

Work Organization, Exposure to Workplace Hazards and Sickness Presenteeism in the European Employed Population

Angelo d'Errico, MD,^{1*} Chiara Ardito, MSc,² and Roberto Leombruni, PhD^{2,3}

Background *Aim of the study was to identify work organization features and workplace hazards associated with sickness presenteeism (SP) among European workers.*

Methods *The study was conducted on data from the European Working Conditions Survey 2010 and included a study population of 30,279 employees. The relationship between work-related factors and SP was assessed through Poisson multivariate robust regression models, adjusting for significant ($P < 0.05$) individual and work-related characteristics.*

Results *SP for at least 2 days in the previous year was reported by 35% of the workers. In fully adjusted model, several psychosocial (decision authority, skill discretion, reward, abuse; psychological, cognitive, and emotional demand), and organizational factors (shift work, working with clients, long work hours) were positively associated with SP, whereas job insecurity and exposure to physical factors (lifting or moving people, vibration) decreased SP risk.*

Conclusions *Our results support the importance of work-related factors, especially psychosocial exposures and organizational features, in determining workers' SP. Am. J. Ind. Med. 59:57–72, 2016. © 2015 Wiley Periodicals, Inc.*

KEY WORDS: *sickness presenteeism; work; psychosocial hazards; physical hazards; epidemiology*

INTRODUCTION

Sickness presenteeism (SP) is a concept used to indicate the phenomenon of people who attend work despite being sick or feeling like they should have taken sick leave [Aronsson et al., 2000]. This definition of SP is the one mainly employed by European studies, whereas in U.S.

studies, where generally there is a strong focus on the consequences of presenteeism on productivity, its definition includes also a reduced performance at work, besides illness [Lerner et al., 2000].¹ Interest in SP has been fostered by studies estimating that its costs would be higher than those attributable to both medical expenses for the treatment of a health condition and sickness absence [Goetzel et al., 2004; Hemp, 2004]. Furthermore, the results of longitudinal studies indicate that SP may increase the risk of developing future health disorders [Kivimäki et al., 2005; Bergström et al., 2009], presumably because it reduces the possibility of recovery [Aronsson and Gustafsson, 2005].

SP is common, according to the reports of several studies, where around 50% or more of the general working population was found to go work while ill at least once during

¹Department of Epidemiology, Piedmont Region, Grugliasco, Italy

²Department of Economics and Statistics "Cognetti De Martiis", University of Torino, Italy

³LABORatorio Revelli, Torino, Department of Economics and Statistics "Cognetti De Martiis", University of Torino, Italy

*Correspondence to: d'Errico Angelo, MD, Department of Epidemiology, Piedmont Region, Local Health Unit ASL TO 3, Via Sabaudia 164, Grugliasco (TO) 10095, Italy. E-mail: angelo.derrico@epi.piemonte.it

Accepted 26 July 2015

DOI 10.1002/ajim.22522. Published online in Wiley Online Library (wileyonlinelibrary.com).

¹ However, recently some North American authors (e.g., Johns, 2010) also use the "sickness presenteeism" definition of presenteeism.

the previous year [Aronsson and Gustafsson, 2005; Hansen and Andersen, 2008; Leineweber et al., 2012; Jourdain and Vézina, 2013].

The wide diffusion of presenteeism, its high costs and its negative consequences on health, all characterize this issue as an important public health problem.

Ill health, in terms of acute episodes of illness or chronic disorders, constitutes part of the conceptual definition of SP and, therefore, is a prerequisite for it [Aronsson and Gustafsson, 2005]. Several chronic health conditions have been reported to increase the risk of presenteeism, including migraine, allergies, irritable bowel syndrome, gastroesophageal reflux disease, mental health problems, and musculoskeletal pain [Aronsson et al., 2000; Marlowe, 2002; Schultz and Edington, 2007]. Furthermore, subjects with multiple health conditions display a higher level of presenteeism than those with fewer or no diseases [Lerner et al., 2000; Schultz and Edington, 2007]: beyond the fact that health problems are precondition for SP, to explain this finding it has been suggested that these workers would attend work in spite of illness because “they have already taken too much time off and are obligated to work” [Lerner et al., 2000].

Sickness absence has been also found positively correlated with SP in several studies [Aronsson et al., 2000; Caverley et al., 2007; Elstad and Vabø, 2008], likely because both indicators are correlated with health status, in terms of presence of health conditions and functional limitations. SP represents an alternative choice to sickness absence, in the sense that a worker facing a health event would, in theory, have the opportunity to decide whether or not to take a sick leave, based on several factors, including the perceived legitimacy of the absence (e.g., type and severity of symptoms), the characteristics of the job (e.g., the extent of physical engagement of the worker in performing it), and the pressures and/or constraints put on the workers in order to reduce sickness absence [Aronsson and Gustafsson, 2005; Johansson and Lundberg, 2004; Roelen and Groothoff, 2010].

Several work-related characteristics have been reported as risk factors for SP. From empirical research, among structural and organizational factors, presenteeism has been found positively associated with employment in jobs involving care or help to others [Aronsson et al., 2000], smaller size of the firm/institution [Hansen and Andersen, 2008], understaffing [Caverley et al., 2007], and working long hours [Hansen and Andersen, 2008]. Adverse working conditions have also been found to increase SP, especially exposure to psychosocial hazards, including time pressure, high workload, and conflicting demands [Aronsson and Gustafsson, 2005; Elstad and Vabø, 2008; Hansen and Andersen, 2008; Demerouti et al., 2009; Claes, 2011], low control over work tasks [Aronsson and Gustafsson, 2005; Gosselin et al., 2013] and work–family conflicts [Johns, 2011, Musich et al., 2006]. Interestingly, also favorable workplace characteristics, such as good relationship and

cooperation with colleagues, were positively associated with SP in some studies [Biron et al., 2006; Hansen and Andersen, 2008].

In the conceptual framework proposed by Johansson and Lundberg [2004] and Johns [2010], known as the “illness flexibility model,” two main groups of work factors are believed to have the greatest influence: pressure for attendance and adjustment latitude. The first one would include characteristics increasing attendance directly, such as availability and percent of wage replacement [Chatterji and Tilley, 2002], as well as other factors expected to increase SP indirectly, such as time pressure [Demerouti et al., 2009], less ease of replacement [Johns, 2011; Aronsson and Gustafsson, 2005; Caverley et al., 2007], teamwork [Johns, 2009], working during non-standard hours [Camerino et al., 2010], and job insecurity [Caverley et al., 2007; Heponiemi et al., 2010]. Different mechanisms have been invoked to explain the effect of these factors: time pressure, together with low replaceability, would act through preventing workers from taking sick leaves because of piling up of work, that they will need to complete after absence [Hansen and Andersen, 2008]; teamwork and working during non-standard hours would operate through pressure for attendance from other team members or colleagues [Grinyer and Singleton, 2000], whereas job insecurity would increase presenteeism because of fear of job loss, especially among low-wage workers and in periods of high unemployment [Hansen and Andersen, 2008]. Regarding adjustment latitude, its positive association with SP would be attributable to the fact that workers who have higher control on their work tasks have greater possibility to adjust their performance in terms of pace and schedule when not feeling well [Johansson and Lundberg, 2004].

Different individual characteristics have also been found to increase presenteeism, such as female gender [Aronsson and Gustafsson, 2005], living in a household with a sick spouse or a high number of children [Kristensen, 1991; Hansen and Andersen, 2008] and over-commitment to work [Hansen and Andersen, 2008].

However, it has been commented that research on causes of presenteeism is still in an early phase of development [Johns, 2010], also considering the low variance explained by the associated factors in most studies [Hansen and Andersen, 2008]. On one hand, no study formally tested the predictive validity of the “illness flexibility model” on SP, especially because uncertainty on the whole set of work characteristics determining pressure for attendance has limited so far the development of validated measurement tools or scales to assess exposure to this dimension. On the other hand, there is a lack of studies on the relationship between SP and exposure to psychosocial stress at work according to the two most diffused conceptual frameworks, that is, the “demand-control-support” [Karasek, 1985; Johnson and Hall, 1988] and the “effort-reward imbalance”

model [Siegrist, 1996]. Furthermore, only a couple of researches have explored the association of SP with exposure to physical and environmental hazards: among them, one found a positive association between exposure to physical demand and presenteeism in a large cohort of Swedish young adults [Löve et al., 2010], whereas the other one reported bending/twisting the upper body to increase the risk of SP, defined as productivity loss, in a sample of Dutch workers [Alavinia et al., 2009]. Last, only a few studies assessed psychosocial hazards as risk factors for SP in large representative samples of the general employed population, allowing to examine with sufficient statistical power associations with low-prevalence work-related factors [Aronsson et al., 2000; Johansson and Lundberg, 2004; Aronsson and Gustafsson, 2005; Hansen and Andersen, 2008; Nyberg et al., 2008; Löve et al., 2010; Leineweber et al., 2012; Jourdain and Vézina, 2013].

Hence, the main aim of this study was to assess which work-related factors were associated with SP among European workers, with a particular focus on the “illness-flexibility model” [Johansson and Lundberg, 2004], on the two most popular stress models cited above, i.e. the “demand-control-support” [Karasek, 1985; Johnson and Hall, 1988] and the “effort-reward imbalance” model [Siegrist, 1996], and on physical hazards. For this purpose, we used data from the 5th European Working Conditions Survey (EWCS), conducted in 2010 on a representative sample of the general working population in 34 countries belonging to the EU or candidate to join the Union. This survey gives on one hand the opportunity to contribute to the knowledge on the subject, since it explicitly asked individuals whether they did work when they were sick during the last 12 month; on the other hand, detailed information was collected in this survey on a large number of organizational, physical, environmental and psychosocial factors in the workplace that may affect the extent of presenteeism.

MATERIALS AND METHODS

Data Collection

The European Working Conditions Survey (EWCS) has been conducted every 5 years in the European countries since 1990 by the European Foundation for the Improvement of Living and Working Conditions (Eurofound). Main objective of this survey is to measure aspects of working conditions and to monitor their trend in time in European countries. The Fifth edition (2010) covered the 27 EU member countries, as well as four candidate countries (Croatia, Macedonia, Montenegro, Turkey), two potential candidates (Albania and Kosovo), and one country as a member of the European Free Trade Association (Norway).

The population surveyed was a representative sample of the employed population aged 15 years and over in each country (16 years and over in Spain, UK, and Norway), selected according to a multistage, stratified random sampling design [Eurofound, 2012].

Interviews were administered in person to the respondents in their homes by trained interviewers. Participation in the survey was 44% overall, although with broad variation among countries (from a minimum of 31% in Spain to a maximum of 74% in Latvia). The final sample included 43,816 subjects, of whom 22,781 men and 21,035 women. The interview questionnaire was composed of more than a hundred questions on socio-demographics, occupation and economic sector of employment, features of work organization and exposure to psychosocial, ergonomic and environmental hazards, as well as questions on health status and on health conditions, sickness absence and SP in the previous year (accessible from: <http://www.eurofound.europa.eu/surveys/ewcs/2010/documents/masterquestionnaire.pdf>).

In the analyses, several work-related characteristics were investigated as possible determinants of SP, including work organizational features and exposure to psychosocial and physical hazards.

Structural and organizational factors examined were: economic sector (ten sectors, based on 1-digit NACE 10 classification), occupational social class (high-skilled white collars, low-skilled white collars, high-skilled blue collars, low-skilled blue collars), type of employment (permanent contract, fix-term contract, temporary agency or other forms of contract, no contract), productivity payments (yes/no), firm size (1, 2–9, 10–49, 50+ workers), working in private or public sector (private, public, NGO/no-profit organizations), time schedule (<35, 35–40, >40 hr/week), teamwork (yes/no), responsibility for the work of other people (0, 1–5, 6+ people), working with clients (almost never or never, 25–50%, more than 50% of the work day), and shift work (0–100 scale based on scores from multiple questions, where 100 is the score of the highest level of shift work, divided in four categories: 0, 1–25, 26–50, >50).

Exposure to psychosocial factors at work was assessed, by means of single or multiple items, through self-assessed frequency/duration of the exposure, level of agreement about the exposure to and presence or absence of exposure to a specific factor. Frequency/duration of exposure was used for social support from colleagues and supervisors, psychological (quantitative) demand, decision authority, emotional demand, and demand for hiding emotions. In turn, the level of job insecurity, job reward, sense of community in the workplace, and work–family conflicts depended on how much workers agreed with statements concerning the exposure to these psychosocial factors on a Likert scale. Finally, the presence or not of the exposure at the dichotomous level was employed for cognitive demand, skill discretion, discrimination and abuse. For three of the

psychosocial dimensions based on multiple questions (psychological demand, decision authority, sense of community), corresponding scores were summed, rescaled to a 0–100 scale and divided in tertiles.

Full details on the construction of the psychosocial indicators, together with Cronbach's α s for composite measures, are presented in Table I. The association of job strain and effort-reward imbalance (ERI) with presenteeism was also examined; in this analysis, the score of the job strain scale was computed as the ratio of the values of psychological demand by those of the job control scale, obtained summing decision authority and skill discretion scores, whereas the effort-reward scale was built as the ratio of demand by reward scores. Summary scores of job strain and ERI were then divided in tertiles to examine their relation with SP.

In order to examine the association between the illness-flexibility model and SP, a "pressure for attendance" scale was built, based on the available variables in the survey which were expected to be part of this construct: psychological (quantitative) demand, teamwork, shift work, emotional demand, working with clients, and time schedule. Exposure to these factors was recoded as 0, 1, and 2, for no, low and high exposure, respectively, except for shift work (4 categories: 0, 1, 2, and 3 for exposure equal to 0, score <25, 25–50, >50, respectively) and teamwork (dichotomous variable coded as 0 or 1, for no or yes); the score corresponding to each factor was then summed to obtain an overall score of the scale. The scale had a score range from 0 to 13 and mean = 5.4 (sd = 2.5). In spite of the low internal consistency observed for this scale (Cronbach's $\alpha = 0.30$), its association with SP was anyway evaluated, based on the consideration that such a low consistency likely reflects the number of the exposure dimensions that this scale is intended to capture.

Physical and environmental hazards at work were all assessed through single questions concerning exposure duration during the work day. Answering options varied on seven possible frequency categories (all the time, almost all the time, around $\frac{3}{4}$ of time, around half time, around $\frac{1}{4}$ of time, almost never, never), which were reduced to the following three classes: (i) high exposure: all the time, almost all the time or around $\frac{3}{4}$ of time; (ii) intermediate exposure: around half time or around $\frac{1}{4}$ of time; and (iii) low exposure: almost never or never. Physical hazards included tiring or painful postures, lifting or moving people, carrying or moving heavy loads, standing, repetitive movements with arm/hand; environmental hazards included exposure to noise, vibration, high and low temperatures, fumes, solvents, environmental tobacco smoke, handling chemicals, handling biological fluids or wastes.

SP was assessed through two questions: "Over the past 12 months did you work when you were sick?" and "If yes, number of working days: ..." The outcome

variable was defined as having worked at least two days while ill in the previous 12 months, as in many previous studies on presenteeism [Aronsson et al., 2000; Aronsson and Gustafsson, 2005; Elstad and Vabø, 2008; Bergström et al., 2009; Heponiemi et al., 2010]. Self-employed workers ($n = 7,374$) and subjects who reported their house as the main place of work ($n = 596$) were excluded, because of possible differences in the meaning of SP for these groups of workers. Workers employed in armed forces occupations ($n = 201$) were also excluded, because their attendance requirements are expected to be different from those of civilian workers in most countries. Other 1,777 subjects with missing data on SP were excluded, together with 3,589 subjects reporting not having been sick in the previous year, given that illness is a prerequisite for presenteeism. The final study population was composed of 30,279 employees, 53.6% of which males.

Data Analysis

Statistical analyses were performed using the software Stata 13, estimating prevalence ratios (PR) of SP by means of multivariate Poisson regression models with the Huber–White sandwich estimator of variance, which has been shown to be an appropriate alternative method to logistic regression when examining frequent outcomes [Barros and Hirakata, 2003]. All analyses were weighted using the general sampling weights provided by Eurofound.

In a first step, the effect of each work factor was examined separately, through an analysis adjusted for country, age (continuous), and various health indicators, including: (i) self-perceived general health (four categories: very good, good, fair, poor/very poor); (ii) mental health: WHO-5 index on a 0–100 scores scale, divided in three categories: high (score: ≥ 48), intermediate (score: 29–48), low (score: <29; WHO, 1998); and (iii) health problems over the last 12 months: hearing, skin, backache, pain in shoulder, neck and/or upper limbs, pain in lower limbs, headache and/or eye strain, stomach ache, respiratory difficulties, cardiovascular diseases, fatigue, insomnia, wounds, other diseases (all yes/no variables).

Subsequently, multivariate models were fitted, exploring the association with the outcome of all covariates with $P < 0.25$ at the previous step in rank order of their significance [Hosmer and Lemeshow, 2000], and selecting those with $P < 0.05$ in the fully adjusted models, through a forward manual procedure. In these analyses, results were adjusted also for household composition (four categories: single without kids, single parent, couple without kids, couple with kids), educational level (four categories: primary, low secondary, high secondary, tertiary education),

TABLE I. Scheme for the Construction of the Psychosocial Dimensions

Scale	Questions used (question number and legend) and answer format	Cronbach's alpha
	Domain: Demands at work	
PSYCHOLOGICAL DEMAND	Q45A: Does your job involve working at very high speed? (5 = all of the time or almost all of the time, 4 = around 3/4 of the time, 3 = around half of the time, 2 = around 1/4 of the time, 1 = almost never or never) Q45B: Does your job involve working to tight deadlines? (5 = all of the time or almost all of the time, 4 = around 3/4 of the time, 3 = around half of the time, 2 = around 1/4 of the time, 1 = almost never or never) Q51G: You have enough time to get the job done (1 = never, 2 = rarely, 3 = sometimes, 4 = most of the time, 5 = always) Q51K: You know what is expected of you at work (5 = never, 4 = rarely, 3 = sometimes, 2 = most of the time, 1 = always)	0.60
COGNITIVE DEMAND	Q49E: Does your main paid job involve complex tasks? (yes/no)	
EMOTIONAL DEMAND	Q51M: You get emotionally involved in your work (high = always or most of the time, intermediate = sometimes, low = rarely or never)	
DEMAND FOR HIDING EMOTIONS	Q51P: Your job requires that you hide your feelings (high = always or most of the time, intermediate = sometimes, low = rarely or never)	
	Domain: Work organization and job contents	
SKILL DISCRETION & DEVELOPMENT DECISION AUTHORITY	Q49F: Does your main paid job involve learning new things (yes/no) Are you able to choose or change: • Q50A: your order of tasks (1 = yes, 0 = no) • Q50B: your methods of work (1 = yes, 0 = no) • Q50C: your speed or rate of work (1 = yes, 0 = no) Q51C: You are consulted before targets for your work are set (5 = always, 4 = most of the time, 3 = sometimes, 2 = rarely, 1 = never) Q51E: You have a say in the choice of your working partners (5 = always, 4 = most of the time, 3 = sometimes, 2 = rarely, 1 = never) Q51I: You are able to apply your own ideas in your work (5 = always, 4 = most of the time, 3 = sometimes, 2 = rarely, 1 = never) Q51O: You can influence decisions that are important for your work (5 = always, 4 = most of the time, 3 = sometimes, 2 = rarely, 1 = never)	0.80
	Domain: Interpersonal relations and leadership	
SOCIAL SUPPORT FROM COLLEAGUES	Q51A: Your colleagues help and support you (high = always or most of the time, intermediate = sometimes, low = rarely or never)	
SOCIAL SUPPORT FROM SUPERVISORS	Q51B: Your manager helps and supports you (high = always or most of the time, intermediate = sometimes, low = rarely or never)	
SENSE OF COMMUNITY	Q77D: I feel 'at home' in this organization (5 = strongly agree, 4 = agree, 3 = neither agree nor disagree, 2 = disagree, 1 = strongly disagree) Q77E: I have very good friends at work (5 = strongly agree, 4 = agree, 3 = neither agree nor disagree, 2 = disagree, 1 = strongly disagree) Q77G: The organization I work for motivates me to give my best job performance (5 = strongly agree, 4 = agree, 3 = neither agree nor disagree, 2 = disagree, 1 = strongly disagree)	0.70
JOB REWARD	Q77B: I am well paid for the work I do (high = strongly agree or agree, intermediate = neither agree nor disagree, low = disagree or strongly disagree)	
DISCRIMINATION	Q65A,B,C,D,E,F,G: Positive answer to any of seven yes/no questions on various forms of discrimination at work (linked to age, sex, ethnicity, nationality, religion, disability, sexual orientation)	
ABUSE	Q70A,B,C; Q71A,B,C: Positive answer to any of six yes/no questions on various forms of abuse at work (verbal abuse, threats and humiliating behavior, bullying, unwanted sexual attention, sexual harassment, physical violence)	
	Domain: Work-individual interface	
WORK-LIFE CONFLICTS	Q41: In general, how do your working hours fit in with your family or social commitments outside work? (low = very well, intermediate = well, high = not very well, very high = not at all well)	
JOB INSECURITY	Q77A: I might lose my job in the next six months (high = strongly agree or agree, intermediate = neither agree nor disagree, low = disagree or strongly disagree)	

and sickness absence in the previous 12 months (three categories: 0, 1–5, 5+ days), as potential confounders.

Given the conceptual overlapping of both the job strain and the effort-reward dimensions with psychosocial demand, decision authority, skill discretion and reward, three different multivariate models were fitted. In the first model, psychosocial demand, decision authority, skill discretion, and reward were kept as distinct measures; the second one included the high strain and reward dimensions, whereas the third one was set with effort-reward, decision authority, and skill discretion. The association between SP and the demand-control-support model was evaluated testing the interactions on SP of job strain with both support from supervisors and coworkers, in order to assess whether the association between job strain and SP was modified by these support dimensions.

The association of SP with the pressure for attendance scale was evaluated dividing it in quintiles; as for job strain and ERI, the variables used to build this scale were excluded from the construction of the fully adjusted model. The interaction between the pressure for attendance (in quintiles) and the job control (in tertiles) scales was also examined, to evaluate the combined effect of these dimensions on SP risk, according to the proposed “illness-flexibility model.”

RESULTS

Characteristics of the study population are shown in Tables II–IV, together with SP prevalence and prevalence ratios of SP associated to each characteristic. Presenteeism for more than 1 day during the previous 12 months was reported by 35.0% of workers (33.2% among males and 37.1% among females) and was highest in Montenegro, Slovenia, Turkey, United Kingdom, and in the Scandinavian countries, whereas it was lowest in Italy, Bulgaria, Poland, and Portugal (Table II). In the analysis adjusted for country, age, gender, and health status, small differences in SP were present by gender or by household characteristics; in contrast, SP was more diffuse in the age class 25–34, among high-skilled white collars and among workers with higher education. Regarding health, SP was significantly increased among workers reporting more sickness absence, worse perceived physical health, lower levels of mental health and several health conditions or symptoms in the previous year, including headache, insomnia, stomach ache, wounds, pain in the back, and in the upper limbs (Table II).

Concerning structural and organizational work features, in the analysis adjusted for country, age, gender, and health status, SP was significantly increased among workers employed in public firms or in companies with more than 50 employees, those working more than 40 hr, or working on shifts, in team, in contact with clients or who have

responsibility for other workers (Table III). SP was also significantly higher among subjects employed in education, public administration, trade, and health care, compared to those in manufacturing, whereas it was significantly lower among workers with no contract, compared to permanent employees (Table III). Significant associations were observed for all psychosocial exposures examined, except for sense of community, coworkers' and supervisor's support (Table IV). Pressure for attendance showed the strongest association with SP, with a RR = 1.64 (95%CI: 1.50–1.79) associated to the highest quintile of exposure and a significant trend in risk across ordered exposure categories ($P < 0.001$). Among physical and environmental exposures, only standing, repetitive hand/arm movements, vibration and environmental tobacco smoke were significantly associated with SP (Table IV).

In the fully adjusted model (Table V), most of the significant associations observed with psychosocial exposures in the previous step were confirmed, whereas those with structural and organizational factors became lower and non-significant, except for any type of shift work (PR = 1.17, PR = 1.21, and PR = 1.15 for low, intermediate, and high exposure, respectively), working more than 40 hr (PR = 1.16) and working with clients (PR = 1.11 and PR = 1.10 for intermediate and high exposure, respectively). Concerning psychosocial factors, presenteeism was significantly higher among workers reporting higher levels of decision authority (intermediate: PR = 1.14, high: PR = 1.19) or psychological demand (intermediate: PR = 1.16, high: PR = 1.20), high skill discretion (PR = 1.10), high cognitive demand (PR = 1.10), intermediate level of emotional demand (PR = 1.10), high reward (PR = 1.23), and abuse (PR = 1.16); in contrast, subjects in the intermediate category of job insecurity displayed a lower risk (PR = 0.92; Table V). Among physical and environmental factors, only exposure to lifting or moving people (intermediate: PR = 0.89, high: PR = 0.83) and to vibration (intermediate: PR = 0.89, high: PR = 0.90) were significantly associated with a reduced presenteeism (Table V).

In the multivariate model including job strain and reward (Table VI), exposure to intermediate levels of job strain were associated with a significantly increased risk of SP (PR = 1.09), while for the highest tertile a slightly non-significant reduced risk was found (PR = 0.98). No significant interaction was found between job strain and supervisor's or coworkers' support on SP risk ($P > 0.20$ for both). In the model with the effort-reward imbalance, decision authority, and skill discretion dimensions (Table VI), ERI was positively associated with SP, although only the prevalence ratio for the highest tertile of exposure was significant (PR = 1.15). In these models, the associations observed with other work factors were the same as in the model including all psychosocial factors

TABLE II. Frequency Distribution of the Study Population (n = 30,279), by Socio-Demographic Characteristics and Associated Prevalence and Prevalence Ratios (PR) of Presenteeism

Socio-demographic and health characteristics	Category	Pop (%)^a	Presenteesim (%)	PR	95%CI
Country ^b	Belgium	2.7	35.4	1	—
	Bulgaria	2.1	20.2	0.68	0.56–0.84
	Czech Republic	2.3	34.3	1.03	0.88–1.21
	Denmark	3.1	48.3	1.66	1.46–1.89
	Germany	5.7	34.6	1.13	1.00–1.28
	Estonia	2.7	42.1	1.25	1.09–1.43
	Greece	1.7	26.1	0.91	0.76–1.10
	Spain	2.7	32.3	1.13	0.97–1.32
	France	7.2	40.9	1.21	1.07–1.36
	Ireland	2.4	35.5	1.38	1.18–1.61
	Italy	3.3	18.0	0.54	0.45–0.65
	Cyprus	2.0	23.9	0.85	0.70–1.02
	Latvia	10.5	42.3	1.38	1.24–1.55
	Lithuania	2.6	32.8	0.96	0.82–1.12
	Luxemburg	2.6	41.6	1.34	1.17–1.54
	Hungary	2.6	35.8	1.07	0.93–1.24
	Malta	2.3	44.0	1.57	1.36–1.81
	The Netherland	2.6	34.5	1.19	1.02–1.38
	Austria	2.5	30.7	1.05	0.90–1.24
	Poland	3.6	20.7	0.67	0.57–0.80
	Portugal	2.4	20.6	0.60	0.49–0.72
	Romania	1.5	28.7	0.91	0.74–1.11
	Slovenia	3.7	55.6	1.70	1.51–1.91
	Slovakia	2.5	41.8	1.27	1.10–1.46
	Finland	2.9	45.7	1.32	1.16–1.51
	Sweden	2.7	48.6	1.62	1.41–1.86
	United Kingdom	4.1	45.9	1.62	1.43–1.83
	Croatia	2.9	35.9	1.13	0.98–1.31
	Macedonia	2.0	31.1	0.93	0.75–1.15
	Turkey	2.6	46.3	1.23	1.07–1.41
	Norway	3.2	45.1	1.59	1.39–1.82
	Albania	0.6	42.1	1.37	1.07–1.77
Kosovo	0.6	22.3	0.84	0.59–1.18	
Montenegro	1.1	61.1	1.82	1.55–2.15	
Age class ^c	15–24	11.2	30.2	1	—
	25–34	24.9	37.5	1.20	1.08–1.33
	35–44	27.0	36.0	1.10	0.99–1.21
	45–54	24.3	35.4	1.00	0.90–1.11
	55+	12.6	31.1	0.89	0.79–1.00
Gender ^d	Males	53.6	33.2	1	—
	Females	46.4	37.1	1.04	0.98–1.09
Occupational class ^e	High-skilled white collar	21.5	44.1	1	—
	Low-skilled white collars	44.6	33.7	0.79	0.75–0.84
	High-skilled blue collars	15.0	28.4	0.69	0.63–0.76
	Low-skilled blue collars	18.9	32.8	0.73	0.68–0.79
Educational level ^e	Primary	5.1	30.2	1	—
	Low secondary	27.1	33.3	1.11	0.97–1.28

(Continued)

TABLE II. (Continued)

Socio-demographic and health characteristics	Category	Pop (%) ^a	Presenteesim (%)	PR	95%CI
Household composition ^e	High secondary	38.8	32.1	1.20	1.05–1.37
	Tertiary	29.0	41.4	1.42	1.24–1.62
	Single without kids	26.5	32.4	1	—
	Single parent	7.4	39.1	1.10	0.99–1.21
	Couple without kids	22.2	34.6	1.07	0.99–1.15
Sickness absence ^e	Couple with kids	43.6	36.2	1.11	1.04–1.18
	0 days	52.5	30.1	1	—
	1–5 days	21.0	43.0	1.24	1.17–1.32
General health ^f	>5 days	22.9	38.9	1.10	1.04–1.17
	Good or very good	78.9	32.4	1	—
	Fair	18.9	43.9	1.45	1.37–1.54
WHO-5 mental health index ^f	Bad or very bad	2.2	51.3	1.64	1.45–1.86
	High (≥ 48)	83.5	32.8	1	—
	Medium (>28 and <48)	9.3	46.9	1.45	1.35–1.55
Insomnia ^f	Low (≤ 28)	7.2	46.4	1.46	1.36–1.58
	No	80.8	30.8	1	—
Stomach pain ^f	Yes	19.2	52.5	1.64	1.56–1.72
	No	86.0	32.5	1	—
Headache ^f	Yes	14.0	50.0	1.55	1.46–1.64
	No	59.8	28.0	1	—
Upper arm pain ^f	Yes	40.2	45.4	1.62	1.54–1.70
	No	56.7	28.4	1	—
Back pain ^f	Yes	43.3	43.6	1.55	1.47–1.63
	No	54.0	28.7	1	—
Wounds ^f	Yes	46.0	42.4	1.54	1.46–1.62
	No	91.0	33.6	1	—
	Yes	9.0	48.5	1.44	1.35–1.54

^aPercentages computed using sampling weights, except for country, whose proportions are unweighted.

^bPRs adjusted for gender, age, general health, WHO-5 index, insomnia, stomach pain, headache, upper arm pain, back pain, wounds.

^cPRs adjusted for country and gender.

^dPRs adjusted for country and age.

^ePRs adjusted for country, gender, age, general health, WHO-5 index, insomnia, stomach pain, headache, upper arm pain, back pain, wounds.

^fPRs adjusted for country, gender, and age.

separately, with only slight changes in the risk estimates (data not shown).

Regarding pressure for attendance (Table VI), the associated risks of SP decreased in the fully adjusted model, compared to those obtained from the analysis adjusted for country, age, gender and health status, but they remained statistically significant in all exposed categories (RR = 1.14, RR = 1.19, RR = 1.29, RR = 1.47 for the 2nd, 3rd, 4th, and 5th quintiles, respectively, compared to the 1st quintile), with a significant trend across ordered exposure categories ($P < 0.001$). The analysis of interaction between pressure for attendance and job control on SP risk showed that all interaction terms were positive and revealed the presence of significant interactions of the highest quintile of pressure for attendance with the

middle ($P = 0.049$) and the high tertile of job control ($P = 0.006$).

DISCUSSION

In the present study, investigating the relationship between SP and work characteristics, a high prevalence of SP was observed in a sample of European workers. Exposure to various psychosocial and organizational factors was found associated with an increased risk of SP, whereas the contribution of physical and environmental exposures was small.

Several structural and organizational work factors were associated with SP in the analysis adjusted for country, age,

gender, and health status, but only few of these associations persisted in the fully adjusted model (shift work, long working hours, and work with clients). This finding suggests that characteristics of the psychosocial environment are the main mediator of previously observed associations between structural factors, such as economic sector [Aronsson et al., 2000] or company size [Hansen and Andersen, 2008], and SP.

The prevalence of SP observed in the EWCS sample was similar to that found by one of the earliest studies on presenteeism using our same definition (2 or more days of presence in the previous year) in the general working population [Aronsson et al., 2000], but lower than in more recent European works adopting also the same definition, where SP was found around 50% or above [Aronsson and Gustafsson, 2005; Hansen and Andersen, 2008; Elstad and Vabø, 2008]. All these studies have been conducted in the Scandinavian countries, but, even limiting the comparison only to the same countries, the prevalence was still lower in the EWCS sample (42%). Furthermore, also studies conducted in other European countries found a prevalence of SP higher than that observed by us [Robertson et al., 2012; Agudelo-Suárez et al., 2010], although their study population was not representative of the general employed population.

As expected, SP was significantly associated with several health indicators, especially those related to poor mental health and to self-reported pain in various body regions. A positive association between poor health and SP has been confirmed by several studies and it has been suggested that SP may be a proxy for debilitating chronic diseases, which would affect the work capacity of the individuals [Hansen and Andersen, 2008].

The positive associations of SP with psychological and cognitive demand, shift work, and long working hours would support the importance of factors increasing pressure for attendance (see Introduction). Moreover, the increased risk of presenteeism associated with emotional demand and working with clients suggests that working with people outside the organization is another form of pressure for attendance that would play a significant role. This finding is consistent with the high risk of SP observed in sectors involving care for elders, children or diseased, such as education and health care, where exposure to these peculiar forms of demand is very common. Our results confirm previous findings indicating that occupations involving care or help to others may imply a tie with the client/patient/pupil, which would predispose workers to go work despite illness [McKevitt et al., 1997; Aronsson et al., 2000].

The combination of factors expected to be part of the pressure for attendance dimension in a single scale produced the strongest association with SP, with prevalence ratios approaching a 50% increase in the highest exposure quintile, compared to the lowest. Such a finding, together with the significant interaction observed between high pressure for

attendance and middle/high decision latitude (the latter used as a surrogate measure of adjustment latitude) would lend support to the illness-flexibility model, indicating that workers exposed to high pressure for attendance or having high job control would be actually at higher risk of SP, and that high exposure to both work features would further increase SP risk.

Decision authority and skill discretion were positively associated with SP, supporting the hypothesis that workers with higher decision latitude are characterized by higher presenteeism because of the possibility to adjust their performance when sick [Johns, 2010]. However, this issue appears still controversial in the literature, given that some previous studies rather found high job control to decrease the risk of SP [Aronsson and Gustafsson, 2005; Gosselin et al., 2013]; other two studies observed a significantly negative association between job control and SP, but it disappeared when controlling for other predictors [Hansen and Andersen, 2008; Löve et al., 2010]. Karlsson et al. [2010] and Alavinia et al. [2009] also found low control to increase SP, but both studies employed a definition of SP based on productivity loss, besides illness, so their results are not directly comparable with those reported by the other authors. Only two studies examined the effect of the job control subscales: one of them found a significant negative association between decision authority and SP, but only among workers with 30 or more years of job seniority [Jourdain and Vézina, 2013], whereas in the other one no association was present with decision authority, but a positive association was found with skill discretion [Biron et al., 2006].

Concerning other psychosocial exposures, high reward was found to increase SP risk, which is a new finding to our knowledge, suggesting that subjects who are more rewarded in their job are more inclined to attend work when sick. However, as in the present study the “reward” dimension was based on its monetary component, this result needs to be interpreted accordingly, that is, workers who feel paid fairly for their job would be more prone to SP.

Exposure to job strain was also positively associated with SP, but only for the intermediate category and with a lower relative risk than that observed for psychological demand, whereas workers with high job strain exposure displayed a slightly decreased risk. Similarly, a positive association was found between SP and high exposure to ERI, although with a strength of association lower than that observed for the dimension of psychological demand alone. Both these observations may indicate that the pressure for attendance exerted by high psychological demand alone would reduce its effect if workers have low adjustment latitude or they feel that their effort is not sufficiently rewarded by their work organization, which would decrease in turn the likelihood of working when ill.

No association was found between supervisor’s or coworkers’ support and presenteeism, whereas two previous

TABLE III. Frequency Distribution of the Study Population (n = 30,279), by Structural and Organizational Employment Characteristics and Associated Prevalence and Prevalence Ratios (PR) of Presenteeism

Employment characteristics	Category	Pop (%) ^a	Presenteeism (%)	PR ^b	95%CI
Economic sector (NACE 1-digit)	Industry	19.2	32.2	1	—
	Agriculture	2.7	29.3	0.93	0.68–1.29
	Construction	7.4	28.6	1.27	0.93–1.69
	Wholesale, retail, food and accommodation	18.4	35.2	1.19	1.05–1.35
	Transport	5.9	35.5	1.13	0.90–1.43
	Financial services	4.0	35.3	1.21	0.99–1.48
	Public administration	7.0	34.0	1.29	1.10–1.51
	Education	9.4	42.7	1.37	1.20–1.57
	Health	11.0	38.6	1.17	1.02–1.34
	Other services	14.9	35.6	1.07	0.94–1.24
Type of employment	Permanent contract	77.6	35.3	1	—
	Fixed term contract	11.7	34.2	1.01	0.94–1.10
	Temporary agency or other forms of contract	3.4	35.3	1.01	0.86–1.19
	No contract	7.2	35.1	0.87	0.78–0.98
Type of employer	Private	67.9	33.9	1	—
	Public	29.4	37.3	1.07	1.02–1.13
	NGO/no-profit organization	2.7	34.4	0.97	0.83–1.13
Working time schedule	Full time	62.6	33.0	1	—
	Part-time	24.4	34.7	0.98	0.92–1.05
	Long work hours	13.0	45.8	1.29	1.20–1.38
Firm size	1 employee	3.3	29.8	1	—
	2–9 employees	28.7	31.8	1.06	0.92–1.23
	10–49 employees	32.5	34.9	1.09	0.94–1.25
	>49 employees	35.5	38.7	1.19	1.03–1.38
Responsibility for other workers	0	85.5	33.9	1	—
	1–5	8.4	40.4	1.21	1.11–1.32
	>5	6.1	43.7	1.30	1.19–1.42
Productivity payments	No	87.6	35.6	1	—
	Yes	12.4	33.3	1.01	0.93–1.10
Teamwork	No	37.1	32.7	1	—
	Yes	62.9	36.4	1.06	1.00–1.12
Shift work (0–100 score)	Score = 0	53.9	30.0	1	—
	Score <25	19.4	38.6	1.23	1.15–1.31
	Score 25–50	18.0	41.8	1.30	1.22–1.38
	Score >50	8.7	43.2	1.24	1.15–1.35
Work with clients	Almost never or never	34.8	28.8	1	—
	25–50% of the work day	17.1	38.4	1.25	1.16–1.34
	>50% of the work day	48.1	38.2	1.22	1.15–1.30

^aPercentages computed using sampling weights.

^bPRs adjusted for country, gender, age, general health, WHO-5 index, insomnia, stomach pain, headache, upper arm pain, back pain, wounds.

studies on samples of the general working population, one cross-sectional [Jourdain and Vézina, 2013] and the other one longitudinal [Löve et al., 2010], found that presenteeism was negatively associated with social support at work at bivariate analysis, although in both the association became non-significant in fully adjusted models. The slight discrepancy with our results could be attributable to the fact that in our study both supervisor and coworkers' support

were measured by single items, which may have not captured the most important aspects of social support at work, in spite the questions used assess the core dimension of social support, that is, help from others in performing job duties.

The lack of association between sense of community and SP also appears inconsistent with previous studies. Hansen and Andersen [2008] found an increased risk of SP among workers reporting a high degree of cooperation with

TABLE IV. Frequency Distribution of the Study Population (n = 30,279), by Psychosocial, Physical and Environmental Exposures in the Workplace, and Associated Prevalence and Prevalence Ratios (PR) of Presenteeism

Psychosocial and physical hazards	Exposure category	Pop (%)^a	Presenteeism (%)	PR^b	95%CI
Psychological demand	Low	35.7	27.0	1	—
	Intermediate	35.6	35.4	1.17	1.10–1.26
	High	28.7	41.7	1.22	1.14–1.31
Cognitive demand	No	43.0	29.4	1	—
	Yes	57.0	39.3	1.24	1.18–1.31
Skill discretion	Low	32.0	28.6	1	—
	High	68.0	38.0	1.24	1.17–1.32
Decision authority	Low	41.4	31.1	1	—
	Intermediate	36.5	36.6	1.18	1.11–1.25
	High	22.1	39.6	1.31	1.23–1.39
Coworkers support	Low	9.2	36.6	1	—
	Intermediate	18.5	35.0	0.96	0.87–1.05
	High	72.3	35.1	0.97	0.89–1.06
Supervisor support	Low	18.6	37.9	1	—
	Intermediate	21.9	34.6	0.96	0.89–1.03
	High	59.4	34.4	0.98	0.92–1.05
Sense of community	Low	51.0	37.1	1	—
	Intermediate	24.3	32.1	0.97	0.91–1.03
	High	24.7	33.7	0.99	0.93–1.06
Reward	Low	40.3	32.3	1	—
	Intermediate	27.5	29.6	0.97	0.90–1.03
	High	32.2	43.3	1.18	1.11–1.25
Emotional demand	Low	50.5	29.2	1	—
	Intermediate	23.1	40.0	1.19	1.12–1.27
	High	26.4	42.2	1.19	1.12–1.26
Need for hiding emotions	Low	37.3	31.8	1	—
	Intermediate	22.7	37.7	1.15	1.08–1.23
	High	40.0	36.6	1.19	1.12–1.26
Work–family conflicts	Low	28.9	50.2	1	—
	Intermediate	52.7	42.2	1.11	1.04–1.18
	High	14.4	33.8	1.21	1.12–1.31
	Very high	4.1	31.6	1.28	1.15–1.43
High strain	Low	33.8	31.7	1	—
	Intermediate	33.2	39.0	1.18	1.10–1.26
	High	33.1	34.4	1.06	0.99–1.13
Effort-reward imbalance	Low	34.3	36.4	1	—
	Intermediate	36.6	36.8	0.93	0.88–0.98
	High	29.1	32.2	0.81	0.76–0.87
Pressure for attendance	1 (low)	24.0	24.6	1	—
	2	30.1	32.2	1.20	1.11–1.30
	3	14.5	36.0	1.26	1.14–1.38
	4	20.6	42.5	1.39	1.28–1.51
	5 (high)	10.8	53.7	1.64	1.50–1.79
Job insecurity	Low	35.7	35.0	1	—
	Intermediate	35.6	31.5	0.89	0.83–0.96
	High	28.7	39.3	1.00	0.94–1.06
Discrimination	No	93.3	34.2	1	—
	Yes	6.7	44.7	1.03	0.95–1.12

(Continued)

TABLE IV. (Continued)

Psychosocial and physical hazards	Exposure category	Pop (%) ^a	Presenteeism (%)	PR ^b	95%CI
Abuse	No	85.0	32.0	1	—
	Yes	15.0	52.0	1.22	1.16–1.29
Tiring or painful postures	Low	53.6	32.6	1	—
	Intermediate	24.0	37.4	1.01	0.95–1.08
	High	22.4	38.1	0.95	0.89–1.01
Lifting or moving people	Low	90.8	34.7	1	—
	Intermediate	4.9	37.1	0.97	0.87–1.07
	High	4.3	39.0	0.93	0.84–1.03
Carrying/moving heavy loads	Low	67.4	33.8	1	—
	Intermediate	19.9	36.1	0.98	0.92–1.04
	High	12.6	39.1	0.96	0.89–1.03
Standing	Low	31.1	35.3	1	—
	Intermediate	21.4	35.7	0.97	0.91–1.04
	High	47.6	34.3	0.93	0.88–0.99
Repetitive hand/arm movements	Low	35.8	33.1	1	—
	Intermediate	21.4	34.9	0.97	0.91–1.04
	High	42.7	36.5	0.93	0.88–0.99
Vibration	Low	77.2	36.0	1	—
	Intermediate	10.2	31.0	0.86	0.79–0.94
	High	12.6	31.5	0.82	0.76–0.93
Noise	Low	69.3	33.9	1	—
	Intermediate	16.7	37.5	1.02	0.95–1.08
	High	13.9	37.0	0.97	0.90–1.04
High temperature	Low	76.9	34.1	1	—
	Intermediate	15.3	37.8	0.98	0.91–1.04
	High	7.8	37.6	0.92	0.84–1.00
Low temperature	Low	76.6	33.9	1	—
	Intermediate	16.3	38.3	0.99	0.93–1.06
	High	7.9	38.5	0.96	0.88–1.06
Fumes, powders, dusts	Low	83.4	34.7	1	—
	Intermediate	8.7	35.7	0.98	0.90–1.07
	High	7.9	36.6	0.92	0.84–1.00
Vapors of solvents/diluents	Low	89.7	35.0	1	—
	Intermediate	6.3	31.9	0.90	0.81–1.00
	High	3.9	38.9	0.98	0.87–1.10
Handling chemicals	Low	84.8	34.3	1	—
	Intermediate	9.0	37.0	0.99	0.91–1.08
	High	6.2	40.6	0.99	0.90–1.08
Environmental tobacco smoke	Low	88.1	35.3	1	—
	Intermediate	7.1	32.0	0.89	0.80–0.98
	High	4.8	33.9	0.88	0.78–0.99
Handling biological fluids/wastes	Low	88.4	34.1	1	—
	Intermediate	5.7	38.2	1.00	0.90–1.11
	High	5.9	44.4	1.01	0.93–1.11

^aPercentages computed using sampling weights.^bPRs adjusted for country, gender, age, general health, WHO-5 index, insomnia, stomach pain, headache, upper arm pain, back pain, wounds.

TABLE V. Prevalence Ratios (PR) of Presenteeism for Exposure to Work Factors Statistically Significantly Associated ($P < 0.05$)—Poisson Multivariate Regression

Exposure	Category	PR ^a	95%CI
Decision authority	Low	1	—
	Intermediate	1.14	1.07–1.21
	High	1.19	1.11–1.28
Cognitive demand	No	1	—
	Yes	1.10	1.03–1.17
Abuse	No	1	—
	Yes	1.16	1.09–1.23
Shift work	Score = 0	1	—
	Score <25	1.17	1.09–1.25
	Score 25–50	1.21	1.13–1.30
	Score >50	1.15	1.05–1.25
Skill discretion	Low	1	—
	High	1.10	1.03–1.18
Psychological demand	Low	1	—
	Intermediate	1.16	1.08–1.25
	High	1.20	1.12–1.29
Time schedule	Full time	1	—
	Part-time	1.04	0.97–1.11
	Long work hours	1.16	1.08–1.25
Emotional demand	Low	1	—
	Intermediate	1.10	1.03–1.18
	High	1.06	0.99–1.13
Job insecurity	Low	1	—
	Intermediate	0.91	0.85–0.99
	High	1.00	0.94–1.07
Work with clients	Almost never or never	1	—
	25–50% of the work day	1.11	1.03–1.20
	>50% of the work day	1.10	1.03–1.18
Reward	Low	1	—
	Intermediate	1.02	0.95–1.09
	High	1.23	1.16–1.31
Lifting or moving people	Low	1	—
	Intermediate	0.89	0.79–0.99
	High	0.83	0.74–0.93
Vibration	Low	1	—
	Intermediate	0.89	0.81–0.99
	High	0.90	0.82–0.99

^aFully adjusted model, including also age, country, gender, health status, sickness absence and occupational class.

colleagues, which, however, decreased and lost significance in the final multivariate model. Biron et al. [2006] also reported a positive association of SP with good relationship with colleagues among employees of a Canadian organization. It is worth underlying that the construct of sense of community, although partially overlapping with that of social support from co-workers, differs from it in that in the former social relationships at work are not specifically oriented toward task performing, but rather to the opportunity for pleasant and meaningful

contacts, as well as for feeling part of a greater social system [Schabracq, 2003].

In the fully adjusted model, the positive association between the absence of formal contract and SP vanished, although a moderate level of job insecurity was found to significantly reduce SP risk. Our results are in line with some studies and in contrast with others, as previous empirical evidences is mixed. In several studies, significantly higher SP was observed among subjects reporting low job security [Caverley et al., 2007; Hansen and

TABLE VI. Prevalence Ratios (PR) of Presenteeism for Exposure to Job Strain, Effort-Reward Imbalance, Pressure for Attendance—Poisson Multivariate Regression Models*

Exposure	Category	PR	95%CI
Job strain	Low	1	—
	Intermediate	1.09	1.03–1.16
	High	0.98	0.91–1.06
Effort-reward imbalance	Low	1	—
	Intermediate	1.05	0.98–1.12
	High	1.15	1.06–1.25
Pressure for attendance	1 (low)	1	—
	2	1.14	1.04–1.24
	3	1.19	1.08–1.31
	4	1.29	1.18–1.41
	5 (high)	1.47	1.34–1.62

*Distinct fully adjusted models, including age, country, gender, health status, sickness absence, and other work factors statistically significantly associated with SP ($P < 0.05$).

Andersen, 2008; Heponiemi et al., 2010], although other authors did not find any association [Aronsson et al., 2000; Claes, 2011] or, similarly to us, found that fix-term workers reported even lower presenteeism than permanent ones [Agudelo-Suárez et al., 2010; Heponiemi et al., 2010]. It has been suggested that the lower risk of sickness absence consistently found among temporary workers, compared to tenure ones [Bourbonnais et al., 1992; Virtanen et al., 2003; Bradley et al., 2007], may be actually attributable to higher presenteeism among the former. Our results do not support this view, indicating that differences in sickness absence between permanent and temporary workers are unlikely explained by differences in SP.

Abuse showed a positive association with SP, which appears in contrast with the positive association previously observed between various forms of bullying or threat and sickness absence [Kivimäki et al., 2000; Voss et al., 2001]. However, an increased risk of presenteeism associated with bullying has been reported also by Kittel et al. [2011] in a large cohort of Belgian workers. One explanation is proposed by Hoel et al. [2003], who suggest that abused workers may feel more under pressure to attend work than other subjects, in order “to avoid being associated with malingering or disloyalty, even if medically they would benefit from staying at home.”

Our results do not support the positive association of SP with work–family conflicts observed in other studies [Musich et al., 2006; Johns, 2011]. In the analysis adjusted for country, age, gender, and health status, we also found an increased risk of SP in all exposed categories, compared to the reference one, but these associations decreased and lost significance in the fully adjusted models, suggesting that the associations previously reported may have been the result of

confounding by other work exposures. For example, in the present study the prevalence ratio for the highest category of work–family conflicts changed from 1.28 (Table IV, analysis adjusted for country, age, gender and health status) to 1.09 ($P = 0.13$), adding to the model psychological demand, shift work and working time schedule.

Among physical exposures, only lifting/moving people was associated with a decreased risk of presenteeism, which would indicate that workers may be less willing to go work when sick if exposed to mechanical loads posing a strain of the back. The high prevalence of self-reported back pain in the sample (above 40%) seems to justify this finding. Regarding environmental exposures, the negative association of vibration with SP could also be interpreted as attributable to an avoidance behavior, as for lifting/moving people. However, due to the scarcity of previous studies investigating the effect of physical and environmental exposures on presenteeism, further research seems needed to clarify these relationships.

Finally, the significant positive association between sickness absence and presenteeism, even after controlling for several indicators of health status and other significant independent variables, appears interpretable as attributable to residual confounding by health status, occurring because only part of the health conditions were ascertained through the questionnaire and considered in the study.

Strengths and Limitations

Main strength of this study is that it was conducted on a large representative sample of the European working population, which on one hand allowed assessing with sufficient statistical power the effect of work factors characterized by low prevalence, on the other hand permits to generalize the findings to the employees living in the countries included in the survey. Furthermore, the availability of detailed information on the health status of the workers and on a great number of individual and work-related characteristics gave the opportunity to control in the analysis for the most important potential confounders of the associations investigated, as identified by previous research.

Among limitations, the self-reported information on presenteeism may have been characterized by low accuracy, although high 1-year test–retest reliability was reported by a study that used the same definition of SP employed in the present study [Demerouti et al., 2009]. Another limitation is that the measures of exposure to several workplace hazards, especially for psychosocial factors, were not based on standard and validated scales, although we followed as much as possible theoretical models and concepts. In this effort, scales based on multiple questions, such as for work with clients, skill discretion or work–family conflicts, were afterward abandoned because of their unacceptably low internal consistency, then relying for the assessment on

single items. The single items scales, although focusing on the core concept of the related psychosocial factor, may have captured only partially the complexity corresponding to that dimension. These problems may have caused imprecision in the measurement of the exposure, leading to non-differential misclassification and dilution of the relative risks estimated. Also, it is difficult to exclude that the observed associations with workplace factors have been biased because of differential reporting by case status, possibly attributable to a different perception of workplace characteristics between workers affected or not by presenteeism. This sort of bias may severely threaten the validity of our results, as the direction of the distortion on the risk estimates would be unpredictable. However, because of the broad spectrum of diseases possibly associated with SP, this eventual reporting bias is expected to be smaller than in studies where specific associations between workplace hazards and diseases were investigated, such as those between ergonomic hazards and musculoskeletal disorders or between psychosocial hazards and mental health.

Last, the cross-sectional design of the study does neither allow to rule out selection of the workers displaying higher presenteeism in jobs characterized by peculiar features, such as higher cognitive demands or decision authority, nor to establish the direction of the observed associations.

In conclusion, a high prevalence of SP was observed in this sample of European workers, as more than one-third of European workers declared to have being working while sick at least 2 days in the previous year. The study identified several workplace exposures associated with presenteeism, mainly belonging to the psychosocial domain. In particular, the significant dose-response relationship observed between SP and pressure for attendance, together with the positive significant interaction between this dimension and decision latitude on SP risk, would support the hypothesis that pressure for attendance and adjustment latitude are among the main contributors to presenteeism and that high exposure to both work features would further increase the risk of SP. Regarding other work factors, such as job strain, reward, ERI, abuse and job insecurity, as well as physical and environmental factors, further research seems needed to elucidate their relationship with presenteeism, given that results in the literature are either inconsistent or too sparse.

REFERENCES

- Agudelo-Suárez AA, Benavides FG, Felt E, Ronda-Pérez E, Vives-Cases C, García AM. 2010. Sickness presenteeism in Spanish-born and immigrant workers in Spain. *BMC Public Health* 10:791.
- Alavinia SM, Molenaar D, Burdorf A. 2009. Productivity loss in the workforce: Associations with health, work demands, and individual characteristics. *Am J Ind Med* 52:49–56.
- Aronsson G, Gustafsson K. 2005. Sickness presenteeism: Prevalence, attendance-pressure factors, and an outline of a model for research. *J Occup Environ Med* 47:958–966.
- Aronsson G, Gustafsson K, Dallner M. 2000. Sick but yet at work. An empirical study of sickness presenteeism. *J Epidemiol Community Health* 54:502–529.
- Barros AJ, Hirakata VN. 2003. Alternatives for logistic regression in cross-sectional studies: An empirical comparison of models that directly estimate the prevalence ratio. *BMC Med Res Methodol* 3:21.
- Bergström G, Bodin L, Hagberg J, Lindh T, Aronsson G, Josephson M. 2009. Does sickness presenteeism have an impact on future general health? *Int Arch Occup Environ Health* 82:1179–1190.
- Biron C, Brun JP, Ivers H, Cooper C. 2006. At work but ill: Psychosocial work environment and well-being determinants of presenteeism propensity. *J Public Mental Health* 5:26–37.
- Bourbonnais R, Vinet A, Vézina M, Gingras S. 1992. Certified sick leave as a non-specific morbidity indicator: A case-referent study among nurses. *Br J Ind Med* 49:673–678.
- Bradley S, Green C, Leeves G. 2007. Employment contracts and effort: Why do temporary workers take less absence? Working Paper 026/2007, Lancaster University Management School, UK.
- Camerino D, Sandri M, Sartori S, Conway PM, Campanini P, Costa G. 2010. Shiftwork, work-family conflict among Italian nurses, and prevention efficacy. *Chronobiol Int* 27:1105–1123.
- Caverley N, Cunningham JB, MacGregor JN. 2007. Sickness presenteeism, sickness absenteeism, and health following restructuring in a public service organization. *J Manage Stud* 44:304–319.
- Chatterji M, Tilley CJ. 2002. Sickness, absenteeism, presenteeism, and sick pay. *Oxford Economic Papers*. 54:669.
- Claes R. 2011. Employee correlates of sickness presence: A study across four European countries. *Work Stress* 25:224–242.
- Demerouti E, Le Blanc PM, Bakker AB, Schaufeli WB, Hox J. 2009. Present but sick: A three-wave study on job demands, presenteeism and burnout. *Career Dev Int* 14:50–68.
- Elstad JI, Vabø M. 2008. Job stress, sickness absence and sickness presenteeism in Nordic elderly care. *Scand J Public Health* 36:467–474.
- Eurofound. 2012. Fifth European Working Conditions Survey. Publications Office of the European Union, Luxembourg.
- Goetzel RZ, Long SR, Ozminkowski RJ, Hawkins K, Wang S, Lynch W. 2004. Health, absence, disability, and presenteeism cost estimates of certain physical and mental health conditions affecting U.S. employers. *J Occup Environ Med* 46:398–412.
- Gosselin E, Lemyre L, Corneil W. 2013. Presenteeism and absenteeism: Differentiated understanding of related phenomena. *J Occup Health Psychol* 18:75–86.
- Grinyer A, Singleton V. 2000. Sickness absence as risk-taking behaviour: A study of organisational and cultural factors in the public sector. *Health Risk Soc* 2:7–21.
- Hansen CD, Andersen JH. 2008. Going ill to work—What personal circumstances, attitudes and work-related factors are associated with sickness presenteeism? *Soc Sci Med* 67:956–964.
- Hemp P. 2004. Presenteeism: At work—But out of it. *Harv Bus Rev* 82:49–58.
- Heponiemi T, Elovainio M, Pentti J, Virtanen M, Westerlund H, Virtanen P, Oksanen T, Kivimäki M, Vahtera J. 2010. Association of contractual and subjective job insecurity with sickness presenteeism among public sector employees. *J Occup Environ Med* 52:830–835.

- Hoel H, Einarsen S, Cooper CL. 2003. Organizational effects of bullying. In: Einarsen S, Hoel H, Cooper CL, editors. *Bullying and emotional abuse in the workplace*. New York: Taylor & Francis.
- Hosmer DW, Lemeshow S. 2000. *Applied logistic regression*, 2nd ed. New York: John Wiley & Sons.
- Johansson G, Lundberg I. 2004. Adjustment latitude and attendance requirements as determinants of sickness absence or attendance. Empirical tests of the illness flexibility model. *Soc Sci Med* 58:1857–1868.
- Johns G. 2010. Presenteeism in the workplace: A review and research agenda. *J Organiz Behav* 31:519–542.
- Johns G. 2011. Attendance dynamics at work: The antecedents and correlates of presenteeism, absenteeism, and productivity loss. *J Occup Health Psychol* 16:483–500.
- Johns G. 2009. Absenteeism or presenteeism? Attendance dynamics and employee well-being. In: Cartwright S, Cooper CL, editors. *The Oxford handbook of organizational well-being*. Oxford: Oxford University Press.
- Johnson JV, Hall EM. 1988. Job strain, work place social support, and cardiovascular disease: A cross-sectional study of a random sample of the Swedish working population. *Am J Public Health* 78:1336–1342.
- Jourdain G, Vézina M. 2013. How psychological stress in the workplace influences presenteeism propensity: A test of the demand-control-support model. *Eur J Work Organ Psy* 23:483–496.
- Karasek RA. 1985. *Job content questionnaire and user's guide*. Los Angeles/Lowell, MA: University of Southern California/University of Massachusetts Lowell.
- Karlsson ML, Björklund C, Jensen I. 2010. The effects of psychosocial work factors on production loss, and the mediating effect of employee health. *J Occup Environ Med* 52:310–317.
- Kittel F, Godin I, Clays EE, Casini A. 2011. Is presenteeism a hidden form of sickness absence? *Psychol Health* 26(Suppl. 2):25.
- Kivimäki M, Elovainio M, Vahtera J. 2000. Workplace bullying and sickness absence in hospital staff. *Occup Environ Med* 57:656–660.
- Kivimäki M, Head J, Ferrie JE, Hemingway H, Shipley MJ, Vahtera J, Marmot MG. 2005. Working while ill as a risk factor for serious coronary events: The Whitehall II study. *Am J Public Health* 95:98–102.
- Kristensen TS. 1991. Sickness absence and work strain among Danish slaughterhouse workers: An analysis of absence from work regarded as coping behaviour. *Soc Sci Med* 32:15–27.
- Leineweber C, Westerlund H, Hagberg J, Svedberg P, Alexanderson K. 2012. Sickness presenteeism is more than an alternative to sickness absence: Results from the population-based SLOSH study. *Int Arch Occup Environ Health* 85:905–914.
- Lerner D, Amick BI, Malspeis S, Rogers W. 2000. A national survey of health-related work limitations among employed persons in the United States. *J Disab Rehab Res* 23:225–232.
- Löve J, Grimby-Ekman A, Eklöf M, Hagberg M, Dellve L. 2010. "Pushing oneself too hard": Performance-based self-esteem as a predictor of sickness presenteeism among young adult women and men—a cohort study. *J Occup Environ Med* 52:603–609.
- Marlowe J. 2002. Depressions surprising toll on worker productivity. *Empl Benefit J* 27:16–21.
- McKevitt C, Morgan M, Dundas R, Holland WW. 1997. Sickness absence and 'working through' illness: A comparison of two professional groups. *J Public Health Med* 19:295–300.
- Musich S, Hook D, Baaner S, Spooner M, Edington DW. 2006. The association of corporate work environment factors, health risks, and medical conditions with presenteeism among Australian employees. *Am J Health Promot* 21:127–136.
- Nyberg A, Westerlund H, Magnusson Hanson LL, Theorell T. 2008. Managerial leadership is associated with self-reported sickness absence and sickness presenteeism among Swedish men and women. *Scand J Public Health* 36:803–811.
- Robertson I, Leach D, Doerner N, Smeed M. 2012. Poor health but not absent: Prevalence, predictors, and outcomes of presenteeism. *J Occup Environ Med* 54:1344–1349.
- Roelen CA, Groothoff JW. 2010. Rigorous management of sickness absence provokes sickness presenteeism. *Occup Med (Lond)* 60:244–246.
- Schabracq MJ. 2003. Organisational culture, stress and change. In: Schabracq MJ, Winnubst JAM, Cooper CL, editors. *The handbook of work and health psychology*. Chichester (UK): John Wiley & Sons.
- Schultz AB, Edington DW. 2007. Employee health and presenteeism: A systematic review. *J Occup Rehabil* 17:547–579.
- Siegrist J. 1996. Adverse health effects of high-effort/low-reward conditions. *J Occup Health Psychol* 1:27–41.
- Virtanen M, Kivimäki M, Elovainio M, Vahtera J, Ferrie JE. 2003. From insecure to secure employment: Changes in work, health, health related behaviours, and sickness absence. *Occup Environ Med* 60:948–953.
- Voss M, Floderus B, Diderichsen F. 2001. Physical, psychosocial, and organizational factors relative to sickness absence: A study based on Sweden Post. *Occup Environ Med* 58:178–184.
- World Health Organization: Regional Office for Europe. 1998. *Well-Being measures in primary health care: The DepCare Project*. Consensus meeting, Stockholm. Available at: http://www.euro.who.int/_data/assets/pdf_file/0016/130750/E60246.pdf

Authors declare that they do not have any competing interests/conflicts of interest.

All authors have contributed substantially to the design of the study, the analysis, the interpretation of the results, as well as to drafting and revising the manuscript.

All authors have given their final approval of the version to be published and all of them agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.