cast some doubt on the relationship since blue collar women who smoke, compared to blue collar non-smoker women, have higher wages 2 years later (see Table 3 in Annex C). Concerning the effects on sick leave, the analysis carried out on Australia, Germany, Mexico and the United States suggests that obesity and smoking increase sickness absence, but with exceptions for male overweight in the United States and for smoking in Australia and Germany (see Table 4 in Annex C).

Cardiovascular diseases and diabetes have negative impacts on employment and wages.

57. OECD analyses show strong evidence of a negative impact of cardiovascular diseases (CVD) on employment while only limited evidence suggests a negative impact of diabetes on employment (see Table 2 in Annex C). Concerning the impact on wages, OECD analyses based on Australian and US data show that when significant differences are found, the general pattern among these shows a negative effect of CVD and diabetes on wages (particularly clear for diabetes) (see Table 3 in Annex C).

Diabetes, cancer and arthritis increase sickness absence to some extent.

58. Regarding the effect of chronic diseases on sick leave, the analyses were only feasible in Australia, Mexico and United States. Overall, results show that chronic diseases such as diabetes, cancer and arthritis increase sick days, while this is unclear for CVD and HBP in the three countries studied (see Table 4 in Annex C).

Smoking and cancer increase the likelihood of early retirement.

59. OECD findings based on longitudinal data for 10 European countries and the United States support that tobacco consumption and having cancer are two determinants of early retirement. For instance, US women who smoke are 1.7 times more likely to exit prematurely from the labour force compared to non-smoking women, and similar findings are found for men. In the European countries, women diagnosed with cancer are 2.5 times as likely as non-ill women to exit prematurely from the labour force, and similar findings emerge for men in the US analysis (see Table 5 in Annex C).

2.2. Mixed effects are found for the labour market impacts of alcohol use and a few chronic diseases.

Harmful alcohol consumption has mixed effects depending on the level and pattern of drinking.

60. OECD analyses suggest a negative effect of hazardous drinking on employment in men but a positive effect in women (see Table 2 in Annex C). Results of the impact of harmful alcohol drinking on wages are conflicting (some show positive effects, others negative effects, without a clear pattern across countries) (see Table 3 in Annex C). Regarding sick leave, results are inconsistent (some show positive effects, others negative effects, without a clear pattern in the three countries studies - Australia, Germany and United States). Our analyses show little evidence for the impact of harmful alcohol use on early retirement (see Table 5 in Annex C).

Cancer, high blood pressure and arthritis have generally mixed effects on employment and wages.

61. OECD analyses show conflicting results that prevent any firm conclusion on the effects of high blood pressure (HBP), cancer and arthritis on employment (see Table 2 in Annex C). HBP and cancer are associated with reduced employment probabilities in Australia, Mexico and the US, whereas they are positively related to employment in women in the study of the European elderly.

62. Concerning the impact on wages, OECD analyses based on Australian and US data show contrasting results for HBP and arthritis while cancer has no significant effect on wages (see Table 3 in Annex C). HBP is associated with lower wages in US blue collar men. However, Australian data suggest that white collar women who have HBP earn more 9 years later compared to women without HBP. Arthritis has a negative impact on wages in blue collar men in the US, but a positive effect in white collar women.

Cardiovascular diseases and high blood pressure may not necessarily be related to increased sickness absence

63. OECD analyses based on longitudinal data for Australia, Mexico and United States suggest contrasting effects of CVD and HBP on sick days. Men who suffer from CVD have 1.17 [0.04; 2.30][1] extra sick days per month in blue collar men in Mexico, and 4.23 [0.05; 8.41] extra days per year in white collar men in the US. However, American white collar women who have CVD have reduced sick days (-0.57 [-1.15; 0] days per year). In Australia, white collar women tend to report more sick days due to CVD whereas blue collar women with CVD report fewer sick days. Having HBP increases sick leave in Australian white collar women, in Mexican blue and white collar women, and in American blue collar men. However, a reverse pattern is observed in Australian white collar men and American white collar women.

Obesity, alcohol use, cardiovascular diseases and diabetes have an unclear influence on early retirement.

64. OECD analyses show little evidence for the impact of chronic diseases like CVD and diabetes, and risk factors like obesity and harmful alcohol use on early exit from the labour force, since results were hardly significant. Besides, HBP and arthritis seem to have no statistical relationship with early exit from the labour force.

2.3. Contrasting findings should be viewed carefully in the light of the national context and other study features.

65. While OECD analyses show predominantly negative labour market outcomes of chronic diseases and risk factors, a few cases reveal inconclusive results combining both positive and negative labour market outcomes. This is the case of the labour market impacts of heavy drinking and high blood pressure which are found to be positive in some analyses, and negative in others, according to the country studied and the statistical method used. These contrasting findings should be viewed carefully in the light of the national context, but they may also be due to some other explanations as suggested below.

66. First of all, it is important to read these findings within the national context, in particular to understand the mechanism in place (either at the workplace or at the national level) to help chronically ill people to cope with diseases once diagnosed, such as the social security system and other policies. For instance, in the United States, health insurance is largely secured through the employment contract, so people with chronic conditions have strong incentives to remain in employment, which may contribute to explain some positive outcomes of chronic diseases on employment. Similarly, in Mexico, a large share of the labour force is non-salaried workers and they do not have social security benefits, which may be a factor to encourage sick people to remain in employment.

67. Other possible reasons for some of the positive links found between diseases and labour market outcomes may include, for instance, that people self-report their chronic diseases, which assumes that people know about their conditions. Evidence suggests that those in higher socioeconomic status have a better knowledge of their conditions. Second, it is possible that people who had a chronic disease diagnosed take up a healthier lifestyle, have regular health check-ups, and are more committed in the management of their disease (or risk factor) and adherence to treatment. Thus, having a chronic diseases diagnosed a few years ago, if well controlled and treated, may not definitely imply negative labour market outcomes. A further possible explanation is that people with chronic diseases are more likely to be union members, that could prevent from involuntary labour-force exit and reduced wages (Pelkowski et al.,2004).

[1] 1.17 estimated extra days with a 95% confidence interval ranging from [0.04; 2.30]

68. Other possible reasons for diverging findings may come from limitations of the data and methods used in the study (e.g. design of the study, estimation error). First, comparability of results is limited due to the use of different national surveys with differences in survey methodology, sampling, and questionnaires. Although efforts were made to have the highest level of comparability across countries, some differences may remain (e.g. age of the population studied, definition of sick leave, definition of hazardous drinking, etc.). Second, although the study exploits longitudinal data that enable the assessment of causality, the methods used may not be good enough to correct for all sources of endogeneity. For instance, the positive effect of hazardous drinking on female employment may arise from reverse causality since women with higher socioeconomic status tend to drink more heavily than their counterparts with lower socioeconomic status.

69. Finally, discrepancies between results in the literature and OECD findings raise the question of possible publication bias in the literature on the impact of chronic diseases and risk factors on labour market outcomes. Generally speaking, studies with statistically significant results are likely to be submitted and published more prominently than studies with null or non-significant results, which may lead in our case to too optimistic conclusions on the labour market outcomes of chronic diseases. In addition, the design of studies focusing on chronically-ill people and their small sample size may also be a potential source of bias.

70. These findings suggest that chronic diseases and behavioural risk factors can truly impair labour market outcomes, although the negative impacts might be overstated in some published studies. The OECD analyses confirm that obesity and smoking damage labour market outcomes but the effect of alcohol use is not always consistent (depending on drinking patterns and gender). Similarly, the effects of chronic diseases are mixed, in particular for hypertension. Policy implications of these analyses are discussed in the next section, which aims to understand what these findings mean for the economy at large.

SECTION 3. PREVENTION POLICIES CAN INFLUENCE THE ECONOMY AT LARGE

71. The previous section showed that chronic diseases and their behavioural risk factors have an impact, mostly causal, on labour market outcomes. If changing the prevalence of diseases and risk factors can improve labour market outcomes, health policies aimed at preventing or better managing chronic diseases and risk factors can provide important benefits to the economy at large. Such policies may cover several dimensions such as the organisation and coordination of care (e.g. diseases management programmes), health care financing (e.g. bundled payments), health professionals' education and the role of primary care in the prevention, early detection and treatment of chronic diseases. Policies can even go beyond the health sector, including labour and social policies (e.g. early return-to-work programmes). For instance, following an acute phase of the disease, people with chronic illnesses who have regained their ability to work at least partially can re-enter the labour force with flexibility and appropriate facilities at the workplace. Early return-to-work programmes are supported by evidence showing that continuing usual activities as normally as possible is associated with better outcomes (Royal College of General Practitioners 1999; Waddell and Burton, 2004).

72. The evidence reviewed and the data analysed in this paper, however, do not provide information on alternative health care and disease management arrangements for the diseases and risk factors examined. The evidence is simply about the presence or absence of a disease or risk factor, and in few cases on the intensity of the risk factor (e.g. overweight vs. obesity, different levels and patterns of alcohol

consumption). Therefore, the conclusions that can be drawn from the body of evidence presented in the paper are more about the potential for (primary and secondary) prevention, rather than health care, to improve labour market outcomes.

73. This section, therefore, reviews the potential for prevention policy to improve the economy as a whole and shows that beyond the health returns (not discussed in this paper), health policy can limit (or reduce to a certain point) health care costs, reduce the loss of labour productivity, and increase social welfare.

74. Prevention policies with specific labour market dimensions can provide the means to pursuing health and labour market objectives at the same time. There are at least a few good examples of countries that have invested in chronic disease prevention programmes deployed at the workplace and/or targeting the working-age population.

- In Japan, employers are legally obliged to provide an annual medical examination and screening to their employees, known as the *kenko shindan* examination. Since 2008, this health programme aims in particular at identifying people at risk for the metabolic syndrome and prevent its acute and chronic disease consequences. Based on the Industrial Safety and Health Act, employers are obliged to take follow-up measures based on the medical examination and doctors' advice. Besides, they are expected to provide health education to their employees and take appropriate measures to prevent second-hand smoking at the workplace.

- In Mexico, the two largest social security organisations (IMSS and ISSSTE) provide health check-ups for the working-age population under the PREVENIMSS and PREVENISSSTE prevention programmes started in 2002 and 2008, respectively. These programmes aim not only to detect early some forms of cancer but also to help people to identify and prevent key risk factors for chronic diseases, like overweight, hypertension, diabetes, tobacco and harmful alcohol use. The National Strategy to Prevent and Control Overweight, Obesity and Diabetes, implemented in 2013, focusses on preventing obesity-related risk factors in adults aged 20 and over.

- In Norway, « healthy living centres » (HLCs) were implemented in the communities to help people to cope with chronic diseases and their risk factors. It has been evaluated that HLCs recruit mainly people at high risk for chronic diseases, about 60 % of whom are unemployed or on sick leave. The services provided by HLCs are important in improving or restoring participants' ability to work. The HLCs cooperate with occupational health care services and employers in the follow up of employees on sick leave to facilitate their return to work.

- Wellness programmes aimed at improving health-related lifestyles are regarded by a few OECD governments as an option to improve health and save health care costs by linking financial incentives with wellness objectives. Several US States, for instance, have expanded coverage in the public programme Medicaid, under the provisions of the Affordable Care Act, and introduced co-payments that can be waived when beneficiaries comply with specific wellness targets.

Box B. Private sector investment in wellness programmes.

The private sector has clear incentives to recruit and maintain fit and healthy workers in order to increase productivity and profitability, in addition to improving workers' well-being. An increasing number of private companies have invested in wellness programmes to improve the health-related behaviours of their employees, with a view to keeping workers in good health and working longer.

Examples of wellness programmes come from all around the world. In the United States where health insurance costs are borne by employers, 94% of large companies offering health benefits and 63% of smaller ones have put in place wellness programmes promoting physical activity, healthier diet and/or smoking cessation to help people to be fit and healthy (Kaiser Family Foundation, 2012). Such programmes are also developed in other countries such as in the United Kingdom (e.g. British Gas with back care workshops, Scotrail with awareness programmes on diet, alcohol and smoking).

While wellness programmes are increasingly offered by private companies, the effectiveness of such programmes is not yet fully established. Recent evidence suggests that wellness programmes promoting healthier lifestyles have a relatively low return on investment (USD 1.50 gained for USD 1 invested) if compared with disease management programmes (helping people to comply with medical therapies and clinical tests), which have returns in the order of USD 4.80 gained for USD 1 invested (Mattke et al,2014.)

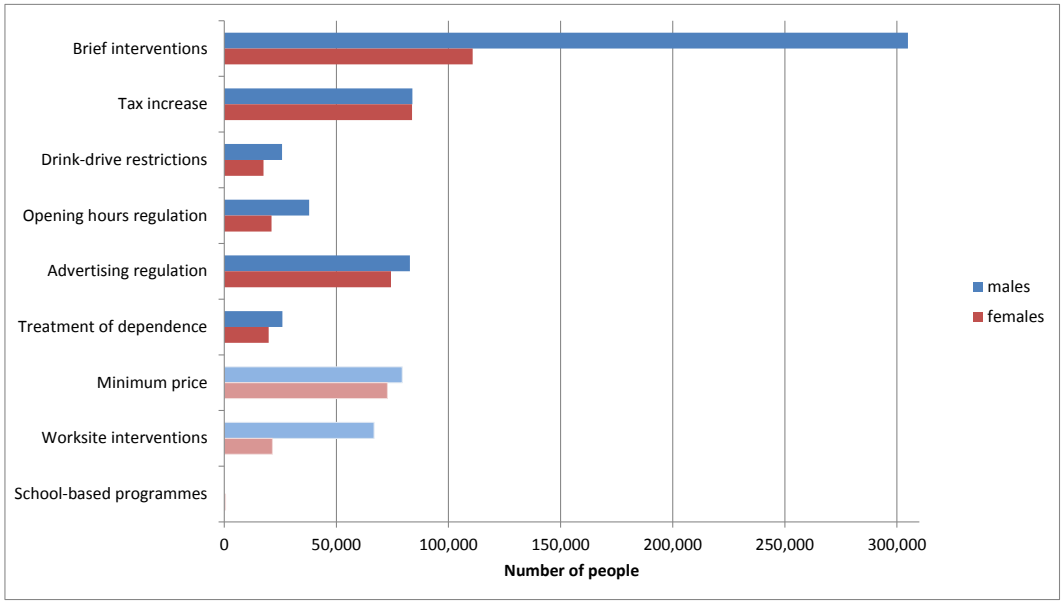
Prevention policy can limit or reduce the costs of health care, but not to a major degree.

75. Prevention policy can limit or reduce the costs of health care, but not to a major degree. If patients are given the tools to better manage their chronic diseases and lifestyle risk factors, this may avoid the chronic diseases to appear or the symptoms to worsen if the disease is already existent, which may result in saving health care spending. The OECD assessment of policy through the OECD computer-based simulation model shows that prevention policy to tackle obesity are not always cost-saving, but some of them are such as, especially fiscal measures and regulation. Prevention policies that are not cost-saving are generally cost effective, although some may take longer to produce their full effects than others (Sassi, 2010).

Prevention policy can improve labour productivity through reducing absenteeism and presenteeism.

76. Prevention policy can improve labour productivity by maintaining people at work, avoiding sickness absence, and achieving better performance at work. Chronic diseases and behavioural risk factors may lower performance at work and even impair people to maintain at work. In particular, harmful use of alcohol is a major cause of the loss of disability-adjusted life year in the working-age population. OECD evidence based on the OECD computer-based simulation model shows that prevention policy to tackle harmful use of alcohol can help to reduce the occurrence of alcohol-related diseases in the working-age population (OECD, 2015b). Figure 2 shows that in Germany, thousands of people in the working-age population can be freed of alcohol-related diseases according to the policy option.

Figure 2. Number of working-age people that would not incur alcohol-related diseases thanks to prevention policies, average effect per year, Germany



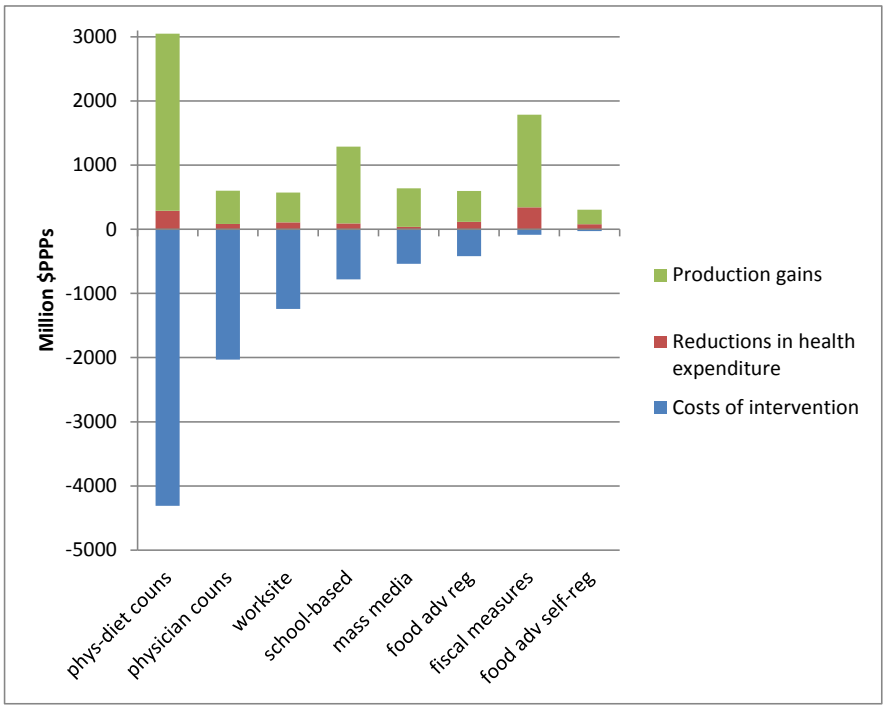
Source: OECD CDP-Alcohol model-based analysis relying on input data from the German Epidemiological Survey on Substance Abuse.

77. Chronic diseases and their lifestyle risk factors such as alcohol consumption, obesity and smoking, create significant costs for society at large through adverse labour market outcomes and potential production losses (as shown in Section 1). OECD evaluation of potential production gains associated with prevention policy to tackle obesity shows that adding up savings in health care expenditure and production gains can offset the cost of implementing prevention strategy.

78. A preliminary assessment of the employment and productivity consequences of a range of obesity prevention strategies was built upon analyses undertaken with the OECD/WHO Chronic Disease Prevention (CDP) model for the European (EUR-A) WHO region (Sassi et al., 2009). This analysis showed that obesity prevention strategies produce two main effects: (a) they increase the number of person/years lived in good health (diseases are prevented or delayed); and, (b) they increase the number of person/years lived with chronic diseases (survival with disease is extended). However, the net effect of the prevention strategies examined in the working age population was an overall decrease in the number of years lived with chronic diseases, while an overall increase was observed only in the oldest age groups (80+).

79. The monetary value of the potential production gains was generated by each prevention strategy, based on published estimates of the value of absenteeism and presenteeism (Goetzel et al., 2004). Potential production gains generated with obesity prevention strategies are estimated between 224 and 2760 million USD PPPs in Europe. In most cases, the value of potential production gains, in addition to the reductions in health expenditure, were estimated to be large enough to offset the costs of delivering the prevention strategies. (Figure 3). However, overall effects largely depend on labour markets' ability to "absorb" the extra supply of labour.

Figure 3. Monetary value of production gains associated with alternative obesity prevention strategies, average effect per year, Europe



Source: OECD/WHO CDP-Obesity model-based analysis.

Prevention policy can save money by avoiding sickness absence and reducing the payment of disability benefits in working-age population.

80. Tackling chronic diseases and behavioural risk factors in working-age population has the potential to save money by reducing the payment of disability benefits. The total cost for sick-leave and disability pension related to obesity in the Swedish female population was estimated at 10.5 billion SEK (USD 1.2 billion) per year (Narbro et al, 1996). By targeting working-age people, prevention could help to keep people at work, avoid long-term sickness absence, and thus avoid the payment of disability benefits borne by the governments, in particular for interventions at the workplace (Huber et al, 2014).

Prevention policy can reduce unemployment benefit expenses and increase revenues by maintaining people economically active.

81. Prevention can help to keep people economically active and it has the potential to reduce the payments of unemployment benefits, and to increase tax revenues and social contributions. Diabetes is significantly associated with a 30% increase in the rate of labour-force exit across the 16 countries studied (Rumball-Smith et al, 2014). Heavy smoking (more than 20 cigarettes per day) is a significant determinant of unemployment four years later in French men (Jusot et al, 2008). People with chronic diseases and risk factors are more affected by job loss and are then more likely to receive unemployment insurance benefits.

82. Evidence from German data shows that health programmes in the workplace can (a) reduce the payments of unemployment benefits borne by the governments, (b) reduce the turn-over in companies and stabilize workers' career, which has positive effects on pension revenues and on contributions to the social insurance system, and (c) strengthen the labour force attachment of the elderly workers, leading to cost savings for public transfers schemes such as unemployment and early retirement benefits (Huber et al 2014).

Prevention policy can reduce health inequalities and improve social welfare.

83. Prevention has the potential to reduce health inequalities and to improve social welfare. Important social disparities in chronic diseases and risk factors exist in OECD countries (Sassi et al, 2009; Devaux and Sassi, 2015), which jeopardizes social inclusion and overall welfare of a society. The OECD evaluation shows that people with lower SES who concentrate the highest prevalence of chronic diseases could benefit more from prevention policy aiming to tackle obesity (Sassi et al, 2009). By targeting the social vulnerable groups who concentrate both poorer health outcomes and poorer labour market outcomes, prevention policy can improve individuals' health, prevent people from leaving prematurely the labour force and improve social inclusion.

CONCLUSION

84. This paper provides a review of the evidence of the labour market outcomes of chronic diseases and associated lifestyle risk factors, as well as new analyses of those impacts. The review takes into consideration a large number of published studies, and the findings of a range of new econometric analyses provide additional information confirming important detrimental labour market impacts, but also mixed effects in some areas. Obesity and smoking clearly impair employment prospects, wages and labour productivity. Cardiovascular diseases and diabetes have negative impacts on employment prospects and wages, and diabetes, cancer and arthritis lower labour productivity. Alcohol use, cancer, high blood pressure and arthritis have mixed effects on employment and wages, and are not always linked with increased sickness absence (e.g. cardiovascular diseases and high blood pressure). Finally, this paper stresses the importance of these findings for the economy at large, and supports the use of carefully designed chronic disease prevention strategies targeting people at higher risk of adverse labour market outcomes, which may lead to substantial gains in economic production through a healthier and more productive workforce.

85. The work presented in this paper suggests that caution is required in interpreting evidence of the labour market outcomes of chronic diseases based solely on the results of published studies, because studies with positive findings are often more likely to be put forward for publication and to succeed in the publication process (causing a "publication bias"). An assessment of the labour market outcomes of chronic diseases should rely primarily on analyses of longitudinal datasets based on statistical approaches that permit to gauge the causal impact of chronic diseases and their risk factors.

86. The findings presented in this paper also support the claim that policies for the prevention of chronic diseases and their risk factors have important social outcomes, in addition to health benefits, which should be accounted for in evaluations of the impacts of such policies. The prevention of chronic diseases should be viewed as a means of improving broader social welfare. Chronic disease prevention can improve employment prospects, wages and labour productivity, and decrease sick leave, disability benefit claims and early exit from the workforce. OECD governments allocate around 3% of their health budget to prevention. They should consider investing further in prevention policies targeting chronic diseases and associated risk factors, in order to make the workforce healthier and more productive, which can lead to potentially substantial gains in economic production.

REFERENCES

Anderson, P. and B. Baumberg (2006), "Alcohol in Europe: a public health perspective", A report for the European Commission.

Anger, S. and M. Kvasnicka (2006), Biases in estimates of the smoking wage penalty. DIW-Berlin Discussion Paper 649.

Asgeirsdottir, T.L. and K.A. McGeary (2009), "Alcohol and labor supply: the case of Iceland", *Eur J Health Econ*, Vol. 10, pp. 455-465.

Auld, M.C. (2005), "Smoking, Drinking, and Income". *The Journal of Human Resources*, Vol. 40, No. 2, pp. 505 – 518.

Bassanini A. and Caroli E. (2014) "Is Work Bad for Health? The Role of Constraint vs Choice", IZA Discussion Paper No. 7891.

Barnay T. (2015) "Health, work and working conditions: a review of the European economic literature" Eur J Health Econ, DOI 10.1007/s10198-015-0715-8.

Bevan S and Hayday S, Costing Sickness Absence in the UK, IES Report 382, Brighton: Institute for Employment Studies, 2001.

Bevan S M, Quadrello T, McGee R, Mahdon M, Vavrovsy A and Barham L, Fit for Work? Musculoskeletal Disorders and the European Labour Market, The Work Foundation, September 2009.

Booth, B.M. and W. Feng (2002), "The impact of drinking and drinking consequences on short-term employment outcomes in at-risk drinkers in six southern states", *The Journal of Behavioural Health Services and Research*, Vol. 29, No. 2, pp. 157-66.

Bouchery, E.E. et al. (2011), "Economic Costs of excessive Alcohol Consumption in the U.S., 2006", *American Journal of Preventive Medicine*, Vol. 41, No. 5, pp. 516–524.

Bradley CJ, Neumark D, Bednarek HL, et al. 2005a. Short-Term Effects of Breast Cancer on Labor Market Attachment: Results from a Longitudinal Study. Journal of Health Economics 24: 137-160.

Bradley CJ, Neumark D, Zhehui L, et al. 2005b. Employment Outcomes of Men Treated for Prostate Cancer. JNCI: Journal of the National Cancer Institute 97: 958-965.

Bradley CJ, Neumark D, Zhehui L, et al. 2007. Employment and cancer: findings from a longitudinal study of breast and prostate cancer survivors. Cancer Investigation 25: 47-54.

Brown, H., Pagán, J., and Bastida, E., (2005), "The impact of diabetes on employment: genetic IVs in a bivariate probit.", Health Economics, Vol. 14, No. 5, pp. 537-544.

Brune, L.F. (2007), "The Smoker's Wage Penalty Puzzle – Evidence from Britain", ISER Working Paper, 2007-31.

Bunn, W.B. et al. (2006), "Effect of smoking status on productivity loss", *Journal Occupational Environmental Medicine*, Vol. 48, No. 10, pp. 1099 – 1108.

Burton, W.N., C.Y. Chen, A.B. Schultz and D.W. Edington (1998), "The Economic Costs Associated with Body Mass Index in a Workplace", *J Occup Env Med*, Vol. 40, No. 9, pp. 786-792, September.

Byrne, S. (2010) Costs to Society of Problem Alcohol Use in Ireland. Dublin: Health Service Executive.

Cabinet Office, UK. (2003). Alcohol misuse: how much does it cost?

Caliendo, M. and W-S. Lee (2013), "Fat chance! Obesity and the transition from unemployment to employment", *Economics and Human Biology*, Vol. 11, pp. 121-133.

Candom, D., (2014). "The Effects of Cancer in the English Labour Market," Working Papers 201409, School Of Economics, University College Dublin.

Carlsen, K., Dalton, S., Diderichsen, F., Johansen, C., (2008), "Risk for unemployment of cancer survivors: A Danish cohort study", European Journal of Cancer, Vol. 44, No. 13, pp. 1866-1874.

Cawley, J., J.A. Rizzo and K. Haas (2007), "Occupation-specific Absenteeism Costs Associated with Obesity and Morbid Obesity", *J Occup Environ Med*, Vol. 49, No. 12, pp. 1317-1324.

Datta Gupta N. and Nicolai K., 2008, "Work environment satisfaction and employee health: Panel evidence from Denmark, France and Spain, 1994-2001", The European Journal of Health Economics, 9(1), pp. 51-61.

Debrand T. and Lengagne P., 2007, "Pénibilité au travail et santé des seniors en Europe", Economie et Statistique, n°403-404, pp. 19-38.

Devaux M. and Sassi F. (2015) Harmful Use of Alcohol Trends and Social disparities, OECD Health Working Paper No. 79.

Drolet, M., Maunsell, E., Mondor, M., Brisson, C., Brisson, J., Mâsse, B., and Deschênes, L., (2005), "Work absence after breast cancer diagnosis: a population-based study", CMAJ, Vol. 173, No. 7, pp. 765-771.

Duguet, E., and Le Clainche, C., (2012), "The Impact of Health Events on Individual Labor Market Histories: The Message from Difference-in-Differences with Exact Matching".

Dwyer, D., et al., (1999), "Health Problems as Determinants of Retirement: Are Self-Rated Measures Endogenous?", NBER Working Paper No. 6503.

Feng, W. et al. (2001), "The impact of problem drinking unemployment", *Health Economics*, Vol. 10, pp. 509-521.

Finkelstein, E., C. Fiebelkorn and G. Wang (2005), "The Costs of Obesity Among Full-time Employees", *Am J Health Promot*, Vol. 20, No. 1, pp. 45-51, Sep-Oct.

Fletcher, J., and Richards, M., (2012), "Diabetes's 'health shock' to schooling and earnings: increased dropout rates and lower wages and employment in young adults", Health affairs (Project Hope), Vol. 31, No. 1, pp. 27-34.

Gates, D.M. et al. (2008), “Obesity and Presenteeism: The Impact of Body Mass Index on Workplace Productivity”, *Journal of Occupational and Environmental Medicine*, Vol. 50, No. 1, pp. 39-45.

Goetzel, R., Z., Long, S., R., Ozminkowski, R., J., Hawkins, K., Wang, S., and Lynch, W., (2004) “Health, Absence, Disability, and Presenteeism Cost Estimates of Certain Physical and Mental Health conditions Affecting U.S. Employers”, Journal of Occupational and Environmental Medicine , 46(4), p.398-412.

Goetzel, R.Z. et al. (2010), "A Multi-Worksite Analysis of the Relationships Among Body Mass Index, Medical Utilization, and Worker Productivity", *Journal of Occupational & Environmental Medicine*: January 2010 – Vol. 52 No. 1S, pp. S52-S58.

Grafova, I.B. and F.P. Stafford (2009), "The wage effects of personal smoking history". *Industrial and Labor Relations Review, Vol.* 62, No. 3, pp. 381 – 393.

Gustavsson, A., M. Svensson, F. Jacobi, et al. (2011) « Cost of Disorders of the Brain in Europe 2010”, European Neuropsychopharmacology, vol. 21, pp.718-779

Halpern, M.T. et al. (2001), "Impact of smoking status on workplace absenteeism and productivity", *Tobacco Control*, Vol. 10, pp. 233 – 238.

Hamilton, V. and B.H. Hamilton (1997), "Alcohol and earnings: does drinking yield a wage premium? ", The Canadian Journal of Economics/ Revue canadienne d’Economique, Vol. 30, No. 1 pp. 135-151.

Harris, H., (2008), “Chronic Disease and Labour Force Participation in Australia: an endogenous multivariate probit analysis of clinical prevalence data”, Centre for Health Economics Research Papers.

Harwood, H. J. (2000), “Updating Estimates of the Economic Costs of Alcohol Abuse in the United States: Estimates, Update Methods, and Data”, Report prepared by The Lewin Group for the National Institute on Alcohol Abuse and Alcoholism.

Heinesen, E., and Kolodziejczyk C., (2013), “Effects of breast and colorectal cancer on labour market outcomes-average effects and educational gradients”, Health economics, Vol. 32, No. 6, pp. 1028-1042.

Howard, J.T and L.B. Potter (2012), "An assessment of the relationships between overweight, obesity, related chronic health conditions and worker absenteeism", *Obes Res Clin Pract*, http://dx.doi.org/10.1016/j.orcp.2012.09.002.

Huber et al (2014) Workplace Health Promotion and Labour Market Performance of Employees. IZA Discussion Paper No. 8297.

ILO (2000), “Mental Health at the Workplace – Introduction” ILO publication, Geneva. http://www.ilo.org/wcmsp5/groups/public/---ed_emp/---ifp_skills/documents/publication/wcms_108221.pdf

INCa (2014) La vie deux ans après un diagnostic de cancer - De l’annonce à l’après cancer, collection Études et enquêtes, INCa.

Jarl, J. and U-G Gerdtham (2012), "Does drinking affect long-term sickness absence? A sample selection approach correcting for employment and accounting for drinking history", *Applied Economics*, Vol. 44, pp. 2811-2825.

Johansson, E., P. Böckerman, A. Uutela (2008), "Alcohol consumption and sickness absence: evidence from microdata", *European Journal of Public Health*, Vol. 19, No. 1, 19-22.

Jusot, F. et al. (2008), "Job loss from poor health, smoking and obesity: a national prospective survey in France", *Journal Epidemiology Community Health*, Vol. 62, pp. 332 – 337.

Kaiser Family Foundation, 2012, Employer Health Benefits 2012 Annual Survey, Section 12 - Wellness Programs and Health Risk Assessments.

Karlström, A., M. Palme and I. Svensson (2002), "The Timing of Retirement and Social Security Reforms: Measuring Individual Welfare Changes", Working Paper No. 2002/8, Institute for Futures Studies.

Knebelmann, J. (2014), "The impact of depression on employment of older workers in Europe", forthcoming as OECD Social, Employment and Migration Working Papers, OECD Publishing, Paris.

Kraut, A., Walld, R., Tate, R., and Mustard, C., (2001), "Impact of diabetes on employment and income in Manitoba, Canada", Diabetes care, Vol. 24, No. 1, pp. 64-68

Latif, E., (2009), "The impact of diabetes on employment in Canada", Health Economics, Vol. 18, No. 5, pp. 577-589.

Lee, Y.L. (1999), "Wage effects of drinking and smoking: an analysis using Australian twins data", University of Western Australia Working Paper 92-22.

Lee, Y.L. (2003), "Wage effects of drinking in Australia", *The Australian Economic Review*, Vol. 36, No. 3, pp. 265–82.

Leijten, F., et al., (2013), "Do work factors modify the association between chronic health problems and sickness absence among older employees?", Scandinavian Journal of Work, Environment & Health, Vol. 39, No. 5, pp. 477-485

Llena-Nozal A, 2009, "The effect of work status and working conditions on mental health in four OECD countries", National Institute Economic Review, 209(1), pp. 72-87.

Levine, P.B., T.A. Gustafson and A.D. Velenchik (1997), "More bad news for smokers? The effects of cigarette smoking on wages", *Industrial and Labor Relations Review, Vol.* 50, No. 3, pp. 493 – 509.

Lundborg, P. (2007), "Does smoking increase sick leave? Evidence using register data on Swedish workers", *Tobacco Control*, Vol.16, pp. 114 – 118.

Lundborg, P., P. Nystedt and D. Rooth (2010), "No Country for Fat Men? Obesity, Earnings, Skills, and Health among 450,000 Swedish Men", IZA Discussion Paper No. 4775, available at *www.ed.lu.se/papers/iza_lundborg.pdf*.

MacDonald, Z. and M.A. Shields (2001), "The impact of alcohol consumption on occupational attainment in England". *Economica*, Vol. 68, pp. 427-453.

MacDonald, Z. and M.A. Shields (2004), "Does problem drinking affect employment? ", *Evidence from England, Health Economics,* Vol. 13, No. 2, pp. 139-155.

Marchand, A., A. Parent-Lamarche and M.E. Blanc (2011), "Work and high-risk alcohol consumption in the Canadian Workforce", International Journal of Environmental Research and Public Health, 8, 2692-2705.

Mattke, Soeren, Hangsheng Liu, John Caloyeras, Christina Y. Huang, Kristin R. Van Busum, Dmitry Khodyakov, Victoria Shier, Ellen Exum and Megan Broderick. (2014). Do Workplace Wellness Programs Save Employers Money?. Santa Monica, CA: RAND Corporation.

McDaid D., M. Knapp, H. Medeiros (2008) "Employment and mental health: Assessing the economic impact and the case for intervention" Mental Health Economics European Network Policy Briefing, Personal Social Services Research Unit, London School of Economics and Political Science.

Minor, T., (2013), "An investigation into the effect of type I and type II diabetes duration on employment and wages", Economics and human biology, Vol. 11, No. 4, pp. 534-544.

Moran, J., Short, P., and Hollenbeak, C., (2011), "Long-term employment effects of surviving cancer", Health economics, Vol. 30, No. 3, pp. 505-514.

Morris, S. (2007), "The Impact of Obesity on Employment", *Labour Economics*, Vol. 14, pp. 413-433.

Mosca, I. (2013), "Body mass index, waist circumference and employment: evidence from older Irish

Mullahy, J. and J.L. Sindelar (1993), "Alcoholism, work, and income", *Journal of Labor Economics*, Vol. 11, pp. 494–519.

Narbro et al 1996 Economic consequences of sick-leave and early retirement in obese Swedish women. Int J Obes Relat Metab Disord. 1996 Oct;20(10):895-903.

Neumann, T.C. (2013), "The effect of drinking and smoking on the labour market outcomes of low-income young adults", *Applied Economics*, Vol. 45, pp. 541 – 553.

Ng, Y., Jacobs, P., and Johnson, J., (2001), "Productivity losses associated with diabetes in the US", Diabetes care, Vol. 24, No. 2, pp. 257-261

OECD (2012) Sick on the Job? Myths and Realities about Mental Health and Work, OECD Publishing, Paris. http://www.oecd.org/employment/emp/theoecdmentalhealthandworkproject.htm

OECD (2015a) Fit Mind, Fit Job - From Evidence to Practice in Mental Health and Work, Paris.

OECD (2015b) Tackling harmful alcohol use, Economics and public health policy, OECD Paris.

Office for national statistics, UK (2014) Sickness Absence in the Labour Market.

Oxford Economics. (2010). The economic costs of arthritis for the UK economy. St Aldates, Oxford

Parrott, S., C. Godfrey and M. Raw (2000), "Costs of employee smoking in the workplace in Scotland", *Tobacco Control*, Vol. 9, pp. 187 – 192.

Pelkowski, J., and Berger, M., (2004), “The impact of health on employment, wages, and hours worked over the life cycle”, The Quarterly Review of Economics and Finance, Vol. 44, No. 1, pp. 102-121.

Peters, B.L. (2004), "Is there a wage bonus from drinking? Unobserved heterogeneity examined", *Applied Economics*, Vol. 36, pp.2299–2315.

Rehm J. et al. (2009), “Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders”, *The Lancet*, Vol. 373, pp. 223-33.

Ricci, J.A. and E. Chee (2005), “Lost Productive Time Associated with Excess Weight in the U.S. Workforce”, *J Occup Environ Med*, Vol. 47, No. 12, pp. 1227-1234.

Royal College of General Practitioners (1999). Clinical Guidelines for the Management of Acute Low Back Pain. Royal College of General Practitioners, London.

Rumball-Smith, J., Barthold, D., Nandi, A., and Heymann, J., (2014), “Diabetes associated with early labor-force exit: a comparison of sixteen high-income countries”, Health affairs (Project Hope), Vol. 33, No. 1, pp. 110-115.

Saliba B, Paraponaris A, and Ventelou B, (2007), “Situations regarding the labour market for people suffering from chronic diseases”, Revue d'épidémiologie et de santé publique, Vol. 55, No. 4, pp. 253-263.

Salonsalmi, A. et al. (2009), "Drinking habits and sickness absence: the contribution of working conditions", *Scandinavian Journal of Public Health*, Vol. 37, pp. 846-854.

Sassi, F. (2010), Obesity and the economics of prevention: Fit not fat. Paris, OECD Publishing and Edward Elgar, 2010.

Sassi, F. et al. (2009), "Improving Lifestyles, Tackling Obesity: The Health and Economic Impact of Prevention Strategies", OECD Health Working Papers, No. 48. Paris, OECD Publishing, 2009. http://dx.doi.org/10.1787/220087432153.

Schofield, D., Shrestha, R., Passey, M., Earnest, A., and Fletcher, S., (2008) “Chronic disease and labour force participation among older Australians”, The Medical Journal of Australia, 189 (8): 447-450.

Schunck, R. and B.G. Rogge (2012), "Unemployment and Smoking: Causation, Selection, or Common Cause? Evidence from Longitudinal Data. SOEP Paper 491", The German Socio-Economic Panel Study at DIW Berlin available at: http://ssrn.com/abstract=2166748.

Schuring M., Burdorf L., Kunst A. and J. Mackenbach, (2007), “The effects of ill health on entering and maintaining paid employment: evidence in European countries”, Journal of Epidemiology & Community Health. Vol. 6, No. 7, pp. 597–604.

Seuring, T., Goryakin, Y., and Suhrcke, M., (2014), “The impact of diabetes on employment in Mexico”, CHE Research Paper 100.

Sobocki, P., B. Jonsson, J. Angst, C. Rehnberg (2006) “Cost of depression in Europe, Journal of Mental Health Policy and Economics, Vol. 9(2) pp.87–98.

Stewart, W., F., Ricci, J., A., Chee, E., Morganstein D. and Lipton R., (2003a), “Lost Productive Time and Cost Due to Common Pain Conditions in the US workforce”, Journal of the American Medical Association, 290 (18), p.2443-2454

Stewart, W.F., J.A. Ricci, E. Chee, S.R. Hahn and D. Morganstein (2003b), “Cost of Lost Productive Work Time among US Workers with Depression”, Journal of American Medical Association, Vol. 289, No. 23, pp. 3135-3144.

Stuckler, D. et al. (2009), "The public health effect of economic crises and alternative policy responses in Europe: an empirical analysis", *Lancet*, Vol. 374, pp. 315–323.

Thavorncharoensap, M. et al. (2009), “The economic impact of alcohol consumption: A systematic review“, Substance Treatment, Prevention and Policy 4(20).

Thomas, C., M. Benzeval, S. Stansfeld (2005) “Employment Transitions and Mental Health: an Analysis from the British Household Panel Survey”, Journal of Epidemiology and Community Health, Vol. 59(3), pp.243-249.

Trogdon et al (2008) Indirect costs of obesity: a review of the current literature. Obes Rev. 2008 Sep;9(5):489-500.

Tunceli, K., Bradley, C., Nerenz, D., Williams, L., Pladevall, M., and Elston L., (2005), “The impact of diabetes on employment and work productivity”, Diabetes care, Vol. 28, No. 11, pp. 2662-2667.

Tunceli, K., K. Li and L.K. Williams (2006), “Long-term Effects of Obesity on Employment and Work Limitations Among U.S. Adults, 1986 to 1999”, *Obesity (Silver Spring)*, Vol. 14, No. 9, pp. 1637-1646, September.

Vahtera, J. et al. (2002), "Alcohol intake and sickness absence: a curvilinear relation", *American Journal of Epidemiology*, Vol. 156, pp. 969-976.

Van den Berg A. et al. 2010.The impact of ill health on exit from paid employement in Europe among older workers. Occup Environ Med 2010;67:845-852.

Van Ours, J.C. (2004), "A pint a day raises a man’s pay; but smoking blows that gain away", *Journal of Health Economics*, Vol. 23, pp. 863 – 886.

Van Rijn, R., et al., (2014), “Influence of poor health on exit from paid employment: a systematic review.”, Occupation and environmental medicine, Vol. 71, No. 4, pp. 295-301.

Vijan, S., Hayward, R., and Langa, K., (2004), “The Impact of Diabetes on Workforce Participation: Results from a National Household Sample”, Health Services Research, Vol. 39, pp. 1653–1670.

Wacker, M. et al. (2013), "The association of smoking status with healthcare utilisation, productivity loss and resulting costs: results from the population-based KORA F4 study", BMC Health Services Research 13:278, available in http://www.biomedcentral.com/1472-6963/13/278.

Waddell G. and Burton A., (2004). Concepts of rehabilitation for the management of common health problems. TSO, London.

Wang et al (2011) Health and economic burden of the projected obesity trends in the USA and the UK, The Lancet Volume 378, No. 9793, p815–825.

Welte R., H-H. König and R. Leidl (2000), "The costs of health damage and productivity losses attributable to cigarette smoking in Germany". *European Journal of Public Health,* Vol. 10, No. 1, pp. 31 – 38.

Weng, S.F., S. Ali and J. Leonardi-Bee (2012), "Smoking and absence from work: systematic review and meta-analysis of occupational studies", *Addiction*, Vol. 108, pp. 307 – 319.

Yelin, E., Trupin, L., and Douglas, S., (2001), "Transitions in employment, morbidity, and disability among persons ages 51–61 with musculoskeletal and non-musculoskeletal conditions in the US, 1992–1994", Arthritis & Rheumatism, 42 (4), 769–779.

Ziebarth, N.R. and M.M. Grabka (2009), "In vino pecunia? The association between beverage-specific drinking behavior and wages", *Journal of Labor Research,* Vol. 30, pp. 219–244.

ANNEXES

ANNEX A – THREE TYPES OF STATISTICAL APPROACH

Fixed effect model and instrumental variables technique

87. Using longitudinal data, the analysis could rely on a fixed-effect instrumental variables (IV) model using a two-stage estimation procedure. A simplified version of the estimated equations is as follows:

$$LMO_{it} = H_{it}\alpha_{1it} + X_{it}\,\alpha_{2it} + \varepsilon_{it} \quad (1)$$

$$H_{it} = LMO_{it}\beta_{1it} + X_{it}\,\beta_{2it} + Z_{it}\,\beta_{3it} + \eta_{it} \quad (2)$$

where LMO_it is one of the labour market outcomes (e.g. employment status, wages) of the individual i at time t; H_it the health status (e.g. having chronic diseases or lifestyle risk factors); X_it a vector of socio-demographic characteristics; ε_it an error term. In equation Eq.(2), Z_it is a vector of instruments i.e. variables that are assumed to affect health but not labour market outcomes (not correlated with ε_it); and η_it an error term.

88. The IV procedure allows purification of the health variable from its correlation with the error term ε_it, that is, from its sources of endogeneity. However, finding a strong and valid instrument is often difficult, at best. For instance, looking at the relationship between obesity and wages, Cawley (2004) used sibling's weight as an instrument for individual weight. Lindeboom et al. (2009) used parental obesity as an instrument for obesity; however they found that to be a weak instrument. In our analysis, possible instruments include: exposure to spouses' unhealthy behaviours (e.g. obesity, smoking, drinking alcohol), or area-level exposures (e.g. obesity rates in the area of residence). When data permit, and if the tests for instrumental variables (i.e. under-identification and weakness tests) provide satisfactory results, the analysis is preferably based on an IV approach. Otherwise, a simple fixed effect model is preferred.

Dynamic analysis

89. When suitable data are available, a temporal ordering of events is assumed to address the causality problem. For instance, several studies in health and labour economics used this assumption to explore the impacts of health on early retirement using longitudinal data. The methodology employed includes logistic regression methods or Cox proportional hazards regression approaches to estimate the health effects on the probability of exit from the labour market (for instance, Jusot et al., 2008; van den Berg et al., 2010; Robroek et al., 2013).

90. Individual repeated measures data allow to analyse the dynamics in the studied relationships, for instance, the effects of having a chronic disease (or a risk factor) in the past on the current labour market outcomes (e.g. exit from employment since the initial period, number of sick days, early retirement). The equation to be estimated (Eq.(3)) considers the lagged health outcomes (H_t) as a predictor of current labour market outcomes (LMO_{t+1}). The link functions used depend on the outcomes (logit regression for exit from employment and early retirement, negative binomial model for number of sick days, and linear regression for wages).

$$LMO_{i,t+1} = H_{i,t}\alpha_{1i,t} + X_{i,t+1}\alpha_{2i,t+1} + \varepsilon_{i,t+1} \quad (3)$$

Propensity score matching

91. In the case of cross-sectional data, another approach to deal with the endogeneity of the health variable in the estimation of the employment equation (Eq.(1)) is propensity score matching. The idea is to match comparable people based on their individual characteristics to create two groups (the treatment *group –chronically-ill people-* and the control group *–non-chronically-ill people*), and then compare the labour market outcomes in the two groups. For instance, Cawley (2004) uses this technique in examining differences between siblings or twins.

92. Two main types of matching are generally employed: the exact matching or the propensity score matching (PSM).

93. The underlying principle of the propensity score matching (Rosenbaum and Rubin, 1983) consists of matching treated people with untreated people (i.e. obese and non-obese, smoker and non-smoker, drinker and non-drinker) in terms of their observable characteristics X and then comparing employment of these two groups of people who have the same unhealthy behaviour propensity.

94. The first thing to do is to estimate the propensity score P(X) for each individual in the sample using the estimated coefficients from a probit regression of chronic conditions B on X. Then test that individuals with the same propensity score P(X) have the same distribution of observed covariates independently of chronic condition status by splitting the sample into blocks of P(X) so that the mean value of P(X) among the two groups of individuals is the same. Then, within each block the means of each observable characteristic X are tested using a t-test to check they do not differ between the two groups. Next, we compute the average treatment effect of the treated (ATT) by matching obese and non-obese individuals on the basis of their propensity score using radius matching for example. The difference in employment between obese and matched non-obese individuals is computed and the ATT is obtained by averaging these differences across the m matches:

$$ATT = \frac{1}{m}\sum_{j=1}^{m}[y_j^{j\in B=1} - y_j^{j\in B=0}]$$

95. The standard error for the ATT is calculated using a bootstrapping procedure, from the standard deviation of the ATT after 200 bootstrap replications.

96. The approach described above is run with and without the common support condition. When this condition is applied observations in the non-obese group are discarded if they have values of P(X) less than the minimum or greater than the maximum estimated value of P(X) in the obese group.

ANNEX B – SURVEY DATA DESCRIPTION

Health and Retirement Survey

97. The Health and Retirement Survey (HRS) in the US is the pioneer survey on health and retirement. The HRS is conducted by the Institute for Social Research at the University of Michigan, since 1992. The HRS is a longitudinal panel study that surveys a representative sample of more than 26,000 Americans over the age of 50 every two years.

98. The HRS explores the changes in labour force participation and the health transitions that individuals undergo toward the end of their work lives and in the years that follow. It collects information about income, work, assets, pension plans, health insurance, disability, physical health and functioning, cognitive functioning, and health care expenditures. Health questions include the status vis-à-vis health-related risk factors (self-reported height and weight, smoking, and drinking), whether any diseases were diagnosed by a doctor, and self-assessed health status. Data on labour outcomes cover employment status, wages and early retirement.

Survey of Health, Ageing and Retirement in Europe

99. The Survey of Health, Ageing and Retirement in Europe (SHARE) follows people over age 50 from 2004 up to nowadays. It contains four data waves (2004/ 2006/ 2008/ 2010). SHARE is a multidisciplinary and cross-national panel database of micro-data on health, socio-economic status and social and family networks of more than 85,000 individuals (approximately 150,000 interviews) from 19 European countries and Israel. The SHARE project is coordinated by the Max Planck Institute for Social Law and Social Policy in Munich. Our analysis was restricted to 10 countries that were present in waves 1, 2 and 4[2]: Austria, Belgium, Denmark, France, Germany, Italy, Netherlands, Spain, Sweden, and Switzerland.

100. The health module in SHARE contains a large variety of questions on health-related issues: Self-assessed health, Long-term illness, Limitation in daily activities, Problem that limits paid work, Doctor told you had conditions (heart attack, high blood pressure/hypertension, cholesterol, stroke/cerebral vascular disease, diabetes, lung disease, arthritis, cancer,…), Age when condition started, Bothered by symptoms, Current drugs at least once a week, Weight and height of respondent, Smoking, Days a week consumed alcohol in last 3 months, How many drinks in a day, How often six or more drinks in last 3 months, Sports or activities that are vigorous or requiring a moderate level of energy. Regarding labour-related information, the survey covers the following topics: Employment status, Main reason for early retirement, Reason stop working, and Whether received public benefits.

Household Income and Labour Dynamics in Australia

101. The Household, Income and Labour Dynamics in Australia (HILDA) survey is a yearly household-based panel study which began in 2001. The survey is designed and managed by the Melbourne Institute of Applied Economic and Social Research (University of Melbourne).

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[2] Wave 3 contains retrospective information (Sharelife). Unfortunately, no relevant information in this wave was found for our study; wave 3 was not used.

102. The HILDA survey collects information about economic and subjective well-being, labour market dynamics and family dynamics. Special questionnaire modules are included each wave. The wave 1 (2001) panel consisted of 7,682 households and 19,914 individuals. In wave 11 (2011), this was topped up with an additional 2,153 households and 5,477 individuals. Interviews are conducted annually with all adult members of each household. Health questions include the status vis-à-vis health-related risk factors (self-reported height and weight, smoking, and drinking), whether any diseases were diagnosed by a doctor, and self-assessed health status.

Panel Study of Income Dynamics

103. The Panel Study of Income Dynamics (PSID) began in 1968 with a nationally representative sample of over 18,000 individuals living in 5,000 families in the United States. The PSID is directed by faculty at the University of Michigan.

104. The collected information covers employment, income, wealth, expenditures, health, marriage, childbearing, child development, philanthropy, education, and numerous other topics. Health data contain obesity status (self-reported), and smoking and drinking status, as well as chronic diseases diagnosed by a doctor, and an indicator of self-assessed health. Labour outcomes include employment status, wages and the number of sick leave.

German Socio-Economic Panel

105. The German Socio-Economic Panel (G-SOEP) is a longitudinal survey of approximately 11,000 private households in the Federal Republic of Germany from 1984 to 2012, and eastern German länder from 1990 to 2012. G-SOEP is produced by DIW Berlin.

106. Variables include household composition, employment, occupations, earnings, health, and satisfaction indicators. In particular, health information contains obesity status (self-reported), and smoking status, as well as chronic diseases diagnosed by a doctor, and an indicator of self-assessed health. Labour outcomes include employment status, wages and the number of sick leave.

Mexican Labour Force Survey

107. The MxFLS (Mexican Family Life Survey) is a longitudinal, multi-thematic survey representative of the Mexican population at the national, urban, rural and regional level. Currently, the MxFLS contains information for a 10-year period, collected in three rounds: 2002 [MxFLS-1], 2005-2006 [MxFLS-2], and 2009-2012 [MxFLS-3]. The survey has been developed and managed by researchers from the Ibero-american University and the Centre for Economic Research and Teaching.

108. The MxFLS-1 collected socioeconomic and demographic information on a sample of approximately 8,400 households (35,000 individuals) in 150 urban and rural communities. The MxFLS-2 relocated and re-interviewed almost 90% of the original sampled households. The MxFLS-3 achieved a re-contact rate of approximately 90% at the household level.

109. The MxFLS collects information on a wide range of socioeconomic and demographic indicators at the individual, household and community level. For example, at the individual level, the MxFLS collects information on the level of education, participation in social programs, labour and non-labour income, decision making processes, migration, participation in the labour market, time allocation, expectations, tastes and habits, health status perceptions, health measures (weight, height, blood pressure and haemoglobin), use of health services, insurance, credits and loans, money and in-kind transfers, and retrospective information on education, migration, marriage, fertility and victimization. MxFLS is made of 3 household questionnaires and 8 individual questionnaires covering different dimensions such as characteristics of adults and children, and health.

Health Survey for England

110. The Health Survey for England (HSE) is a cross-sectional survey, conducted annually since 1991. Since 1994, the HSE has been carried out by the Health and Social Survey Research group at the Department of Epidemiology at University College London with NatCen Social Research. HSE includes adults aged 16 and over, and since 1995 has also included children aged 2-15.

111. The HSE includes a set of core questions, asked each year on general health and psycho-social indicators, smoking, alcohol, demographic and socio-economic indicators, questions about use of health services and prescribed medicines and measurements of height, weight and blood pressure.

Description of key variables and covariates for the analysis

112. As mentioned above, four dimensions of labour market are envisaged depending on data availability. These include:

a. *Employment status*. According to internationally accepted OECD-ILO definitions, an employed individual is someone in the armed forces or who has worked for pay (in cash or in kind) at least one hour during the reference period (a week or a day) or has a formal attachment to a job but is temporarily not at work (e.g., because of holiday, illness or maternity leave). In this study, people are defined as "not employed" if they are: retired, disabled, student, unemployed, and homemaker.
b. *Wages*. Data on wages are usually collected through employment and income surveys, more rarely in health surveys. Monthly or hourly individual's wage is generally used in this study.
c. *Productivity*. Productivity is difficult to measure, it can be approximated by the rate of absenteeism from work or the number of sickness absences, the amount of disability benefits[3] received, and the rate of presenteeism[4]. In this study, productivity is measured by means of the number of sick days (per month or per year depending on country).
d. *Early retirement*. This information is mainly available in health and retirement surveys focusing on senior people. In this study, early retirement refers to the situation when people retire before the national legal retirement age.

113. Two types of health outcomes are studied: risk factors and chronic diseases. Among risk factors, obesity is defined as a Body Mass Index (BMI) above 30, and overweight as a BMI over 25. Smoking is categorised into three groups: current smokers, ex-smokers, and never smokers. Hazardous drinking (HD) identifies men/women who drink more than 3/2 alcoholic drinks per day. Heavy Episodic Drinking (HED) (also called binge drinking) identifies people who drink more than 6 alcoholic drinks per occasion (more than 5 alcoholic drinks in the US).

114. Chronic diseases are usually reported in the survey through the following question: "Have you been diagnosed one of these conditions by your doctor?" followed by a list of conditions where we identify chronic diseases that are of interest for the study.

115. Table 1 displays an overview of key health and labour variables present in each national survey. All analyses were restricted to individuals who responded to several waves of survey, and who were between age 25 and the national retirement age. All analyses presented in this study were carried out for men and women separately, and controlled for a range of covariates (age, age squared, ethnicity, marital status, education level, socio-economic status either measured by occupation or household income, and the type of occupation defined as blue or white collar). In some of the analyses, an interaction term between the effect of risk factors/diseases and the type of occupation was tested in order to detect possible differential impacts on labour outcomes.

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[3] Data on disability benefits are usually collected with household income information.

[4] Presenteeism is sometimes measured in labour/health surveys through the following question : "During the last 12 months, did it happen that you went to work, even when you thought you should report sick?"

Table 1. Overview of health and labour outcomes in each survey

	Risk factors				Chronic diseases						Labour outcomes			
Country	**Obesity**	**Smoking**	**Hazardous drinking**	**Heavy Episodic Drinking**	**Cardio-vascular diseases**	**High blood pressure / hypertension**	**Diabetes**	**Cancer**	**Arthritis**	**Pyschological problem / dementia**	**Employment status**	**Wages**	**Sick leave**	**Early retirement**
Australia: HILDA 2001-2011	X	X	X (regular drinking)	no	Heart diseases, stroke	X	X	X	X	X	X	X	X	no
Germany: GSOEP 1984-2012	X	X (1999, 2001, 02, 04, 06, 08,10)	no	no	cardiac diseases, heart attack, stroke	X (diseases only in 2009, 2011)	X (diseases only in 2009, 2011)	X (diseases only in 2009, 2011)	no	X (diseases only in 2009, 2011)	X	X	X	no
Mexico: MxLFS, 2002, 05-06, 09-12	X (measured)	X	no	no	Cardio vascular diseases	no	X	X	X	no	X	no	X	no
USA: PSID 1970-2007	X	X	X	X	Heart attack, heart diseases, stroke	X	X	X	no	no	X	X	X	no
USA: HRS 1992-2010	X	X	X	no	Heart attack, stroke	X	X	X	X	X	X	X	not able to retrieve	X
European countries: SHARE 2004, 06, 08, 10	X	X	X	X	Heart attack, stroke	X	X	X	X	no	X	no	X	X
England: HSE 2002-11	X (only in 2 waves) (measured)	X	X	X	stroke	not studied	not studied	not studied	not studied	not studied	X	no	no	no

Note: More details on national surveys available in Annex A.

ANNEX C: RESULTS

Table 2. Summary of findings, Effect on employment

Outcomes		Australia (HILDA)	Germany (GSOEP)	Mexico (MLFS)
Employment	Obesity	**Strong negative effect on employment once accounting for endogeneity** - Negative effect on exit from job for white collar women (OR:0.54 [0.33; 0.90])(lagged var) - Negative effect on employment (OR for keeping in work: 0.80 [0.66;0.97] in women). (FE) - Negative effect on employment (Coeff. for keeping in work: -0.61 [-1.11;-0.12] in all genders). (IV)	**Strong negative effect on employment** - Negative effect on employment in white collar men (OR for obese: 0.54 [0.32;0.91] 4 years later, 0.48 [0.28;0.81] 6 years later) and in blue collar women (OR for obese: 0.46 [0.22;0.98] 6 years later), Positive effect of overweight on employment 4 years later in blue-collar men (OR for overweight: [1.02;3.19]) (lagged) - Negative effect on employment in women (OR for obese: 0.7 [0.56;0.90]) and (OR for overweight: 0.6 [0.51;0.74]) (FE)	**Negative effect on employment in women** - Negative effect on employment in white collar women 4 years later (OR for obese: 0.66 [0.46;0.95]) and 7 years later(OR: 0.64 [0.45;0.92]), but Positive effect of overweight on employment 4 years later in white collar men (OR for overweight: 2.25 [1.1;4.6]) (lagged) - NS (FE, IV)
	Smoking	**Negative effect on employment** - Positive effect on exit from work, 12 years later in blue/white collar women (blue: OR:1.56[1.16;2.37] ; white: OR:1.85[1.16;2.94]) (lagged) - NS (FE, IV)	**Negative effect on employment in men, Positive effect in women** - Negative effect on employment 2 years later in blue collar men (OR: 0.37 [0.20;0.69]) 4 years later in blue collar men (OR: 0.43 [0.26;0.74]) (lagged) - Positive effect on employment in women (OR: 1.84 [1.50;2.28]) (FE)	**Positive effect on employment in men** - NS (lagged) - Positive effect on employment in men (OR for never-smk vs smk: 0.59 [0.40;0.90]) (FE) - NS (IV)
	Drinking	**Negative effect on employment in men, unclear pattern for women** - Positive effect on exit from work, 3 years later in blue&white collar women (OR for blue collars:1.99[1.05;3.77]; white collars: OR:2.58 [1.32;5.05]) (lagged) - HD: Positive effect on employment for women (OR for for keeping in work:1.33[1.03;1.71]). (FE) - HD: Negative effect on employment for men (Coeff for for keeping in work:-0.54[-1.02;-0.6]). (IV)	**Positive effect of regular drinking on employment in women** - NS (lagged) - Positive effect of regular drinking on employment in women (OR: 1.61 [1.05;2.47]) (FE)	Not included
	CVD	NS (lagged var) Not possible to estimate with FE model, because diseases only present in one wave.	Not studied	**Negative effect on employment in women** - Negative effect on employment 7 years later in white collar women (OR: 0.34 [0.13;0.87]) (lagged) - NS (FE, IV)
	HBP	NS (lagged var) Not possible to estimate with FE model, because diseases only present in one wave.		**Negative effect on employment in women** - Negative effect on employment 4 years later in blue collar women (OR: 0.55 [0.33;0.96]) and 7 years later in white collar women (OR: 0.54 [0.34;0.86]) (lagged) - NS (FE, IV)
	Cancer	**Negative effect on employment in men** - Positive effect on exit from work, 9 years later, for blue collar men (OR: 3.66 [1.13;11.83]) Not possible to estimate with FE model, because diseases only present in one wave.		- NS (lagged model) - NS (FE, IV)
	Diabetes	NS (lagged var) Not possible to estimate with FE model, because diseases only present in one wave.		**Negative effect on employment in men** - Negative effect on employment 7 years later in white collar men (OR: 0.37 [0.15;0.89]) (lagged) - NS (FE, IV)
	Arthritis	NS (lagged var) Not possible to estimate with FE model, because diseases only present in one wave.		- NS (lagged model) - NS (FE, IV)

Notes: Results of three types of model are presented: the dynamic model with lagged health variables (lagged), the fixed-effect model (FE), and the fixed-effect model with instrumental variables (IV). NS stands for Not Significant. Different types of estimates are reported according to the link function used in the models: Odds Ratios (OR) for logistic regressions, Incidence Rate Ratio (IRR) for negative binomial models, and coefficients for linear regressions. CVD means cardiovascular diseases, HBP high blood pressure. Results in light grey are those which do not support detrimental labour market outcomes.

Table 2. Summary of findings, Effect on employment (cont.)

Outcomes		USA (PSID)	European countries (SHARE)	USA (HRS)	England (HSE)
Employment	Obesity	**Negative effect on employment** - Negative effect on employment in blue collar men 4 years later (OR: 0.712 [0.51;1.00]) and 6 years later (OR: 0.691 [0.50;0.95]), but *Positive effect on employment* in white collar men 2 years later (OR: 2.13 [1.00; 4.55]) (lagged) - Negative effect on employment in women: (OR: 0.82 [0.69; 0.97]) (FE) - NS (IV)	**Positive effect on employment once accounting for individual heterogeneity** - Positive effect on exit from work 6 years later in white collar men (OR:1.73 [1.00; 2.99]) (lagged) - Positive effect on employment in men (OR:1.97 [1.08;3.58]) and in women (OR:1.65[1.02;2.68]) (FE) - NS (IV)	NS (FE, IV)	**Negative effect on employment** - Negative effect on employment in men (coef.: -0.018***) and in women (coef.:-0.40***) (biprobit) - Negative effect on employment in men (ATT: -0.040***) and in women (-0.073***) (PSM)
	Smoking	**Negative effect on employment** - Negative effect on employment in blue collar men (OR for never-smk vs. smk: 1.82 [1.12;2.97] 2 years later, 2.02 [1.36;3.00] 4 years later, 1.95 [1.35;2.82] 6 years later), white collar men (2.31 [1.10;4.86]), white collar women (1.85 [1.15;2.98] 2 years later, 2.10 [1.18;3.73] 4 years later), and in blue collar women (1.87 [1.15;3.04] 6 years later). (lagged) - Positive effect of quitting smoking (vs. smoking) on employment in blue collar men (OR for ex-smk vs. smk: 1.71 [1.11;2.63] 4 years later, 1.89 [1.26;2.83] 6 years later) (lagged) - NS (FE) - NS (IV)	**Strong negative effect on employment** - Positive effect on exit from job 4 years later for blue&white collar women (OR for Smoking vs Non-Smk: 2.30[1.10;4.81] in blue collars; 2.08[1.22;3.55] in white collars) (lagged) - NS (FE) - Negative effect on employment for men (Coeff:-0.48[-0.95;-0.01]) (IV)	NS (FE, IV)	**Negative effect on employment** - Negative effect on employment in men (coef.: -0.986***) and in women (coef.:-1.10***) (biprobit) - Negative effect on employment in men (ATT: -0.086***) and in women (-0.072***) (PSM)
	Drinking	**Strong negative effect on employment in men** - Negative effect on employment 2 years later in white collar men (OR for heavy drinker: 0.54 [0.29; 1.00]) (lagged) - NS (FE) - Negative effect in men (coef for heavy drinker: -0.15 [-0.26;-0.04]) (IV)	Not included	NS (FE, IV)	**Unclear pattern** NS (biprobit), - positive effect on employment in women (ATT: 0.066**) (PSM)
	CVD	**Negative effect on employment** - Negative effect on employment 2 years later in men (OR: 0.598 [0.37;0.97]), 4 years later in men (OR: 0.642 [0.42;0.97]), Negative effect on employment 6 years later in white collar women (OR: 0.49 [0.29;0.85]) (lagged) - Negative effect in men (OR: 0.57 [0.41; 0.78]) and women (OR: 0.61 [0.48; 0.78]) (FE) - NS (IV)	**Negative effect on employment** - Positive effect on exit from job 6 years later for white collar men (OR:3.20[1.20;8.53]) (lagged) - NS (FE)	Not studied	Not studied
	HBP	**Negative effect on employment** - Negative effect on employment 4 years later in white collar men (OR: 0.60 [0.38; 0.95]) (lagged) - Negative effect in women (OR: 0.75 [0.64; 0.88]) (FE) - NS (IV)	**Positive effect on employment in women** - NS (lagged) - *Positive effect on employment* in women (OR:1.54[1.05;2.26]) (FE)		
	Cancer	**Negative effect on employment in women** - NS (lagged) - Negative effect in women (OR: 0.73 [0.54; 0.97]) (FE) - NS (IV)	**Positive effect on employment in women** - *Negative effect on exit from job* 6 years later for blue collar women (OR:0.17[0.03;0.89]) - NS (FE)		
	Diabetes	**Negative effect on employment in women** - NS (lagged model) - Negative effect in women (OR: 0.66 [0.51; 0.86]) (FE) - NS (IV)	- NS (lagged var) - NS (FE model)		
	Arthritis	**Negative effect on employment in women once accounting for individual heterogeneity** - *Positive effect on employment* 2 years later in white collar women (OR: 1.69 [1.01; 2.81]) (lagged) - Negative effect in women (OR: 0.74 [0.63; 0.87]) (FE) - NS (IV)	- NS (lagged var) - NS (FE model)		

Notes: Results of three types of model are presented: the dynamic model with lagged health variables (lagged), the fixed-effect model (FE), and the fixed-effect model with instrumental variables (IV). NS stands for Not Significant. Different types of estimates are reported according to the link function used in the models: Odds Ratios (OR) for logistic regressions, average treatment effect between two groups (ATT) for matching (PSM) and coefficients for probit regressions. CVD means cardiovascular diseases, HBP high blood pressure. (***) means significant at 1%. Results in light grey are those which do not support detrimental labour market outcomes.

Table 3. Summary of findings, Effect on wages

Outcomes		Australia (HILDA)	Germany (GSOEP)
Wage	**Obesity**	NS (lagged var)	**Negative effect on wage in women** - Negative effect of obesity on wage in white-collar women 2 years later (coef: -0.11 [-0.18;-0.04]), 4 years later (coef: -0.1 [-0.17;-0.02]), Negative effect of overweight 2 year later in white collar women (coef for overweight: -0.05 [-0.09;-0.004]) but *positive effect of overweight on wage* 2 years later in white collar men (coef for overweight: 0.05 [0.005;0.11]) (lagged) - NS (FE model)
	Smoking	**Negative effect on wage in men** - Negative effect on wages in blue collar men, 2 years later (coef:-0.11[-0.22;-0.01])	**Negative effect on wage** - Negative effect on wage 2 years later in white collar men (coef: -0.1 [-0.16;-0.04]), 4 years later in white collar men (coef: -0.13 [-0.19;-0.07]) and women (coef: -0.06 [-0.1;-0.01]), 6 years later in white collar men (coef: -0.11 [-0.17;-0.05]) (lagged) - NS (FE model)
	Drinking	**Negative effect on wage in HD in women, but positive effect of HED in men** HD: negative effect on wage in blue collar women 2 years later, (coef:-0.18 [-0.35;-0.01]) HED: *positive effect on wage* in blue collar men 3 years later (coef:0.12 [0.10;0.23])	**Negative effect of regular drinking on wage in men, but positive effect in women** - Negative effect of regular drinking on wage 2 years later in blue collar men (coef: -0.093 [-0.17;-0.01]), positive effect on wage 4 years later in white collar women (coef: 0.08 [0.01;0.16]) (lagged) - NS (FE model)
	CVD	**Negative effect on wage in men** - Negative effect on wage in white collar men 2 years later (coef:-0.34[-0.56;-0.12]). No effects 9 years later. (lagged) Not possible to estimate with FE model, because diseases only present in one wave.	Not studied
	HBP	**Positive effect on wage in women** - Positive effect on wage in white collar women 9 years later (coef:0.17 [0.001;0.33]). (lagged) Not possible to estimate with FE model, because diseases only present in one wave.	
	Cancer	NS (lagged) Not possible to estimate with FE model, because diseases only present in one wave.	
	Diabetes	**Negative effect on wage in women** - Negative effect on wage in white collar women 2 years later (coef:-0.30[-0.59;-0.004]). No effects 9 years later. Not possible to estimate with FE model, because diseases only present in one wave.	
	Arthritis	NS (lagged var) Not possible to estimate with FE model, because diseases only present in one wave.	

Notes: Results of three types of model are presented: the dynamic model with lagged health variables (lagged), the fixed-effect model (FE), and the fixed-effect model with instrumental variables (IV). NS stands for Not Significant. Different types of estimates are reported according to the link function used in the models: Odds Ratios (OR) for logistic regressions, Incidence Rate Ratio (IRR) for negative binomial models, and coefficients for linear regressions. CVD means cardiovascular diseases, HBP high blood pressure. Results in light grey are those which do not support detrimental labour market outcomes.

Table 3. Summary of findings, Effect on wages (cont.)

Outcomes		USA (PSID)	USA (HRS)
Wage	Obesity	**Negative effect on wage in men but positive in women** - Negative effect on wage 2 years later in white collar men (coef: -7.3 [-13.51;-1.09]), *Positive effect* in blue collar women (coef: 4.5 [0.40;8.62]) (lagged) - NS (FE) - NS (IV)	**Negative effect on wage for both genders** (FE IV)
	Smoking	**Negative effect on wage in women** - Negative effect on wage in men (coef. for never-smk vs smk: 3.86 [0.69;7.03] 2 years later, 4.99 [2.02;7.97] 4 years later, and 3.50 [0.26;6.75] 6 years later) (lagged) - Negative effect of quitting smoking on wage for men (coef. of ex-smk vs. smk: -1.33 [-2.64;-0.04]) and positive for women (coef: 0.949 [0.21;1.68]) (FE) - NS (IV)	NS (FE IV)
	Drinking	**Negative effect of HED on wage in men and women, but positive effect of HD in men.** - HD: Positive effect on wage in blue collar men (coef: 7.00 [0.35;13.65] 4 years later, 8.058 [1.51;14.61] 6 years later) HED: Negative effect on wage 2 years later in white-collar men (coef: -12.86 [-19.12;-6.59]) and women (-8.81 [-14.35;-3.27]), 4 years later in white collar men (coef: -12.49 [-19.33;-5.64]), 6 years later in white collar women (coef: -13 [-24.08;-1.93]). (lagged) - NS (FE) - NS (IV)	HD: positive effect on wage for both genders (FE IV)
	CVD	- NS (lagged, FE, and IV)	Not studied
	HBP	**Negative effect on wage in men** - Negative effect on wage 6 years later in blue collar men (coef: -3.86 [-7.31;-0.00]) (lagged) - NS (FE model) - NS (FE-IV model)	
	Cancer	NS (lagged, FE and IV-FE models)	
	Diabetes	**Strong negative effect on wage in men** - Negative effect on wage 2 years later in men (coef: -7.46 [-10.94;-3.97] in blue collar men / -7.93 [-15.17;-0.69] in white collar men), and respectively 4 years later (coef: -7.34 [-11.10;-3.59] / -8.13 [-15.02;-1.24]) and 6 years later (coef: -10.57 [-17.57;-3.56]) / -9.36 [-13.17;-5.55]) (lagged) - NS (FE) - NS (FE)	
	Arthritis	**Negative effect on wage in men, but positive effect in women** - Negative effect on wage 6 years later in blue collar men (coef: -4.27 [-7.94;-0.62]) (lagged) - Positive effect on wage in white collar women (coef: 1.86 [0.48; 3.24] (FE) - NS (IV)	

Notes: Results of three types of model are presented: the dynamic model with lagged health variables (lagged), the fixed-effect model (FE), and the fixed-effect model with instrumental variables (IV). NS stands for Not Significant. Different types of estimates are reported according to the link function used in the models: Odds Ratios (OR) for logistic regressions, Incidence Rate Ratio (IRR) for negative binomial models, and coefficients for linear regressions. CVD means cardiovascular diseases, HBP high blood pressure. Results in light grey are those which do not support detrimental labour market outcomes.

Table 4. Summary of findings, Effect on sick leave

Outcomes		Australia (HILDA)	Germany (GSOEP)
Nbr of sick days	Obesity	**Some positive effects on sick days in women** - some positive effects on sick days in white&blue collar women, 2, 3 or 6 years later (IRR: 1.44[1.11;1.88] in white collar women 2 years later; 1.41[1.09;1.92] in blue collar women 3 years later; 1.49[1.10;2.03] in white collar women 6 years later). - NS (FE) - NS (IV)	**Positive effect of obesity on sick days in women, but some signs of negative effect in men** - *Negative effect of obesity on sick days* in blue collar men (IRR for obesity: 0.71 [0.56;0.90] 4 years later, 0.75 [0.58;0.96] 6 years later), positive effect of overweight on sick days in white collar women (IRR for overweight: 1.27 [1.03;1.57] 2 years later, 1.33 [1.08;1.64] 4 years later) and in white collar men (IRR for overweight: 1.42 [1.08;1.88] 6 years later) (lagged) - Positive effect on sick days in white collar women (Coef. for obese: 3.7 [0.00;7.51] and for overweight: 1.67 [0.02;3.32]) (FE)
	Smoking	Inconsistent results - Positive effect of smoking on sick days in blue&white collar women 6 years later (IRR:1.18[1.03;2.74] in blue collars; 1.41[0.99;2.00] in white collars. Positive effect of quitting smoking (vs. non-smk) on sick days in white collar women (IRR:1.47[1.15;1.88] 2 years later; 1.43[1.12;1.83] 3 years later; 1.41[1.09;1.82] 6 years later) (lagged var) - NS (FE) - *Negative effect on taking any sick leave* in both genders (Coeff. -2.33 [-4.33;-0.34]) (IV).	**Inconsistent results** - Positive effect on sick days in white collar men (IRR: 1.42 [1.08;1.87] 6 years later, 1.45 [1.09;1.94] 4 years later) and women (IRR: 1.24 [1.00;.1.53] 4 years later) (lagged) - *Negative effect on sick days* in white collar men (Coef.: -1.7 [-3.38;-0.17]) (FE)
	Drinking	**Negative effect of HD on sick days in men, positive effect in women. Positive effect of HED in both genders.** - HD: Negative effect on sick days in blue collar men 2 to 6 years later (IRR for HD in blue collar men: 0.67[0.50;0.97] 2 years later, 0.60[0.42;0.87] 4 years later, 0.65[0.44;0.96] 6 years later). Positive effect on white collar women 2 and 3 years later (IRR: 1.52[1.00;2.30] 2 years later, 1.48[1.01;2.17] 3 years later) HED: Positive effect in men (IRR for HED 3 years later: 1.47[0.99;2.20] for white collar men). Positive effect in women (IRR: 1.64[1.05;2.56] 3 years later). - HD: *Negative effect* on taking any sick leaves in men (OR:0.80 [0.66;0.97]) (FE) - HD: *Negative effect* on taking any sick leaves in men (Coeff: -0.81 [-1.63;0.02])(IV)	**Mixed results for regular drinking** - Positive effect of regular drinking on sick days in blue collar men (IRR: 1.36 [1.02;1.84] 2 years later, 1.41 [1.06;1.88] 4 years later) and *negative in blue collar women* (IRR: 0.32 [0.11;0.98] 4 years later) (lagged) - *Negative effect of regular drinking on sick days* in men (Coef.: -1.3 [-2.73;-0.05]) (FE)
	CVD	**Positive effect on sick days in white collar women, but negative in blue collars.** - Positive effect on sick days 2 years later in white collar women (IRR:2.86[1.38;5.93]), but negative effect in blue collar women (IRR: 0.44 [0.19,1.00]). No effect 9 years later. - Not possible to estimate with FE model, because diseases only present in one wave.	Not studied
	HBP	**Negative effect in white collar men, but positive in women.** - Negative effect in white collar men (IRR:0.66[0.44,0.98]) and positive effect in white collar women (IRR:1.72 [1.19;2.49]) 2 years later. No effect 9 years later. - Not possible to estimate with FE model, because diseases only present in one wave.	
	Cancer	- NS (lagged) - Not possible to estimate with FE model, because diseases only present in one wave.	
	Diabetes	**Positive effect in white collar men** - Positive effect in white collar men 2 years later (IRR:5.20[2.40;11.23]). No effect 9 years later. - Not possible to estimate with FE model, because diseases only present in one wave.	
	Arthritis	**Positive effect in blue collar men** - Positive effect in blue collar men 2 years later (IRR:1.82[1.19;2.77]). No effect 9 years later. - Not possible to estimate with FE model, because diseases only present in one wave.	

Notes: Results of three types of model are presented: the dynamic model with lagged health variables (lagged), the fixed-effect model (FE), and the fixed-effect model with instrumental variables (IV). NS stands for Not Significant. Different types of estimates are reported according to the link function used in the models: Odds Ratios (OR) for logistic regressions, Incidence Rate Ratio (IRR) for negative binomial models, and coefficients for linear regressions. CVD means cardiovascular diseases, HBP high blood pressure. Results in light grey are those which do not support detrimental labour market outcomes.

Table 4. Summary of findings, Effect on sick leave (cont.)

Outcomes		Mexico (MLFS)	USA (PSID)
Nbr of sick days	Obesity	**Positive effect on sick days** - Positive effect on sick days 4 years later in women (IRR: 1.289 [1.01;1.64]) (lagged) - Positive effect on sick days in blue collar men (coef: 0.393 [0.03;0.76]) (FE) - NS (IV)	**Positive effect on sick days in women, negative effects in men** - Negative effect of overweight on sick leave in blue collar men (IRR: 0.603 [0.38;0.96] 2 years later, positive effect 4 years later in white collar men (IRR: 1.48 [1.06;2.05] 4 years later) (lagged) - NS (FE) - NS (IV)
	Smoking	**Mixed effects of quitting smoking between men and women** - Negative effect of quitting smoking (vs. smoking) on sick days in blue collar women (IRR for ex-smk vs. smk: 0.07 [0.00;0.5] 4 years later, 0.26 [0.07;0.92] 7 years later) (lagged) - Positive effect of quitting smoking (vs. smoking) on sick days in white collar men (coef for ex-smoker vs smok: 1.07 [0.11;2.02]) (FE) - NS (IV)	**Positive effect of smoking on sick days in white collars, but negative effect in blue collar women** - Positive effect of smoking on sick leave in white collar men (IRR for never-smk vs. smok: 0.53 [0.32;0.89] 2 years later, 0.60 [0.37;0.95] 4 years later). Negative effect of smoking in blue collar women (IRR for never-smk vs smok: 1.73 [1.04;2.9] 4 years later). (lagged) - Positive effect of quitting smoking (vs. smoking) on sick leave 2 years later in blue collar men (IRR: 1.24 [0.85;1.81]) and women (IRR: 1.79 [1.06;3.02]), but negative effect in white collar men (IRR: 0.45 [0.26;0.79]) (lagged) - Positive effect of quitting smoking (vs. smoking) on sick leave in white collar men (IRR for ex-smk vs smok: 2.65 [0.086; 5.22]) (FE) - NS (IV)
	Drinking	Not included	**Inconsistent results** - HD: Positive effect on sick leave 2 years later in white collar women (IRR: 1.53 [1.07;2.20]), 4 years later in white collar men (IRR: 1.63 [1.05;2.54]) and women (IRR:1.55 [1.07; 2.25]), but *negative effect* in blue collar women (IRR: 0.58 [0.35;0.98]) (lagged) - HED: Positive effect on sick leave 2 years later in white collar men (IRR: 5.23 [1.09;25.16]), 4 years later in white collar men (IRR: 4.79 [1.44;15.99]), but *negative effect* 6 years later in white collar women (IRR: 0.56 [0.36;0.86]). (lagged) - *Negative effect of HED* in men (coef.: -1.31 [-2.44;-0.19]) (FE) - NS (IV)
	CVD	**Mixed results** - Negative effect 4 years later on sick days in blue collar men (IRR: 0.134 [0.05;0.39]) (lagged) - Positive effect on sick days in blue collar men (coef: 1.168 [0.04;2.30]), but negative effect in white collar women (coef: -0.57 [-1.15;-0.00]) (FE) - NS (IV)	**Strong evidence for positive effect on sick days in men** - Positive effect on sick leave 4 years later in blue collar men (IRR: 3.35 [1.67;6.77]) and white collar women (IRR: 3.62 [1.18;11.13]), positive effect on sick leave 6 years later in blue collar men (IRR: 2.25 [1.10;4.64]) and white collar women (IRR: 1.72 [1.11;2.64]) (lagged) - Positive effect in white collar men (coef: 4.23 [0.05; 8.41]) (FE) - NS (IV)
	HBP	**Positive effect on sick days in women** - NS (lagged model) - Positive effect on sick days in blue&white collar women (coef: 0.722 [0.04;1.41] in blue collars, 0.57 [0.02;1.13] in white collars) (FE) - NS (IV)	**Positive effect on sick days in men, but negative effect in women.** - Positive effect on sick leave in blue collar men (IRR: 1.55 [1.12;2.17] 2 years later, 1.464 [1.04;2.05] 4 years later) , negative effect in white collar women (IRR: 0.71 [0.54;0.93] 4 years later) (lagged) - NS (FE) - NS (IV)
	Cancer	**Positive effect on sick days in women once accounting for individual heterogeneity** - *Negative effect on sick days* in white collar women (IRR: 0.038 [0.007;0.205] 4 years later, 0.03 [0.00;0.20] 7 years later) (lagged) - Positive effect on sick days in women (coef: 1.57 [0.31;2.84]) (FE) - NS (IV)	**Positive effect on sick days once accounting for individual heterogeneity** - *Negative effect on sick leave* in white collar women (IRR: 0.57 [0.39;0.84] 4 years later, 0.57 [0.38;0.87] 6 years later) (lagged) - Positive effect in men (coef: 2.37 [0.02;4.73]) and women (coef: 2.68 [1.01;4.36]) (FE) - NS (IV)
	Diabetes	**Positive effect on sick days in white collar men** - NS (lagged) - Positive effect on sick days in white collar men (coef: 0.82 [0.01;1.63]) (FE) - NS (IV)	**Positive effect on sick days in women** - Positive effect on sick leave 4 years later in blue collar women (IRR: 2.127 [1.03;4.38]) (lagged) - NS (FE) - NS (IV)
	Arthritis	**Positive effect on sick days in men once accounting for individual heterogeneity** - *Negative effect on sick days* 4 years later in bluecollar men (IRR: 0.343 [0.16;0.74]) (lagged) - Positive effect on sick days in white collar men (coef: 2.11 [-0.00;4.23]) (FE) - NS (IV)	**Positive effect on sick days** - Positive effect on sick leave 2 years later in blue collar men (IRR: 1.513 [1.01;2.27]) and 6 years later in women (IRR: 1.669 [1.10;2.53]) (lagged) - NS (FE) - NS (IV)

Notes: Results of three types of model are presented: the dynamic model with lagged health variables (lagged), the fixed-effect model (FE), and the fixed-effect model with instrumental variables (IV). NS stands for Not Significant. Different types of estimates are reported according to the link function used in the models: Odds Ratios (OR) for logistic regressions, Incidence Rate Ratio (IRR) for negative binomial models, and coefficients for linear regressions. CVD means cardiovascular diseases, HBP high blood pressure. Results in light grey are those which do not support detrimental labour market outcomes.

Table 5. Summary of findings, Effect on early retirement

Outcomes		USA (PSID)	European countries (SHARE)	USA (HRS)
Early retirement	Obesity	**Negative effect on early retirement in women** - Negative effect on early retirement 2 years later for blue collar women (OR: 0.285 [0.09;0.93]) (lagged) - NS (FE) - NS (IV)	**Positive effect on early retirement in men** - Positive effect on early retirement in men 4 years later (OR:1.62[0.99;2.65]) (lagged) - NS (FE) - NS (IV)	NS (lagged var)
	Smoking	**Positive effect of smoking on early retirement in men, negative in women** - *Negative effect of smoking* on early retirement in blue collar women (OR for never-smk vs. smk: 13.93 [3.51;55.25] 2 years later, 7.96 [1.55;40.88] 4 years later, 14.27 [3.16;64.34] 6 years later), but Positive effect in blue collar men (OR for never-smk vs. smok: 0.12 [0.01;0.9] 4 years later). - Positive effect of quitting smoking (vs. smoking) on early retirement in blue collar women (OR for ex-smk vs. smk: 11.91 [2.84;49.0] 2 years later, 8.63 [1.76;42.3] 6 years later), Negative effect in blue collar men (OR for ex-smk vs. smk: 0.12 [0.01;0.9] 4 years later) (lagged) - Negative effect of quitting smoking (vs. smoking) in women (coef. for ex-smk vs smk: 0.13 [0.04;0.23]) (FE) - NS (IV)	**Strong evidence for positive impact of smoking on early retirement in women** - Positive effect on early retirement in women 4 years later (OR for Smoking vs Non-smk:1.72[0.99;3.00]) (lagged) - NS (FE) - Positive effect on early retirement in men (Coeff:0.40[-0.02;0.82], p-value=0.06) (IV)	NS (lagged)
	Drinking	**Negative effect of HD on early retirement** - HD: Negative effect on early retirement in blue collar women (OR: 0.02 [0.00;0.14] 4 years later, 0.16 [0.03;0.87] 6 years later) (lagged) - HD: Negative effect on early retirement in white men collar (coef.: -0.10 [-.20; -0.005]) (FE) - NS (IV)	Not included	NS (lagged)
	CVD	NS (lagged, FE and IV)	**Positive effect on early retirement in men, negative in women** - Positive effect on early retirement in men 6 years later (OR:2.60[1.13:5.98]) (lagged) - Negative effect on early retirement in women (OR: 0.50[0.24;1.02]) (FE)	NS (lagged)
	HBP	NS (lagged, FE and IV)	NS (lagged var) NS (FE)	NS (lagged)
	Cancer	**Positive effect on early retirement in men** - NS (lagged) - Positive effect in men (coef: 0.05 [0.01;0.09]) (FE) - NS (IV)	**Positive effect on early retirement in women** - NS (lagged var) - Positive effect on early retirement in women (OR:2.49[1.16;5.32]) (FE)	NS (lagged)
	Diabetes	**Positive effect on early retirement in women, negative in men** - Negative effect on early retirement in blue collar men (OR: 0.378 [0.20;0.73] 2 years later, 0.28 [0.14;0.56] 4 years later, 0.24 [0.12;0.49] 6 years later) (lagged) - Positive effect in white collar women (coef: 0.11 [0.031;0.19] (FE) - NS (IV)	NS (lagged) NS (FE)	NS (lagged)
	Arthritis	NS (lagged, FE and IV)	NS (lagged) NS (FE)	NS (lagged)

Notes: Results of three types of model are presented: the dynamic model with lagged health variables (lagged), the fixed-effect model (FE), and the fixed-effect model with instrumental variables (IV). NS stands for Not Significant. Different types of estimates are reported according to the link function used in the models: Odds Ratios (OR) for logistic regressions, Incidence Rate Ratio (IRR) for negative binomial models, and coefficients for linear regressions. CVD means cardiovascular diseases, HBP high blood pressure. Results in light grey are those which do not support detrimental labour market outcomes

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