Report Information from ProQuest

26 October 2023 01:51

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Towards a better understanding of work participation among employees with common mental health problems: a systematic realist review

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ABSTRACT (ENGLISH)

Objectives Common mental health problems (CMHP) represent a major health issue and burden to employees and employers. Under certain conditions work contributes to wellbeing and participation of employees with CMHP. Promoting work participation is important, however the specific conditions in which work participation occurs is complex and largely unclear. This calls for a novel, realistic approach to unravel the complex relationship between outcomes, context and underlying mechanisms of work participation. Methods In the present realist review, peer-reviewed studies conducted between 1995 and 2020 were systematically reviewed on the outcome measures 'stay at work' (SAW) and 'work performance' (WP). The database search from seven databases identified 2235 records, of which 61 studies met the selection criteria and methodological rigor. Results The synthesis demonstrates how work participation is promoted by the following mechanisms and contextual factors: (i) organizational climate and leadership, (ii) social support, (iii) perceived job characteristics, (iv) coping styles, (v) health symptoms and severity, (vi) personal characteristics, and (vii) features of interventions. An explanatory framework, based on the Capability-for-Work model, presents a new set of capabilities leading to SAW and WP. Conclusions This systematic realist review revealed mechanisms and contextual factors that promote both SAW and WP among employees with CMHP. These show how the organizational climate, social support in the work context, job characteristics and certain capabilities enable employees with CMHP to participate at work. Our contributions and practical implications are discussed, providing valuable insights for employers, professionals and researchers in the development of evidence-based interventions.

FULL TEXT

Headnote

Objectives Common mental health problems (CMHP) represent a major health issue and burden to employees and employers. Under certain conditions work contributes to wellbeing and participation of employees with CMHP. Promoting work participation is important, however the specific conditions in which work participation occurs is complex and largely unclear. This calls for a novel, realistic approach to unravel the complex relationship between outcomes, context and underlying mechanisms of work participation.

Methods In the present realist review, peer-reviewed studies conducted between 1995 and 2020 were systematically reviewed on the outcome measures 'stay at work' (SAW) and 'work performance' (WP). The database search from seven databases identified 2235 records, of which 61 studies met the selection criteria and methodological rigor.

Results The synthesis demonstrates how work participation is promoted by the following mechanisms and contextual factors: (i) organizational climate and leadership, (ii) social support, (iii) perceived job characteristics, (iv) coping styles, (v) health symptoms and severity, (vi) personal characteristics, and (vii) features of interventions. An

explanatory framework, based on the Capability-for-Work model, presents a new set of capabilities leading to SAW and WP.
Conclusions This systematic realist review revealed mechanisms and contextual factors that promote both SAW and WP among employees with CMHP. These show how the organizational climate, social support in the work context, job characteristics and certain capabilities enable employees with CMHP to participate at work. Our contributions and practical implications are discussed, providing valuable insights for employers, professionals and researchers in the development of evidence-based interventions.
Key terms capability approach; mental health; realist research; stay at work; sustainable employment; work ability.
Work participation among employees with common mental health problems (CMHP) is an increasingly important, yet highly complex phenomenon (1). The complexity of work participation is that work can cause CMHP and on the contrary, it can be the solution to those who are affected by CMHP. Under certain conditions, work contributes to the well-being and work participation of employees with CMHP. As the Organisation for Economic Co-operation and Development (OECD) calls for preventing instead of reacting to negative work outcomes, such as sickness absence and reduced work capacity (2), a thorough understanding of how to promote work participation is needed. Common mental disorders refer to depression, anxiety disorder, or stress-related disorder (3, 4). However, a large number of employees who suffer from such problems are undiagnosed and do not receive treatment (5). We also consider this group of employees at risk of negative work out- comes, as a consequence of psychological complaints. Since most people affected by CHMP or psychological complaints are employed and actually working, this phase needs increased attention while the individual is at work (6, 7). Therefore, we use a relatively broad definition of employees with diagnosed mood, anxiety or stress-related problems as well as self-reported psychological complaints.
Previous studies on work participation among employees with CMHP show that staying at work and being productive is affected by individual factors such as higher symptom severity (eg, a past history of CMHP, co-morbidity), and work-related factors (eg, lower job control, job strain or a supportive work environment) (1, 8). While these studies give an insight into factors that promote or hinder work participation, it remains unclear what really enables employees with CMHP to effectively continue working? As work participation is both a means and a goal to promote one's level of work performance and the ability to stay at work, we need to unravel these two aspects and how they interact in order to develop effective interventions for employers (8, 9). Other reviews in occupational health have concluded that the interaction between work outcomes, the underlying mechanisms, and how actors in the work environment collaborate have proven crucial to intervene effectively, and yet these are not yet clearly understood (5, 10, 11). Therefore the present study addresses the recommendation to move from 'what works' to promote work participation to 'what works, for whom, under what circumstances and how' (12, 13). This calls for a novel approach in our attempt to understand work participation, in which realist research may provide a suitable methodological answer. Pawson et al (14) developed the realist review approach from the philosophical tradition of critical realism, which seeks to consider the complexity of causal relations when explaining social interactions and interventions (9, 14). It is a theory-driven evaluation method providing an analysis that is more explanatory in nature.
Our initial program theory to develop an explanatory framework for work participation is the Capability-forWork model (15). This model is based on the concept of capability, as developed by Sen (16). Capabilities represent a person's opportunity and ability to achieve certain human functionings, taking into account someone's particular circumstances. Previous articles have applied the literature on human development and capabilities to the work context (17, 18). Among the many things that human beings might develop the capacity to do, employment and work are addressed as a functioning (19). Furthermore, following Sen (16), it is not enough to establish the resources individuals have, but rather to consider what they can actually do or become with those resources to achieve certain (work) functionings. These so called 'conversion factors' refer to the process of converting one's resources to tangible capabilities, resulting in work functioning that the employee chooses to achieve. In this, Bonvin (20) refers to personal and social conversion factors, which play a key role with regard to capability for work.
In this study, work participation is operationalized by two work outcomes (21). The first outcome is stay at work (SAW), that is, 'the employee is currently working' addressing a relatively new concept in the field of occupational

health that has no uniform definition in the literature (22). We define SAW as continuing to work, indicated as no absenteeism or not being absent >50% or <6 weeks (8, 23). Besides SAW, we are interested in different facilitators of work performance (WP), or 'how the employee functions at work'. WP refers in the present review to subjective (self- or other rated) performance or objective (externally rated) performance (24). Derived from the Capability-for-work model, we hypothesized that work participation is determined by the way an employee succeeds in converting personaland work inputs and resources (ie, conversion factors) into capabilities and subsequently into work functioning such as SAW and WP (15).

To the best of our knowledge, a realist synthesis of evidence relating to SAW and WP for employees with CMHP has not been conducted thus far. In this study, we aim to create a better understanding of work participation by providing a robust, systematic overview of current knowledge and by developing an explanatory framework. To do so, this study adopts a systematic realist review approach. The following research question guided this approach: What mechanisms promote SAW and WP (work outcomes), for whom, under what circumstances and how, amongst employees with CMHP?

Methods

Identification and selection process

For the sake of readability, in this section we briefly report the steps followed in the review process. A more detailed description of the review methodology is provided in the supplementary material, www.sjweh.fi/article/4005, Appendix A, including the identification and selection process, use of theory and appraisal tools, and data extraction and synthesis. The systematic realist review followed the steps and procedures outlined by RAMESES publication Standards for Realist Synthesis (25). Details of the protocol for this systematic realist review are registered on PROSPERO and can be accessed at www.crd.york. ac.uk/prospero/display_record.php?RecordID=108913 and can be found in the published study protocol (21). Regarding the search strategy and study selection, we adhered to the PRISMA guidelines for the conduct of systematic reviews (26). All scientific peer-reviewed studies available between 1 January 1995 and 26 June 2020 were retrieved in this systematic realist review. We conducted a computer-based search in the following databases, Pubmed, Medline, PsycInfo, Embase, Cochrane, Cinahl and Web of Science. An example can be found in supplementary Appendix A. Three independent authors dually assessed the studies' rigor and relevance in each of the following phases using the selection criteria (table 1): title and abstract screening, full text screening and quality appraisal using the Mixed Methods Appraisal Tool (MMAT) (27) and data extraction.

Extraction and analysis process

For each study, the research team drafted one or more context-mechanisms-outcome (CMO) configurations, first independently and later discussed dually. These configurations described the causal links between context, mechanisms and outcomes (ie, SAW or WP). From each study, information from the methods, results and discussion section regarding relevant contextual factors or mechanisms leading to the selected outcomes were retrieved. Studies of high quality (see table 2) were used to form CMO configurations. Studies with insufficient methodological quality (answering 'no' to screening questions) were excluded and studies with risk of bias, rated as 'medium quality', were only used to support CMO configurations derived from high quality studies. Several iterative steps were followed to explore patterns within the extracted CMO configurations to develop middle range program theories, using 'if.. .(context), then.. .(outcome), because of...(mechanisms)' statements. Middle-range program theories are based on at least two included studies. In the final stage of the synthesis, we developed an explanatory framework, using the initial program theory to demonstrate what works, for whom, under what circumstances and how to promote SAW and WP.

Results

The search process yielded 2235 records, shown in figure 1. Screening on title and abstract led to the exclusion of 2044 articles, resulting into 191 articles for full text screening. After full text screening and quality appraisal, 61 articles were included. One study was excluded due to insufficient methodological quality. Studies ranked as medium quality were characterized by relatively low response rates or incomplete outcome data, or missing information regarding adherence and randomization procedures. The majority of the studies used quantitative data

(N=53), only seven studies used qualitative data and one study used mixed methods. Table 2 provides an overview of characteristics of the included studies per outcome. Below, we first present the middle range program theories, which frame mechanisms and contextual factors that facilitate SAW, followed by the middle range program theories that facilitate WP.

Tables 3 and 4 present the summary of mechanisms that facilitate each outcome, SAW and WP, respectively. To explain the causal relations between context, mechanisms and outcomes we describe each middle range program theory. Thereafter, we present our findings in an explanatory framework. Figures 2 and 3 depict what works, for whom, under what circumstances and how, refining the Capability-for-work model. In-depth information regarding the data synthesis of CMO configurations per study, leading to the middle range program theories, is presented in supplementary Appendix B.

Stay at work (SAW)

The mechanisms, presented in table 3, reveal how organizational climate, social support in the work context, and perceived job characteristics enable employees with CMHP to stay at work. Furthermore, coping, severity of mental health symptoms, the personal context and features of interventions are factors affecting the chance for SAW.

Middle-range program theory 1: Organizational climate. Trustful relationships in which the supervisor shows openness to talk about mental health conditions in an open climate in general, may contribute to SAW among employees with depression because (a lack of) openness by supervisors is mirrored by employees (28, 29).

Middle-range program theory 2: Social support. Adequate and timely social support and supportive relationships, from colleagues but particularly supervisors who are willing to assist and listen to work related problems, increase the chance for SAW among employees with CMHP because this helps to obtain a manageable workload (23, 30-34). Facilitation, by either a mental health professional or job retention specialist - who (i) acts independently, with sympathy and pragmatism (ii) provides an expert insight and (iii) is familiar with the workplace - also improves the likelihood to stay at work (23, 35, 36).

Middle-range program theory 3: Perceived job characteristics. There is an inconsistent pattern with regard to job demands and control and its effect on SAW. A possible program theory, based on CMO configurations, could be that experiencing low job demands and high job control helps an employee to exert control over one's own work, including adjustments that can be made (32, 33, 35, 37-40). Heavy workload, overtime and high job strain reduce the chance for SAW, among employees with stress or depression (28, 30, 31, 38). Job modifications help, however in a different way for white- versus blue-collar workers, due to the type of duties and work context (23, 30, 41-43).

Middle-range program theory 4: Coping styles. A lack of adaptive skills, due to reduced psychological flexibility and a different perspective on situations, reduces the capacity to bear responsibilities, which in turn has a negative effect on SAW (30, 32, 44). Useful coping skills for SAW are: being more alert on signals of reduced mental health, reading and understanding own signals, exerting control over one's own work and workload, balancing positive and negative influences of work, making adjustments and informing colleagues, protecting oneself, taking control, and being assertive (23, 28, 30, 35, 37, 45-49). Also, being highly motivated towards the job increases the likelihood for SAW (23, 31, 50, 51). Adversely, employees who do not talk about their depression, hide themselves or deny their symptoms have a higher risk of absenteeism (6, 28-30, 34, 48). Improving active coping skills and advancing self-management in daily life subsequently contribute to SAW (36, 46, 50, 52-54) by addressing work in counselling besides personal problems (36, 43, 55)

Middle-range program theory 5: Health symptoms and severity. Better mental and physical health contributes to SAW because the employee's experience of lower severity of symptoms leads to improvement in WP (by increased cognitive functioning or decreased exhaustion) (30, 33, 39, 56-60). Likewise, facing additional health complaints as well as previous sick leave, decreases the chance for SAW (44, 56, 60-62). Interventions offering psychotherapy or pharmacotherapy seem more effective than preventative treatment or stress reduction interventions (45, 47, 50, 52, 54, 62-68).

Middle-range program theory 6: Personal context. Personal characteristics may contribute to SAW based on possible underlying mechanisms, such as financial drive by owning a house, being self-employed, or being married

(30, 33, 38, 56). Employees with depressive disorders who had more life events, personal problems or exposures in other life domains than work may experience tension or confusion about symptoms, leading to more absence days (28, 30, 38, 69).

Middle-range program theory 7: Features of interventions. If interventions focus on multiple components, for example if they target both personal inputs (symptom reduction and coping with symptoms) and work inputs (coping at the workplace or a better work-related health), this may lead to an increased likelihood for SAW (35, 46, 47, 49, 50, 52-54). In these interventions, using online or telephone support systems in addition to face-to-face care is successful because it (i) increases adherence and better access to early and regular screening and (ii) tailors messages to needs and integrates learned skills into daily life (46, 47, 53-55). Preventative, worksite-based job retention interventions or adding a work-focused intervention to integrated care did not seem effective on the outcome of SAW (45, 67, 68, 70).

Explanatory framework to stay at work based on the Capability-for-Work model. Based on the initial program theory and the presented middle range program theories, figure 2 depicts an explanatory framework for SAW. The mechanisms (the 'how') are mainly to be found under conversion factors and the capability set. The circumstances that facilitate SAW are to be found under Context on macro, meso, micro level and Personal- and Work inputs. We suppose that employees with CMHP can realize SAW through the following set of capabilities: (i) having meaningful relations and social support at work, (ii) exerting control, (iii) evaluating and adjusting the workload, (iv) experiencing freedom to create opportunities for active coping, (v) and experiencing better health, increased cognitive functioning and work performance. Those capabilities reflect the employee "being able" as well as "being enabled" (15). We also found the so-called 'ripple effects', in which the outcome of one CMO configuration became the context or mechanisms for the next in the chain of causality. For example, interventions on symptomatology (mechanism) seem to reduce the severity of symptoms (outcome). This outcome acts as an input (severity of symptoms) on SAW (outcome).

Work performance

Table 4 presents the summary of the mechanisms that facilitate WP (outcome 2) for employees with CMHP. Five middle-range program theories are proposed on how social support, perceived job characteristics, coping styles, health symptoms and severity and features of interventions promote the employee's WP respectively.

Middle-range program theory 1: Social support. A work environment where supervisors feel comfortable to offer help and support to employees, helps employees to feel motivated and valued, which in turn may have a positive effect on their job performance (29, 71). Practical job support from colleagues and managerial support from supervisors, offered continuously while functioning at work despite CMHP, helps to improve WP as the employee experiences trust and empathy (6, 29, 33, 48, 51, 69, 71).

Middle-range program theory 2: Perceived job characteristics. There is inconclusive evidence on interventions regarding job characteristics and their beneficial effect on WP among employees struggling with CMHP. Some studies suggest the combination of (perceived) high job demands and low job control may reduce WP among employees with CMHP (39, 40, 72). However, other studies contradict this suggestion (33, 73).

Middle-range program theory 3: Coping styles. If employees with CMHP experience reduced capacity to work, they initially use working facade strategies (such as increasing hours or taking work home), compensating possible shortcomings to avoid reduced performance because of fear and perceived stigma from colleagues and supervisor. However, these strategies seem counterproductive, as they result in emotional exhaustion, dissatisfaction and loss of refueling in the long run (6, 41, 71, 74). Interventions (eg, counselling) prove to promote WP because they improve effective coping styles in the long term. Examples of these interventions are (i) reconsidering one's attitude to work, (ii) reaching out for supervisor support, (iii) learning new approaches to manage job demands, and (iv) calming the mind and retrieving space for recovery (6, 36, 39, 53, 54, 67, 75-77).

Middle-range program theory 4: Health symptoms and severity. Self-rated health and severity of symptoms are important predictors of WP among employees with depression, anxiety or sleep disorder because once the employee experiences less symptoms, work productivity improves (39, 57, 59, 62, 72, 78). Chronicity of symptoms

has shown to reduce WP (33, 51, 59, 79). Interventions to reduce symptoms result in increased cognitive functioning, a pro-active attitude towards change, better mental-interpersonal task performance, improved time management and output, and subsequently to increased WP (36, 47, 49, 50, 53, 55, 64, 67, 76-78, 80, 81). Among employees with stress, interventions improve stress recovery and symptom management, which subsequently leads to improved productivity (50, 53, 64).

Middle-range program theory 5: Features of intervention. Interventions that use technology, through email, phone or app, may reduce mental health symptoms as well as work limitations. The use of these technologies helps to better monitor the employee's behavior by tailoring the interventions with personal feedback, fostering belief changes and facilitating the transfer of training components to daily life (53, 55, 70, 76, 77, 80, 82-84)

Explanatory framework on work performance based on the Capability-for-Work model. An explanatory framework on how to realize WP among employees with CMHP is presented in figure 3. This figure illustrates that both personaland work-related conversion factors promote WP through a set of capabilities. The capability set consists of (i) receiving social support from work and home, (ii) being motivated and feeling valued, (iii) experiencing freedom for active coping, and (iv) experiencing less symptoms and increased cognitive functioning. Where WP acts as a goal (outcome on its own), it also acts as a capability for SAW. This may support the idea of meta-capability suggested by Venkatapuram (85): being a capability in itself and also conditional (contextual factor) for achieving other capabilities. Capabilities may or may not result into work outcomes due to constrained or limited choices, as proposed in the Capability-for-Work model. Unfortunately, the included studies did not provide insights in the opportunity to make individual choices to achieve both work outcomes (see figure 2 and 3).

Discussion

This paper provides a systematic realist review of studies that have assessed work participation among employees with CMHP. This review (i) contributes to the development of a more uniform definition of the concept SAW among the study population at risk of negative work outcomes due to CMHP, (ii) identifies mechanisms that promote work participation through the outcomes of SAW and WP (iii), sheds light on how the work context may promote work participation in practice and research, and (iv) provides an explanatory framework using middle range program theories, based on the Capability-for-Work model. These contributions, their implications for practice and future research as well as the limitations of the present study are discussed below.

Contributions of the present study

The present study adds to our understanding of the complex, multifactorial process of work participation for employees with CMHP. The overall findings of this review are consistent with the findings of previous reviews on related outcomes, finding theoretical support for the dynamic interrelation between personal factors and work-related factors leading to work participation for employees with CMHP (5, 8, 86). However, our review also shows how social support in the work context, perceived job characteristics, coping styles and better experienced health may promote WP and SAW. Furthermore, insight is given in how organizational climate and personal context promote SAW and what features of interventions seem effective. In addition, the findings of this review shed light on underlying mechanisms towards an adequate, supportive, work environment that enables employees with CMHP to remain at work. Because we used a systematic realist review approach rather than summarizing factors that may not provide insights into causal relationships, we were able to "unpack" each mechanism, and reveal under what circumstances these mechanisms lead to the outcome of interest. In this way, it explains what often is experienced by practitioners in individual cases and is hard to support by empirical evidence due to averaged, usually small effects in quantitative studies.

Notwithstanding all efforts regarding preventative mental health interventions, our findings call for more attention to employees already facing CMHP in the work context, in line with the recommendations of the OECD and other researchers (5-7, 87). We operationalized SAW in such a way that it includes employees with CMHP who are currently working or reported partly sick. Interestingly, we observed in the review process that the current research agenda is still focused on absenteeism and return to work concerning employees with CMHP rather than SAW, despite the growing evidence base on prevention and positive psychology in the general working population (88). A

possible explanation could be that the phase of being on sick leave or absent as a negative work outcome is directly related to costs of employers and society as a whole and thus of a greater interest in research and practice. Besides, being absent is more visible than being at work while being affected by CMHP. Signals of CMHP usually develop silently and slowly, making it harder for employers to signal and intervene. Also, CMHP are often stigmatized, making it hard for employees to decide whether or not to disclose their condition to their employer (89). This supports our decision to include both diagnosed and self-reported CMHP in this study. To gain insight in the promotion of work participation in a group of at-risk employees, we choose not to emphasize the highly discussed boundary between normality and pathology. Because complaints are often dynamic and fluctuating, such a clear distinction is not necessary for the purpose of this review. We found that the mechanisms and contexts to promote work participation apply to those employees with psychological symptoms in the subthreshold group, to those who did not seek help or had no access to care, as well as to employees with a diagnosed common mental disorder. Regarding the retrieved mechanisms, more attention in the scientific literature was given to (intervening on) personal factors than work-related or organizational factors. This implies that, in interventions that promote work participation, efforts and effects seem to be attributed to the person rather than the work situation. This is not in line with the literature showing that work-related factors have great causal effects on sustainable work participation among the general working population. For example, the Job Demands Resource theory suggests that in order to effectively continue working despite facing CMHP, solutions can be found in the work context and job designs, more than intervening (only) on personal factors (90). Besides, despite our study approach to search in each included study for contextual factors, it was difficult to identify the organizational circumstances in which each mechanism or outcome occurred apart from the pre-defined intervention components. However, even if organizational circumstances were not analyzed explicitly, we succeeded to identify mechanisms that refer to the role of employers in supporting employees to stay at work (receiving supervisor support, being offered job modifications). This supports the evidence regarding the important responsibility of employers in facilitating employees with CMHP (13, 86, 91, 92). Therefore, more insight into work-related mechanisms and circumstances leading to SAW is needed to develop effective organizational interventions for employees with CMHP (93).

The use of the Capability-for-Work model contributed to the findings of our review in three ways. First, considering the plethora of CMO configurations derived from 61 studies, this model helped us to arrange factors and understand causal effects and underlying mechanisms. As such, we could distinguish inputs (pre-existing work- or personal factors that are often non-changeable) from conversion factors and capabilities (often changeable). Through a capability approach lens, mechanisms (how and why) were identified as conversion factors and capabilities. More specifically, we found that both personal conversion factors and social, work-related conversion factors are needed to realize capabilities to work (20). The framework adds to the understanding of causal relationships between all factors and the outcomes SAW and WP. Nevertheless, we emphasize that what may be a conversion factor or capability for one employee, can be a pre-existing personal factor for the other. Second, our review contributes to the development of the capability set for work, defined by Abma et al (94) in that we add to their seven capabilities, presenting specific capabilities for employees with CMHP. For example, the capability of building and maintaining meaningful contacts at work, is elaborated in our study by the capability of receiving work-related social support and having trustful relations with the supervisor and colleagues. Third, using the Capability-for-Work model, our review reveals that it is not the medical condition itself but its interactive effect with WP and circumstances that influence the employee's functioning at work and ability to stay at work (95). Therefore, it will be more interesting to investigate whether employees are "being able" and "being enabled" to participate in work, and thus to unravel which set of capabilities is needed to do so, rather than solely to assess their medical condition. In this way, we highlight the importance of placing work participation in a wider spectrum of human development, shifting the focus from having a mental health condition as an impairing factor to the establishment of capabilities and choices (96).

Implications for practice

This review provides valuable information to employers and occupational health professionals as to what implications they should focus on in order to promote work participation for employees with CMHP. The first practical

implication refers to the importance of multilevel interventions from employers, addressing overarching themes on an organizational- and team-level combined with tailored interventions on the individual level. Employers could improve the work situation of employees with CMHP, and the teams and organizational culture they work in, by creating a socially safe, open working climate. On the individual level, employers could ask employees who are having a hard time at work what they can still do despite their problems, and what they need in their job or in the work context in order to remain at work. This way, the employer enables the employee to convert inputs and resources into capabilities. Employers should seek advice from occupational health professionals since they can support, on different levels and on both sides, the employer as well as the employee with CMHP.

Next, we highlight the need for early intervention, and suggest professionals to find ways to assess and intervene on capabilities and WP before employees report sick, besides assessing the employee's (severity of the) condition or other pre-existing personal factors. Occupational health professionals can discuss individual short-term adjustments in the job or work context with the employee and employer. For long term solutions, those professionals can support employers to detect a mismatch between the employee's capabilities and the work (context).

In line with addressing employee's abilities rather than problems, we recommend two ways to increase employee's experience of freedom, often referred to as autonomy in the literature. On the side of healthcare and the psychological treatment of individuals with CMHP, we recommend (mental) healthcare professionals to address work-related problems in the consultation and to transfer lessons learned, such as active coping, to the work context. Likewise, we urge employers to facilitate work and a work environment where lessons learned can be practiced by employees, by enhancing autonomy or facilitating temporary job modifications (97). This may have the twofold effect of increasing employee's capabilities and employee engagement as well as contributing to mentally healthy workplaces (95).

Finally, providing continuous social and practical support at the workplace is crucial to promote work participation. Employers should take preventative measures whilst the employee is still at work, for example by educating supervisors and colleagues on reading signals and talking about mental health. Also, employers can increase supervisors' skills on ways to offer support to employees and increase know-how of situations that require referral to occupational health professionals.

Recommendations for future research

The following recommendations for future research result from this study. First, our review showed that WP acts as a meta-capability for SAW, illustrating a possible parallel link between CMHP and the level of work performance during the phase of staying at work (98, 99). Further research is needed to test the link between both work outcomes, verifying whether and how WP can be used as a means to decrease the severity of CMHP, resulting in an increased chance to stay at work. Second, additional research is warranted to further develop the Capability-for-work model on work participation for employees with CMHP. We recommend the use of empirical data to test the newly presented set of capabilities among employees with CMHP in work participation. Besides, to further explore the causal relations presented in the explanatory framework, mean correlations that exist in the study population on group level could be tested but also underlying mechanisms that occur on an individual level. Third, we recommend realist evaluation as an approach to "unpack" underlying mechanisms and contextual factors in order to develop effective organizational interventions. As our research included only one mixed methods study and few qualitative studies, we cannot emphasize enough on the integration of process and outcome evaluation, using novel, mixed methods evaluation designs (12, 100).

In a next step, based on our review results, we will develop and evaluate a multilevel workplace intervention. This intervention aims to improve supervisor's skills and competence to support employees with CMHP and create a work context that promotes work participation.

Strengths and limitations

This systematic realist review provides a comprehensive overview of mechanisms and contextual factors promoting work participation. By using a realist approach, we succeeded to unravel mechanisms and their causal relationship with the work environment and selected outcomes. The realist data extraction- and data analysis process was time-

consuming. However, it seemed valuable as the rigorous understanding of not only what works, but also under what circumstances and how work participation occurs, resulted in more practical contributions. Furthermore, we stimulate the debate among researchers on the understanding of work participation by contributing to theory development of the Capabilityfor-work model regarding various work participation outcomes.

The present review has a number of limitations that must be addressed. First, it could be argued that the heterogeneity in the type of studies and measures of outcomes led to CMO configurations with different levels of relevance or rigor. To overcome this, two researchers conducted each review step independently, using clearly defined concepts, inclusion and exclusion criteria and assessment tools. Also, the researchers discussed every defined CMO configuration. A second limitation refers to the dichotomous outcome of SAW. Due to the inconsistent definition of SAW in the literature, we screened a plethora of studies using the opposite outcome of SAW, reported as absenteeism or sickness absence. Barriers leading to absenteeism are not automatically facilitators of SAW, so the outcome of absenteeism is not irreversible as such. Therefore we only included studies that compared employees with CMHP who were absent to similar employees who stayed at work. A third limitation is that although we used information regarding context, mechanisms or implementation from the discussion section in publications, the contextual information was only explicitly provided to a certain extent (study population, employment sector). Where information regarding the context of the study was not given, we cannot know under what circumstances certain interventions work. This is a common limitation of realist synthesis and, therefore, is also relevant to our study. For an in-depth discussion on the use of realist research, we refer to our protocol paper (21).

Concluding remarks

This systematic realist review revealed mechanisms and contextual factors that promote both WP and SAW for employees with CMHP. In these situations, the work environment can support employees to participate at work. Program theories using a realist approach reveal how the organizational climate, social support in the work context, and perceived job characteristics enable employees to participate at work. Furthermore, coping styles, severity of mental health symptoms, the personal context and features of interventions enable employees to participate at work. By providing an overview of recent scientific literature, this study provides valuable insights and practical implications for employers, occupational health professionals and researchers in the development and evaluation of evidence-based interventions. Novel explanatory frameworks, based on the Capability-forWork model, present causal relations between personaland work factors and a set of capabilities leading to SAW and WP. Finally, the study adds to the debate on using novel methodological research approaches such as realist synthesis, answering what works, for whom, under what circumstances and how.

Acknowledgements

Thanks are due to Thomas Pelgrim for his support to develop a librarian-guided search string and to Jac van der Klink, founder and expert of the Capability-forWork model, for his contribution to the discussion and application of this model in our study.

Declaration of interest statement

The authors declare no conflict of interest. The GAK Institute supported this work under grant 2017-928.

Sidebar

van Hees SGM, Carlier BE, Vossen E, Blonk RWB, Oomens S. Towards a better understanding of work participation among employees with common mental health problems: a systematic realist review. Scand J Work Environ Health. 2022;48(3):173189. doi:10.5271/sjweh.4005

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Received for publication: 16 February 2021

DETAILS

Subject:	Databases; Health problems; Mental health; Work environment; Mental disorders; Occupational health; Leadership; Participation; Context; Employees; Employment; Organizational aspects; Staff participation; Employers; Social interactions; Reviews
Business indexing term:	Subject: Work environment Occupational health Employees Employment Employers
Publication title:	Scandinavian Journal of Work, Environment &Health; Stockholm
Volume:	48
Issue:	3
Pages:	173-189
Publication year:	2022
Publication date:	2022
Section:	Review
Publisher:	Scandinavian Journal of Work, Environment &Health
Place of publication:	Stockholm
Country of publication:	Finland, Stockholm
Publication subject:	Occupational Health And Safety
ISSN:	03553140
e-ISSN:	1795990X
Source type:	Scholarly Journal
Language of publication:	English
Document type:	Journal Article
DOI:	https://doi.org/10.5271/sjweh.4005
ProQuest document ID:	2652915837

Evaluating effectiveness of an integrated return-to-work and vocational rehabilitation program on work disability duration in the construction sector

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ABSTRACT (ENGLISH)

Objective The aim of this study was to investigate whether an integrated return-to-work (RTW) and vocational rehabilitation (VR) program - the Work Reintegration (WR) program - was associated with reduced work disability duration in the construction sector in Ontario, Canada. Methods Workers' compensation data from the Ontario Workplace Safety and Insurance Board were extracted for lost-time construction worker claims following work-related injuries between 2009 and 2015. Claims receiving referrals to RTW and VR specialists (treatments) were matched with claims receiving no referrals (controls) during the periods before and after the WR program introduction. Multivariable difference-in-differences linear and quantile regression models were used to examine differences in cumulative disability days paid during twoyears post-injury between treatment and control groups before and after the program change and the difference in these differences, overall, and at different disability distribution percentiles. Results The WR program introduction was associated with reductions in cumulative disability days paid for all claims but most notably among longer duration claims referred to RTW specialists (reduction of 274 days at the 90th percentile in the disability distribution) and shorter duration claims referred to VR specialists (reductions of 255 and 214 days at the 25th and 50th percentiles in the disability distribution, respectively). Conclusions The WR program introduction was effective in reducing cumulative disability days paid for construction worker claims but the effects varied at different percentiles in the disability distribution, as well as by specialist referral. The findings highlight the benefits of better integrated RTW and VR services to injured workers in the construction sector.

FULL TEXT

Headnote

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duration in the construction sector in Ontario, Canada.

Methods Workers' compensation data from the Ontario Workplace Safety and Insurance Board were extracted for lost-time construction worker claims following work-related injuries between 2009 and 2015. Claims receiving referrals to RTW and VR specialists (treatments) were matched with claims receiving no referrals (controls) during the periods before and after the WR program introduction. Multivariable difference-in-differences linear and quantile regression models were used to examine differences in cumulative disability days paid during twoyears post-injury between treatment and control groups before and after the program change and the difference in these differences, overall, and at different disability distribution percentiles.

Results The WR program introduction was associated with reductions in cumulative disability days paid for all claims but most notably among longer duration claims referred to RTW specialists (reduction of 274 days at the 90th percentile in the disability distribution) and shorter duration claims referred to VR specialists (reductions of 255 and 214 days at the 25th and 50th percentiles in the disability distribution, respectively).

Conclusions The WR program introduction was effective in reducing cumulative disability days paid for construction worker claims but the effects varied at different percentiles in the disability distribution, as well as by specialist referral. The findings highlight the benefits of better integrated RTW and VR services to injured workers in the construction sector.

Key terms difference-in-difference; observational study; observational study design; occupational rehabilitation; Ontario; sickness absence; sick leave; quasi-experimental study; work disability absence; work-related injury; work-related musculoskeletal disorder; worker compensation.

Work-related injuries and illnesses are often more common in the construction sector than other industries. The construction sector has the highest injury claim counts and rates in most developed countries (1-3). Additionally, measures of return-to-work (RTW) and work disability outcomes are shown to be worse in construction than other sectors (4-6). RTW and vocational rehabilitation (VR) program interventions present opportunities to improve work disability outcomes for injured workers. While there is a substantial body of literature evaluating intervention effectiveness (7-12), studies have either been limited in methodology or not specifically focused on the construction sector.

RTW is best understood as an evolving process, comprising multiple phases, as opposed to a linear process with single independent events (13, 14). While in most cases RTW will encompass return to pre-injury employment with a pre-injury employer, it may require transitions to employment with a new occupation and new employer following VR interventions with educational training and work placement programs. Recent observational studies that have compared recipients and non-recipients of VR using propensity score matching (PSM) techniques have shown mixed results, including effectiveness (7, 15-17), ineffectiveness (18), or only effectiveness in particular segments of study populations (19, 20). While these studies provide valuable insight into the effectiveness of various VR programs and methodological advancement over previous research, there is an absence of evidence for program effectiveness in specific sectors (eg, construction) that face unique RTW challenges.

The construction sector is often associated with physically demanding work that is episodic, taking place across multiple worksites, and largely conducted by small firms. These characteristics, alongside others, can contribute to unique barriers to RTW. For example, small construction firms are reported to have greater difficulties in offering modified or alternate work for injured workers than large firms (21-23). Construction firms implementing disability management and RTW programs have reportedly found such programs to be costly, especially for providing new equipment, educating staff on programs and policies, and providing suitable duties (22). Only two studies have examined rehabilitation programs with construction workers. One focused on a three-week reconditioning program where just over half returned to their workplace and were still employed one year later (24). A second evaluated a workplace-based rehabilitation program to find a positive effect on RTW when workers were able to develop competent work behavior through progressive exposure to work, worksite assessments and work accommodations (25).

The purpose of this study was therefore to determine whether the introduction of a new integrated RTW and VR

program offered by the Ontario Workplace Safety and Insurance Board (WSIB) was associated with reduced work disability duration in the construction sector.

Methods

Workers' compensation and work reintegration

In Ontario, Canada, the WSIB is the organization responsible for providing wage-loss benefits, medical coverage and support to help workers get back to work after a work-related injury or illness. Ontario businesses fund the WSIB through premiums, and it provides nofault collective liability insurance and access to industry-specific health and safety information for over five million people across more than 300 000 workplaces.

Between December 2010 and August 2011, the WSIB established Work Reintegration (WR), a program that replaced two separate RTW and VR programs and practices with a single integrated one (26). More specifically, the VR aspect of the WR program replaced the previous, externally managed, 'Labour Market Re-Entry' services with internally managed 'Work Transition' services. In terms of the RTW aspect of the WR program, the 'Early and Safe Return-to-Work' practices that workplace parties were previously encouraged to follow were replaced with a new RTW service delivery model (see table 1 for key differences and figure 1 for timeline). Among several new features, the WR program introduced earlier RTW and VR interventions, penalties for worker and employer non-cooperation, program time limits, relocation assistance, and employment placement and retention support services (27). Examining the overall effect of the WR program introduction is therefore possible by comparing the work disability duration of claims that received VR services in the periods before and after the WR program introduction, with comparable claims that received RTW services or no services during the same periods.

Data

Employer, claim, payment, and program referral data were obtained from the WSIB for the years 2009 to 2017. Use of data for research purposes was governed by information sharing agreements between the WSIB and the research team, including data storage and access services provided by Population Data BC. Personal identifiers were removed from the data provided to the research team and replaced with anonymous claim identifiers. Ethical approval for the research project was obtained from the Behavior Research Ethics Board at the University of British Columbia (certificate number H13-00896). Data preparation and analyses were conducted using SAS 9.4 (SAS Institute Inc, Cary, NC, USA) and Stata 15.0 (StataCorp, College Station, TX, USA).

Study cohort

The study population included workers with eligible claims for non-fatal, work-related injuries and musculoskeletal disorders (MSD) that occurred between the years 2009 and 2015, resulting in at least one day of compensated lost-time, in construction industry classifications. Benefit payments for all claims included a maximum follow-up time of two years, post-injury (including payments from years 2016 and 2017). Occupational disease (such as asthma and cancer) and mental health claims were excluded due to these claims typically having a longer time between exposure onset and claim registration. Workers had to be 15-80 years of age at the time of injury with complete information on analytical variables to be included in the cohort.

Outcome measure

The outcome measure was cumulative disability days paid up to two years of the injury date. To ensure consistent follow-up, benefit payment dates up to 730 calendar days from the injury date were included. To account for different work schedules, adjustments were made to standardize cumulative disability days paid to a five-day workweek. Claims with more than 520 days (equivalent to two years based on a five-day workweek) were right-censored. This variable was chosen due its consistent measurement during the study period and availability for all claims.

Treatment and control groups

During the study period, claims could be referred to RTW and VR specialists. In some cases, they could receive referrals multiple times and to different types of specialists offering different forms of services. Since the majority of claims that received VR referrals also received RTW referrals (80%), claims were separated into three distinct groups during the pre-program change period (20092010) and post-program change period (2011-2015): claims with no referrals (control group), claims with only RTW specialist referrals, and claims with VR specialist referrals

that may or may not have also included RTW specialists (treatment groups). Due to data limitations, treatment and control groups and program periods were defined based on injury year and referral type, regardless of referral timing or services received.

Propensity score matching

Workers that received RTW and VR specialist referrals were different from those not referred, with more severe injuries, and from particular occupations, industries, and firm sizes. To account for this selection bias, a matching method was used to construct comparable cohorts for claims from all three groups, prioritising the representation of VR specialist referral claims since the majority of program changes were specific to VR. Accordingly, the VR specialist referral group was matched with the other groups separately, dropping out claims with VR specialist referrals that did not share matching characteristics with those from the other groups. The proportions of the aggregate, unmatched cohort was approximately a ratio of 1:2:5 for referral to VR specialists, RTW specialists, and no referrals, respectively.

Considering the relative proportion of claims under each treatment, a nearest neighborhood matching approach was used (28), where one VR specialist referral claim was matched with a maximum of two nearest RTW specialist referral claims and five nearest no referral claims, respectively. Matching was conducted separately for the pre-program change period (2009-2010) and post-program change period (2011-2015) (see supplementary material, www.sjweh.fi/article/4006, for more details). After matching, three balanced cohorts were obtained for both periods, determined by propensity score estimates from a logit model with all observable characteristics contributing to treatment likelihood. Sociodemographic and work-related factors

Age at time of injury, year and quarter of injury date, injury type and severity proxy, occupation, pre-injury earnings, industry subsector, firm size and residential community size were used for matching. Injury data were coded using Canadian Standards Association Z795-03 coding for work injury and disease (29). Injury type was categorized into five groups similar to previous research (30, 31): non-MSD, back soft tissue injuries, other soft tissue injuries, limb fractures and other fractures. An injury severity proxy was created using predicted log cumulative disability days paid, based on a multi-jurisdictional multivariable regression model of injured construction workers from British Columbia, Alberta, Manitoba and Ontario, merged at the level of the claim using 2-digit part of body and 3-digit nature of injury codes. Occupation was coded to National Occupational Classification 2006 (32) and categorised into trade, transport and equipment operators and related occupations versus all other occupations. Quintiles were calculated for pre-injury gross annual earnings. Industry subsector was coded to the North American Industry Classification 2012 (33) and categorised into heavy and civil engineering construction versus construction of buildings/specialty trade contractors. Firm size was based on the number of full-time equivalents (FTE) and classified as small, medium, and large firms based on thresholds of <10, 10-99 and >100 FTE, respectively. The six-digit postal code of the worker at the time of injury was converted, using a Statistics Canada conversion file (34), to the 2011 Census community size code to distinguish between claims from large urban areas and those from smaller urban or rural areas.

Difference-in-differences quantile regression

Cumulative disability days paid were compared for claims that received referrals to VR specialists, RTW specialists, and no referrals. A difference-in-differences (DiD) method was used and allowed for different treatment effects for the VR specialist group versus the RTW specialist only group (no referral claims represented the control group). The baseline estimation model was:

(ProQuest: ... denotes formula omitted.)

where yu was the cumulative disability days paid for claim i at time t, POST, was an indicator equal to 1 if the claim was observed after 2010, I(RTW=1), and I(VR=1), were indicators for being in the RTW specialist group, or VR specialist group respectively. Ztt is a vector of claimlevel observable characteristics as described above. vu are random error terms. The parameters of interest were ß4 and ß5, which identified the effects of the RTW and VR referrals on cumulative disability days paid. The inverse propensity weights imposed on this model were calculated from the matching.

The DiD method relies on the parallel trends assumption that control and treatment groups have similar pretrends and would have continued on the same paths had the intervention not taken place. To test this assumption, the trends in pre-program change period cumulative disability days paid were compared for each group and presented a comparable downward trend for all three groups. Since cumulative disability days paid is a highly skewed measure, with a large proportion of claims receiving few disability days and a small proportion continuing to accumulate disability days during the two years following injury, linear regression was used to model differences at the mean whereas quantile regression was used to model differences at the 25th, 50th, 75th and 90th percentiles of the distribution. This approach follows previous work disability and RTW studies that have relied on similar skewed outcome data (30, 31, 35). Each regression model is adjusted for the same variables used in the propensity score matching, with the exception of the injury severity proxy.

Results

Descriptive statistics of the claim cohorts show how the control and treatment groups across the entire study period were different (table 2). Overall, in the unmatched cohorts, compared to claims with RTW specialist referrals or no referrals, claims with VR specialist referrals had a larger proportion of fracture-related injuries, higher pre-injury earnings, worked for smaller sized firms, were of older age at the time on injury, were paid more cumulative disability days paid, and had higher predicted disability cumulative disability days paid based on their injury characteristics. Following matching, there was greater balance on the preceding characteristics.

Table 3 summarizes the pre-program change differences in cumulative disability days paid between the three groups, as well as their post-program change differences, and the DiD (pre-post differences for the treatment groups relative to pre-post differences for the control group) at the mean, 25th, 50th, 75th and 90th percentiles of the disability distribution, after matching and adjusting for individual-level characteristics. Claims from the three groups had fundamentally different cumulative disability days paid from each other, even after matching on observable characteristics. Claims referred to RTW and VR specialists had, on average, 108.5 [95% confidence interval (CI) 96.5-120.5] and 390.4 (95% CI 380.0-400.8) more paid disability days, respectively, than claims with no referrals during the pre-program change period. These differences were relatively consistent across the disability distribution. Following the program change, claims from all three groups were paid less cumulative disability days. Claims referred to RTW and VR specialists experienced larger reductions in their cumulative disability days paid than claims with no referrals but the effects differed by percentiles in the disability distribution. RTW referral claims with longer durations experienced the largest reduction in cumulative disability days paid whereas VR referral claims with shorter durations experienced the largest reductions. For example, claims referred to RTW specialists had 204.36 (95% CI -253.55- -155.17) fewer paid disability days at the 90th percentile whereas claims referred to VR specialists had 255.4 (95% CI 276.6-234.2) fewer paid disability days at the 25th percentile and 213.9 (95% CI 228.0-199.80) at the 50th percentile.

Using the estimates from the multivariable quantile regression at the 50th percentile of the disability distribution, the predicted disability days paid were obtained for the pre- and post-intervention periods for all three groups (figure 2). The introduction of the WR program resulted in a decline of cumulative paid disability days from 15.5 to 11.7 for claims with no referral, and from 109.8 to 52.6 and 500.2 to 294.7 for claims referred to RTW and VR specialists, respectively. In other words, claims at the median of the distribution would have experienced a drop of approximately 200, 50 and <5 days if they were referred to VR specialists, RTW specialists or no specialists, respectively.

Discussion

The purpose of this study was to determine whether the introduction of the WSIB WR program was associated with reduced work disability duration in the construction sector in Ontario. Using a DiD quantile regression approach with matched cohorts, the findings suggest that the program reduced cumulative disability days paid for all claims and particularly for longer duration claims (90th percentile of the disability distribution) referred to RTW specialists and shorter duration claims (25th percentile of the disability distribution) referred to VR specialists.

Unlike VR programs in most other studies, the WR program is an integrated RTW and VR program offered to

individuals with work disability due to work-related injury and illness and within the context of a no-fault workers' compensation system. Furthermore, unlike most existing studies, this study examined the effectiveness of the program within the context of the construction sector and with regards to changes in cumulative disability days paid. Some studies have used measures related to insurance benefit receipt, such as those based on the probability of individuals no longer receiving disability insurance benefits and shown evidence of effectiveness (17, 36). For example, a study of social security disability insurance beneficiaries in the United States found that individuals receiving services from state VR agencies had a higher rate of completing a trial work period and achieving suspension or termination from the disability insurance program due to work than their matched counterparts (17). A Canadian study evaluating the effectiveness of a VR program provided to Canadian pension plan disability insurance beneficiaries found no effect of exiting disability benefits or on obtaining employment among men compared to their matched counterparts. However, the study did find an increase in obtaining substantial gainful employment among women compared to their matched counterparts (36). In contrast to these studies, the present study evaluated the effectiveness of an integrated RTW and VR program available to much broader population and found a robust effect in reducing the number of disability days paid to injured workers in the construction sector. Understanding why the WR program was more effective for long-duration claims referred to RTW specialists and short-duration claims referred to VR specialists is complex. It is possible that injured workers with these types of claims were more receptive to program services whereas those with long duration claims referred to VR specialists were more likely to experience persistent and significant disability as they may have had more severe injuries, which made ever achieving RTW unlikely. The timing and length of interventions can be key factors in the effectiveness of VR programs. A study evaluating a VR program for individuals with MSD and mental-related work disability within the Finnish earnings-related pension scheme found that among those with shorter rehabilitation (<10 months), the largest gains in work participation were observed in the year after rehabilitation, after which it decreased. In contrast, among those with longer rehabilitation (>10 months), increasing gains were observed with each follow-up year. While the WR program has thresholds in which specific activities should take place - such as following an injury having (i) a RTW specialist meeting in <12 weeks, (ii) an initial meeting with a case manager and work transition specialist within 6-9 months, or (iii) a work transition plan approved in less than one year (27) - there may still be variation in the timing of these events and their affiliated support services that can further explain differences in overall program effectiveness.

The findings suggest that despite there being evidence of program effectiveness in the construction sector, there may still be challenges for injured construction workers returning to work, particularly among those with long disability duration. There are barriers to RTW that are unique to the construction sector that may help explain this. As highlighted in a scoping review (Sharpe et al, unpublished manuscript), these barriers often relate to the offer of work accommodations, such as modified work or alternative duties that are more more challenging given the physical nature of construction work (21-23). Limited transferable skills may act as a barrier to work accommodations and VR, particularly since the sector includes specialized occupations that may limit opportunity to offer alternative work outside an injured worker's skillset. Organizational factors, including firm size, also shape RTW. For example, construction firms are typically small and small firms face greater difficulties than large firms in accommodating injured workers (21-23). Other notable barriers the authors highlight include a lack of understanding of the nature of construction work among healthcare providers, leading to difficulties in identifying injured worker's restrictions and capabilities (22), and how construction workers may accept injuries as part of work in the industry and work through pain to remain in the workplace due to normative expectations of masculinity and stoicism in the sector (37).

The findings suggest that efforts to better integrate RTW and VR services through the WR program have resulted in improvements (reductions) in cumulative disability days paid to injured construction workers. However, it is important to acknowledge that cessation of disability benefits is not necessarily a measure of successful RTW. Workers may follow complex RTW trajectories, comprising multiple phases (13, 14). Furthermore, it should be acknowledged that over time the WSIB and many other disability insurers have changed their focus to include workers' abilities to work

or be deemed "employable". Consequently, while a worker may no longer be claiming disability benefits and is deemed "employable", they may still have unresolved medical problems, giving them a disadvantage in the labor market (38). Complementing the administrative data-based approach in this study with more qualitative approaches that take into account the perspective of the workers' experience would further understandings of the extent to which the WR program has improved RTW of injured construction workers and where improvements to the program can still be made.

Strengths and limitations

This study is the first to evaluate the effectiveness of the WR program. A unique contribution of this study was the use of quantile regression to examine differences in the effectiveness of an integrated RTW and VR program by varying levels of disability duration. This contrasts with the majority of evaluations that have focused on VR intervention effects on employment probabilities (7, 15, 18, 20). By using this approach, the study shows how the WR program was associated with a reduction in the cumulative disability days paid of longer duration claims referred to RTW specialists and shorter duration claims referred to VR specialists. This finding is important from a policy and practice perspective as many injured workers benefitted from the program in terms of reducing disability duration, whereas those with more severe injuries or disability may still experience barriers to RTW, indicated by smaller reductions in disability duration among longer duration claims referred to VR specialists. The combination of a DiD with PSM matching algorithm provides a robust study design that other observational studies of VR programs have also used (7, 16).

There are however limitations to how the program periods were measured and the treatment and control groups within them. Due to the program periods being based on injury year, as well as the phase-out period of claims under the old program, there is a degree of overlap between claims in both periods and lag in program effect measurement. However, it is more likely that the overall effectiveness of the WR program was underestimated as a result of this as there was likely a larger number of claims from the old program, receiving fewer, externally managed services, grouped with those of the new program, reducing the treatment effect. Since the control and treatment groups were based on specialist referral, as opposed to when the referrals were made or what services were received and when, this study was unable to determine whether the reduction in disability days was due to earlier referrals or other program changes (eg, increased services). Nonetheless, the measurements used serve as proxies for estimating overall program effectiveness.

It should be noted that on 1 January 2013, the WSIB expanded compulsory workers' compensation coverage to independent operators, sole proprietors, partners in a partnership, and executive officers of corporations carrying out business in the construction sector (39). However, given that these groups are less likely to file claims than larger construction firms, financially incentivized to not claim disability benefits in the long-term (ie, experience rating), and the fact that the matching approach included matching on firm size, any potential bias in the results introduced by this change is thought to be minimal. There is the possibility of unobserved heterogeneity between the treatment and control groups that may bias the results. This is a common limitation of relying solely on administrative data. Lastly, the outcome variable only provided a proxy for RTW as claims no longer receiving payments for cumulative disability days do not necessarily result in RTW and could instead be in receipt of disability pension, other employer-based renumeration (sick pay), or no renumeration. Since the outcome variable was cumulative, claims with the same disability days paid may have accumulated the days over different calendar periods. It is also possible that differences observed over time for long duration claims (eg, 90th percentile of the disability distribution) may have been underestimated due to the censoring of data at two-years post-injury. However, this was a necessary methodological decision in order to create comparable cohorts over time.

Concluding remarks

The findings suggest that the WSIB WR program introduction was effective in reducing cumulative disability days paid for injury claims among construction workers referred to RTW and VR specialists. While the effects varied at difference percentiles in the disability distribution, as well as by type of program referral, further research could examine the type and timing of services received to understand what specific changes in the WR program contribute

to the overall findings.

Acknowledgements

This study was funded by a research grant provided by the Workplace Safety and Insurance Board (WSIB) of Ontario. The provision of the grant support does not in any way infer or imply WSIB endorsement of the research findings. All inferences, opinions, and conclusions drawn in this study are those of the authors and do not reflect the opinions or polcies and opinions of the WSIB. Christopher McLeod was supported by a Michael Smith Foundation for Health Research Scholar Award. Robert Macpherson, Ailin He, Mieke Koehoorn and Christopher McLeod were supported by research operating funds through the Partnership for Work, Health and Safety - a research partnership between WorkSafeBC (the British Columbia workers' compensation system) and the University of British Columbia. The authors report no conflicts of interest.

Sidebar

Macpherson RA, He A, Amick III BC, Koehoorn M, McLeod CB. Evaluating effectiveness of an integrated return-to-work and vocational rehabilitation program on work disability duration in the construction sector. Scand J Work Environ Health. 2022;48(3):229-238. doi:10.5271/sjweh.4006

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Received for publication: 3 September 2021

DETAILS

Subject:	Construction industry; Liability insurance; Regression analysis; Regression models; Occupational safety; Employment; Workweeks; Workers' compensation; Rehabilitation; Injuries; Vocational rehabilitation; Workers compensation; Disability management
Business indexing term:	Subject: Liability insurance Employment Workweeks Occupational safety Construction industry Vocational rehabilitation Workers compensation Disability management
Location:	Ontario Canada; United States--US; Canada
Publication title:	Scandinavian Journal of Work, Environment &Health; Stockholm
Volume:	48
Issue:	3

Pages:	229-238
Publication year:	2022
Publication date:	2022
Section:	Original article
Publisher:	Scandinavian Journal of Work, Environment &Health
Place of publication:	Stockholm
Country of publication:	Finland, Stockholm
Publication subject:	Occupational Health And Safety
ISSN:	03553140
e-ISSN:	1795990X
Source type:	Scholarly Journal
Language of publication:	English
Document type:	Journal Article
DOI:	https://doi.org/10.5271/sjweh.4006
ProQuest document ID:	2652912380
Document URL:	https://www. proquest.com/scholarly-journals/evaluating-effectiveness-integrated-return-work/docview/2652912380/se-2?accountid=211160
Copyright:	Copyright Scandinavian Journal of Work, Environment &Health 2022
Last updated:	2022-04-21
Database:	Public Health Database

Informal employment, precariousness, and decent work: from research to preventive action

Benavides, Fernando G; Silva-Peñaherrera, Michael; Vives, Alejandra

ABSTRACT (ENGLISH)

Informal employment--that is work without a contract, legal protection or social security--is the most common employment arrangement in the world. According to the International Labor Organization, its share of total employment (SDG indicator 8.3.1) was 61% (2 billion workers) by 2016. While globally the proportion of informal workers is larger among men (63% versus 58% for women), there are more countries (55%) where the share of women in informal employment exceeds that of men. In fact, informal employment constitutes a persistent, structural pillar of labor markets, especially in low- and middle-income countries. And while in the USA and the EU, informal employment is around 18% and 15% of the occupied labor force, respectively, figures are 53% for Latin America, and 88% and 77% in Africa and Asia (excluding China), respectively. Here, Benavides et al examine the health impact of informal employment.

FULL TEXT

Decent work, defined by the International Labor Organization (ILO) in 1999 in relation to promoting productive and freely chosen employment, fair income, security in the workplace, guaranteeing rights at work, granting social protection, freedom of organization and creating social dialogue, is a basic condition for the health and wellbeing of workers and their families (1). Underpinned by the Declaration of Philadelphia, which states that all human beings have the right to develop in freedom and dignity, economic security and equal opportunity (2), decent work is key goal number 8 of the United Nations' 2030 Agenda for Sustainable Development (SDG).

However, informal employment - that is work without a contract, legal protection or social security - is the most common employment arrangement in the world. According to the ILO, its share of total employment (SDG indicator 8.3.1) was 61% (2 billion workers) by 2016. While globally the proportion of informal workers is larger among men (63% versus 58% for women), there are more countries (55%) where the share of women in informal employment exceeds that of men (3). In fact, informal employment constitutes a persistent, structural pillar of labor markets, especially in low- and middle-income countries. And while in the USA and the EU, informal employment is around 18% and 15% of the occupied labor force, respectively, figures are 53% for Latin America, and 88% and 77% in Africa and Asia (excluding China), respectively.

Despite this overwhelming reality, we have little evidence of the health impact of informal employment. In a seminal study carried out in Brazil, Santana &Loomis (4) showed that workers without job contracts (informal employment) had a 20% greater risk of occupational injury than workers with a contract (formal employment). In a recent 2011 study based on the first working and employment conditions survey in Central America, LopezRuiz et al (5) showed that the lack of social security coverage (informal employment) was associated with a higher prevalence of poor self-perceived health and poor mental health in both genders. Utzet et al (6) confirmed these results in a study based on a sample of 176 786 workers from national working conditions and health surveys carried out in 13 Latin American and Caribbean countries between 2012 and 2018, which found that informal workers (defined by coverage or contribution to a health/pension plan/insurance) reported significantly worse self-perceived health than formal workers, both among women [1.28 (95% CI 1.14-1.43)] and men [1.30 (1.12-1.50)]. In another study, based on ecological data (2000-2016) for 17 Latin American countries, SilvaPeñaherrera et al (7) found a clear and significant positive association between the national rates of informal employment and adult mortality rates.

The main hypothesized mechanisms that could explain the relationship between informal employment and poor health include poor employment conditions (low income, employment insecurity, lack of social security and workplace rights, etc.) and poor working conditions (unsafe workplace, poor air quality, heavy load handling, high demand and low control, etc.), as well as poor living conditions and limited access to health services. However, much research is still needed to better understand the health consequences of informal employment and its mechanisms, acknowledging that informal work is a heterogeneous phenomenon that makes both research and policy-making especially challenging.

In high-income countries, on the other hand, where informal employment is generally <20% (8), its effect on worker's

health has been studied scarcely (9) and with contradictory results. For example, a study using the European Working Conditions Survey of 2010 did not find differences in self-perceived health between formal and informal employees (10), while another study conducted with data from Spain comparing four different employment profiles only found differences in self perceived health status among women in informal employment (11). An explanation for these results could be that healthcare coverage in Spain is universal, and some social protection services, not necessary by direct contribution to the social security system, are not restricted to formal employees. This might attenuate possible health inequalities resulting from working in informal arrangements. In Chile, using the 2010 employment conditions survey, Ruiz et al (12) found differences in health that were only significant among men. The authors hypothesized that formalization may not be as beneficial for women as men given the higher levels of precariousness of female formal employment and the double burden of unpaid work.

Conversely, research on the health impact of precarious employment on formally employed workers have increased in the last two decades (13). In fact, precarious employment, which may affect the full range of standard and non-standard employment arrangements, is considered an emerging determinant of health (14). One reason that could explain this interest, as compared to the volume of research on informal employment and health, is that employment precariousness is a growing problem in high income countries (15, 16). This progress in the available evidence on the association between precarious employment and poor health is also not unrelated to the fact of having a developed a conceptual proposal of the key dimensions of employment precariousness for health, and a measurement instrument, the Employment Precariousness Scale - EPRES (17), which has been adapted to different countries from Chile (18), Spain (19), Sweden (20) and Greece (21) to the European Union (22) more recently. Ervasti &Virtanen (23) has underlined these efforts and their limits.

Briefly, we could summarize that informal employment is characterized by the lack of a contract and social security coverage and that precarious employment is characterized by a weak employment relation with different extents of employment insecurity, low wages, limited workplace rights and social protection among formally employed workers. A shared feature of workers in poor employment conditions is that they generally perform less qualified jobs, face more risks at work and lack the power to bargain over their working and employment conditions to improve them (24). Informal and precarious workers are generally invisible for statistics, such as occupational injury and unemployment rates and, as a consequence, do not exist for policy-making or social security purposes. Globally the gap is enormous: only 35% of the world's employed population has coverage for occupational injuries and <19% of the unemployed receive unemployment benefits (25).

To manage this social interaction, we propose a unified conceptual framework of working and employment conditions. For public policy decision-makers and professional practitioners, the former are the classical object of the occupational health and safety issue, and the latter are the object of the human resources issue. Integrating both dimensions in an axis of coordinates, as is shown in figure 1, we could broaden our understanding of decent work as the best interaction between working and employment conditions. In this scenario, informal employment generally represents the worse scenario as unprotected jobs lack employment and income security and are performed in unhealthy and unsafe working conditions. In the middle position would be precariously employed salaried workers, who - although covered by legal regulatory frameworks - are frequently ill-protected by labor inspection, granted limited or insufficient social security coverage, and most probably incapable of demanding healthy working conditions. Finally, the best and desirable scenario would be decent work combining healthy and nurturing employment and working conditions.

This framework may contribute to understanding that employment and working conditions are strongly interrelated and that both require attention both from research and policy making. The ILO emphasizes that promoting decent work for all requires realizing fundamental rights at work, creating more and better employment and income opportunities, extending social protection, and promoting social dialogue. We add that this is not only a necessary step towards decent employment but an indispensable one to grant all workers adequate working conditions and thus achieve the goal of decent work in an integral manner.

We are in the middle of a great transformation probably comparable to the Industrial Revolution in the 18th and 19th

centuries. One which has been accelerated by the COVID-19 pandemic (26). An epoque change characterized by a new economic and labor space, as well as a social one - cyberspace - which deepens the digitization of the economy and the exponential increase in the flexibility of the labor market (27). Think of gig-working in delivery or driving, at a high risk for workers own health, or other forms of platform teleworkers, caregivers, etc., always available for the work that is needed, when it is needed. It is the other side of the relocation of work, both physically and organizationally, and with the only link being the internet connection (28). New forms of work on the bridge between self-employment and informal or highly precarious dependent work that require still greater effort if the health of the workforce is to be protected.

Sidebar

1 Center for Research in Occupational Health, Universitat Pompeu Fabra, Barcelona, Spain.
2 Ibero-American Observatory on Safety and Health at Work, Ibero-American Social Security Organization
3 CIBER Epidemiología y Salud Pública (CIBERESP) and IMIM (Hospital del Mar Medical Research Institute), Barcelona, Spain.
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DETAILS

Subject:	Workers; Social security; Employment; Occupational health; Labor; Low income groups; Labor market; Working conditions; COVID-19
Business indexing term:	Subject: Workers Occupational health Employment Labor market Working conditions Social security
Location:	Chile; Spain
Publication title:	Scandinavian Journal of Work, Environment &Health; Stockholm
Volume:	48
Issue:	3
Pages:	169-172
Publication year:	2022
Publication date:	2022
Section:	Editorial
Publisher:	Scandinavian Journal of Work, Environment &Health
Place of publication:	Stockholm
Country of publication:	Finland, Stockholm
Publication subject:	Occupational Health And Safety
ISSN:	03553140
e-ISSN:	1795990X
Source type:	Scholarly Journal
Language of publication:	English
Document type:	Editorial
DOI:	https://doi.org/10.5271/sjweh.4024
ProQuest document ID:	2652912279

Short-term effectiveness of face-to-face periodic occupational health screening versus electronic screening with targeted follow-up: results from a quasi-randomized controlled trial in four Belgian hospitals

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ABSTRACT (ENGLISH)

Objectives In many countries, organisations are legally obliged to have occupational physicians screen employees regularly. However, this system is time-intensive, and there may be more cost-effective alternatives. Our objective is to compare the short-term effectiveness of periodic occupational health screening of hospital employees by an occupational physician with a system of electronic screening with targeted follow-up. Methods A randomized controlled trial was set up among personnel of four Belgian hospitals, with three measurement moments between June 2019 and December 2020, to compare differences in self-assessed health, healthcare use, productivity and intermediate outcomes over 19 months. Mixed effects models were used to assess differences in effectiveness. Superiority and non-inferiority post-hoc tests were used as a robustness check. The experiment coincided with the first two COVID-19 waves during which hospital employees were exposed to an exceptional period of occupational stress. Results In total, 1077 employees (34% of the target population) participated. Although we observed some immediate effects of the intervention (less trust in the physician, absenteeism, and healthcare use), all these effects disappeared over time. After 19 months, including two waves of COVID-19 hospitalizations, no significant differences were observed between employees screened through face-to-face contact and those screened electronically. Conclusions Our study finds no indication that, in the short-term, substituting physician screening of the workforce with a quicker survey-based screening with targeted follow-up has different effects on the studied endpoints. However, as health and disease are often the result of a long-term process, more evidence is needed to determine long-term effects.

FULL TEXT

Headnote
Objectives In many countries, organisations are legally obliged to have occupational physicians screen employees regularly. However, this system is time-intensive, and there may be more cost-effective alternatives. Our objective is to compare the short-term effectiveness of periodic occupational health screening of hospital employees by an occupational physician with a system of electronic screening with targeted follow-up.
Methods A randomized controlled trial was set up among personnel of four Belgian hospitals, with three measurement moments between June 2019 and December 2020, to compare differences in self-assessed health, healthcare use, productivity and intermediate outcomes over 19 months. Mixed effects models were used to assess differences in effectiveness. Superiority and non-inferiority post-hoc tests were used as a robustness check. The experiment coincided with the first two COVID-19 waves during which hospital employees were exposed to an exceptional period of occupational stress.
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Conclusions Our study finds no indication that, in the short-term, substituting physician screening of the workforce with a quicker survey-based screening with targeted follow-up has different effects on the studied endpoints. However, as health and disease are often the result of a long-term process, more evidence is needed to determine long-term effects.
Key terms health assessment; medical examination; mixed-effect model; multilevel modelling; occupational stressor; randomized controlled experiment.
Work and health are intricately linked. On the one hand, evidence points out that work is an important source of value and meaning (1, 2) and has positive effects on health (3, 4). On the other hand, the workplace can be a hazardous environment when employees are confronted with physical, chemical, biological, or psychosocial hazards (5, 6).
To minimize the impact of occupational risks on health and functioning, many countries make use of periodic occupational health screenings. In the US, the Occupational Safety and Health administration (OSHA) requires medical screening for numerous hazardous substances (7). In the EU (and UK), these routine medical examinations are offered to nearly all workers on an annual basis as an implementation of Article 14 of Directive 89/391/EEC (8, 9). The European Agency for Safety and Health at Work (EU-OSHA) survey among European workplaces - the European Survey of Enterprises on New and Emerging Risks (ESENER) - indicated that 65% of establishments (58% for micro and 89% for large enterprises) arrange regular medical examinations to monitor the health of employees (10). These periodic health screenings can include measuring biometrics and offer a clinical investigation by an occupational physician (9, 10). They focus on primary (eg, vaccination), secondary (eg, screening for diseases), and tertiary prevention (eg, return to work), often take a job-specific risk analysis as a starting point, and can lead to both individual (employee) and collective (worksite) measures (11, 12).
However, there is - as of yet - insufficient evidence on the effectiveness of health examinations, and more research is needed in this field. A systematic review of general health screening found 14 studies of sufficient quality, and did not find studies that indicated an effect on all-cause, cardiovascular, or cancer mortality. In contrast, it suggested they could lead to adverse effects such as overtreatment, misplaced reassurance, or (in the case of false positives) unnecessary worries about health (11). However, these health checks were not performed in an occupational health setting, and are therefore not readily transferable. Even if only high-risk individuals are targeted, it remains an open question whether their screening is beneficial (12), and more research is needed.
Another common challenge of such workers' health surveillance systems is that they are demanding in terms of working hours. In Belgium for instance, an occupational physician sees about 70% of employees regularly, thus taking up a significant portion of both employees' and physicians' time (13). Meanwhile, occupational physicians are

proving ever more difficult to recruit (14-16). Therefore, the question rises whether it is possible to allow for alternative, less labor-intensive means of screening workers without unduly compromising effectiveness.
A targeted approach might be more promising. A possible alternative is therefore to use a screening survey that selectively refers employees to the occupational physician when it detects indications of functioning and/ or (work-related) health problems. This could save occupational physicians' time, and it is a priori an attractive option for employers and employees. The former might save on screening costs, the latter might prefer a survey's practical ease (an online survey can be completed everywhere). Research also points out that some health problems are more easily disclosed in surveys than during face-to-face consultations (17). Several countries already use surveys as surveillance systems to monitor occupational health (18-20), while others (eg, Finland and The Netherlands) have used health risk appraisals for the purpose of triage and screening (21). Belgium has taken legal steps in the direction of implementing novel triage instruments and allows some employees to be followed up at two-yearly intervals with a medical questionnaire in between, which serves to identify employees in need of closer follow-up (22). A new instrument has been developed especially to this end, which could be relevant for other countries as well (23).
In this study, we present the results of a quasirandomized trial in four Belgian hospitals that compares care-as-usual (periodic health screenings by the occupational physician) with employees who complete an electronic health survey with selective follow-up (the intervention group). We compare the short-term effectiveness across four groups of outcomes: health, health-related productivity, healthcare use, and intermediate variables. The experiment coincided with the first two COVID-19 waves. As this affects both control and intervention groups equally, this allowed us to assess the effects of the intervention during a time that was, particularly in the hospital sector, characterized by heightened stress, work pressure, occupational health complaints, and population demand for health services (24).
Methods
Experimental design
The study protocol is published on ClinicalTrials.gov (Identifier NCT04684316). In a population of 53 Flemish hospitals, we recruited 4 large ones that were willing to participate in this study. In these hospitals, 3150 employees were eligible for periodic health screenings: personnel with safety functions, jobs with heightened vigilance, work that involves physical, biological or chemical agents or tasks that are an ergonomic or mental burden (22). Occupational groups that perform especially risky activities (frequent exposure to ionizing radiation, preparation of cytostatics, or exposure to carcinogens, mutagens, or reprotoxic substances) are excluded from the study population, as it is deemed that in these cases the electronic survey does not constitute adequate care that minimizes health risks.
We estimated that a minimum of 1700 employees (selected from four hospitals) had to be recruited (with an assumed dropout of 50%, effectively participating 850), equally divided over the two groups. This is grounded on power analyses in Stata 2014 MP, estimating sample size for a two-sample means test assuming equal standard deviations in intervention and control group, power 0.9 and significance level of 0.05, based on three data sources (25-27).
Employees were allocated to one of four groups (figure 1, panel A): a random and non-random intervention group where employees received an electronic survey with selective occupational physician follow-up, and a random and non-random control group where all the occupational physician conducted periodic health screenings of employees. In May 2019, the majority of the participants were randomized (with a computerized random number generator) between control and intervention group until both groups were of equal size (1575 employees). However, some employees (who had gone the longest without a consultation) had already received a periodic health screening between January and June 2019, and were therefore non-randomly assigned to the control group. For one hospital, half of the participants were already allocated to the non-random control group in this way. Since randomization would have resulted in an intervention group with less than half of the participants, all remaining employees were (non-randomly) allocated to the intervention group.
The consultations (figure 1, panel B) occurred between January and June 2019 for the non-random control group,

and between July and December 2019 for the other participants (random control group and employees of the intervention group that were referred by the algorithm). The quality of the randomization is evaluated by comparing the descriptive statistics of the control and intervention group and the samples against aggregate (population) data from the hospitals.

There are three measurement moments [each time with the same survey (23), and in both groups]: between June and October 2019 (before COVID-19), between February 2020 and May 2020 (seeing the start of the first COVID wave in Belgium), and between September 2020 and December 2020 (during the second peak in the hospitals). If participants in the intervention group did not complete the first survey, they were referred to the occupational physician for a consultation. The design is graphically represented in figure 1, panel B. The data for COVID-19 hospitalizations in Belgium and how this relates to the timing of the measurements is shown in figure 1, panel C. Both COVID-19 waves were notoriously large in Belgium, amongst the highest per capita in the world at the time (29).

In care-as-usual, all employees at risk were invited to attend a yearly screening, starting with a biometric examination, spirometry, vision test, and blood and urine test. The occupational physician then investigated the general health status and systems of the employee, which includes an anamnesis with questions about new health burdens or changes in occupational risks, followup questions on previous complaints, medical advice, referral to a healthcare provider, or booking another appointment with an occupational health specialist. In the intervention group, all employees completed an online health screening questionnaire. Dependent upon their answers, 20% of the employees [ie, the 20% of the employees who mostly needed contact with the occupational physician, as described elsewhere (23)] were referred to the occupational physician for a discussion of the results. For that 20%, the consultation then pro- ceeded similar to care-as-usual. The other 80% did not receive further care.

In the control group, we expected that health screening would give rise to additional healthcare use in the short-term. The early detection and follow-up of health problems might then lead to a long-term amelioration in health, lower healthcare use and less absenteeism. In the intervention group, the short-term rise in healthcare use was expected to be smaller because there was less contact with an occupational physician, which could in turn lead to less long-term benefits.

However, these long-term effects often only occur after several years. Given the relatively brief timing of our data collection (19 months), we tried to circumvent this complication by also incorporating short-term outcomes. We expected the health literacy (25) and trust in physician to be higher in the control group compared to the intervention group, as these employees received more individual advice, and had an extra contact moment with the physician. We also expected turnover intention to be higher for the intervention group, as the occupational physician was less able to address job-specific issues. Finally, worry about health was expected to be higher in the intervention group as this is related to their health status.

Therefore, we compared the short-term effectiveness across four groups of outcomes over a follow-up period of 19 months: health, health-related productivity (absenteeism and presenteeism), healthcare, and intermediate variables (supplementary material, www.sjweh. fi/article/4011, supplement G). We focussed on three primary variables: general health [EuroQol 5-Dimension (EQ-5D] visual analog scale, 0-100), musculoskeletal problems (nordic musculoskeletal questionnaire, NMQ, 1-10), and general mental health (general health questionnaire, GHQ, 0-12). Secondary variables were absenteeism (days absent last four weeks), spontaneous consultations with the occupational physician (0-), health literacy score (HLS, 0-100), trust in physician (0-55), turnover intention, and a weighted score of worry intensity (how much do you worry about your health?), and frequency (how often do you worry about your health?). Supplementary tables S7-11 contain analyses for additional variables: stress (0-12), burnout (0-16), sleep problems (0-16), need for recovery at work (NFR, 0-11), referrals by the occupational physician (0-), work-related consultations with other providers (0-), job satisfaction (0-16), role conflicts (0-12), use of prescribed medication (no/yes), use of non-prescribed medication (no/yes), weighted presenteeism [multiplying days of reduced functioning by a functioning weight, as recommended in Bouwmans, Krol (30)].

Statistical analysis

Generalised linear mixed effects models (GLMM) were used to assess the effect of the intervention upon the outcome measures. We discuss their nature, as well as the approach we took for our data, in depth in Supplement A. In our analyses, fixed effects were used on the level of the employee, and a random intercept and (time) slope effect was introduced to allow each employee to deviate from the (overall) fixed effect. The choice of the covariance structure (and random effects) for each outcome was based on the Akaike information criterion (AIC) (31).
If the quality of the sample indicated significant differences, we controlled for those covariates in the regression analyses, and made use of post-hoc TukeyKramer tests (also called honest significant difference tests) as a robustness test of our estimates (see Supplement A). Results were averaged over the levels of the covariates (hospital, gender, education), and a P-value adjustment was used by the Tukey method for comparing a family of 6 estimates (3· 2 groups).
In addition, non-inferiority and non-superiority tests of means were performed, with tests assuming a difference of delta (5) affirms non-inferiority or non-superiority of the intervention mean versus the control mean. We thus verified whether the intervention was non-inferior (when higher outcomes are better) or non-superior (when higher outcomes are worse) in comparison to the control group (32). If the test was non-significant, non-inferiority or non-superiority cannot be concluded. Delta values were based on power calculations, clinically meaningful effects, and recommendations (32-34).
Results
Sample
In the four hospitals, 1077 unique employees participated in one or more of the three survey rounds and completely filled out the survey: 516 were allocated to the intervention group (441 random, 75 non-random), and 561 to the control group (81 random, 480 non-random). This means the average overall participation rate was 34% (1077 in 3150). Table 1 shows characteristics for wave 1 stratified by group. Supplementary table S1 shows the participation over the three survey rounds (N=776 for wave 1, N=418 for wave 2, N=588 for wave 3), and descriptive statistics by wave. Supplementary table S2 shows descriptive statistics for the 208 respondents (7%) that completed all three survey waves, and presents health status information.
The 1077 unique employees gave rise to 1782 response records over all three measurement moments: 906 responses were from the control group, 876 from the intervention group. Of the 876 responses in the interven- tion group, 126 were referred by the algorithm to the consultation of an occupational physician (the top 20% of the scores), 684 were not referred (524 because they were in the bottom 80% of the scores, 160 because they missed the first measurement), and 66 were not referred but still opted for a face-to-face consultation. The 160 employees in the intervention group that missed the first measurement were invited for a face-to-face consultation with the physician, due to ethical reasons.
We assessed the quality of our sample in two ways. First, we evaluated the randomization process by verifying whether the control and intervention group differed substantially on background characteristics. Supplementary tables S3-5 show descriptive statistics by group for waves 1, 2, and 3, which demonstrate small differences for education in wave 1 (not wave 2 or 3). Second, we compared our sample with aggregated population data from hospitals B, C and D (there was no data available for hospital A), the results are presented in supplementary table S6. In light of these results, we controlled all regressions for age, gender, and education, but not occupation (since this is highly correlated to education), and made use of post-hoc tests.
Generalised mixed models for final and intermediate outcomes
The estimates from the generalized mixed regressions are shown in tables 2-3, full models are available in supplementary tables S7-11, and show the average fixed effects for group and time, and the interaction effects. Note how the absence of COVID-19 makes the first measurement (pre-COVID) fundamentally different from the second and third measurements.
The results indicate no significant overall differences between intervention and control group for health status (EQ-5D vas), musculoskeletal problems, general mental health, health literacy, turnover intention, and worrying about health. The intervention group had, on average, lower scores for trust in the physician (-0.94 on a scale of 55. The

intervention group was also, on average, fewer days absent from work [incident rate ratio (IRR) 0.30], and had fewer spontaneous consultations (IRR=0.35). However, these were mainly the result of differences in the first measurement.

The interactions at time 2 indicate an increase in the difference of intervention and control group for musculoskeletal problems, health literacy, the weighted worryscore, and (because turnover intention in the control group increased) a decrease in the difference of turnover intention, compared to the difference of intervention and control group in time 1.

At the point of final measurement, general mental health is reduced for the intervention group. The between group differences of absenteeism and spontaneous consultations decreased (the intervention group rose in comparison to the control group in time 1, making the difference smaller). The interactions thus indicate a short-term difference between groups at time 1 that diminished over time. We judged the absence of effects in time 2 and 3 as more important than the presence of group differences in time 1, as we hypothesized that the occupational burdens to which participants were exposed were higher during COVID-19 (time 2 and 3).

Supplementary tables S12-13 summarize the posthoc estimations. For the superiority post-hoc differences, only absenteeism, referrals, and spontaneous consultations are significantly different between groups (first three columns of supplementary table S12). This is represented graphically in supplementary figure S1. In the non-inferiority tests, the majority of the estimates indicate the intervention is at least as good as care-as-usual (EQ-5D, NMQ, stress, GHQ, NFR, HLS, trust, job satisfaction, absenteeism, healthcare use, and presenteeism). If the null hypothesis cannot be rejected, this does not indicate that the reverse (inferiority of the intervention group) is true.

Discussion

Non-inferiority tests indicate the intervention group performs at least as well as the control group on the majority of the outcomes. The regressions and (superiority) post-hoc analyses indicate that there were some short-term effects of the intervention: trust in the physician, absenteeism and healthcare use (referrals, spontaneous consultations, and work-related consultations) were lower in the intervention group. However, these differences predominantly occurred in wave 1 and were no longer present in the third measurement moment when participants had been exposed to exceptional circumstances.

Because the second and third measurement largely coincided with peaks in COVID-19 hospitalizations, the COVID pandemic possibly increased the healthcare needs of hospital personnel during this period (24). We believe this was an unforeseen advantage of our study: whereas in normal situations it can take a long time before employees develop complaints, the external health shock accelerates this process, as employees were temporarily put under extreme strain. However, while our data and other publications (24) suggests this is the case, a causal interpretation is subject to discussion: personnel might have been more committed to their patients' care than usual; as operations were postponed, workload might have decreased, and not all participants were medical personnel.

In a way, the absence of large differences between the control and intervention group could have been expected for some of the outcomes (eg, overall health): it often takes a long time before the beneficial effects of screening become apparent, and our study duration (19 months) might have been too short to pick this up. Although the COVID-19 pandemic had a clear impact on the data - for instance visible in the increased stress, burnout risk, and musculoskeletal functioning problems over time - it did not increase the differences between the face-to-face screenings of the control group compared to the targeted screenings. While outcomes changed over time, differences between groups remained largely absent.

The differences we did find (absenteeism, trust, and healthcare use) were mainly driven by differences in the first measurement. Their direction seems plausible: after the control group had a face-to-face screening, it seems natural that their trust in their physician would increase. Likewise, if health or functioning problems are discussed in the screening, this might lead to additional consultations (hence increased healthcare use) or increased absenteeism (eg, to consult specialists or by following the physician's advice to stay home). The rise in healthcare use is consistent with other literature, where a higher healthcare use is one of the short-term consequences of face-to-face screening, but the rise in absenteeism is not (27). The fact that these effects are no longer present in the second

and third wave might be explained by several factors. COVID-19 might have urged personnel (from control and intervention groups alike) to refrain from taking absence leave because of the increased pressure on the hospitals or from visiting physicians because of contact restrictions. In addition, it is also possible that the effects of face-to-face contact were only temporary: an immediate increase in healthcare use, absenteeism, and trust that faded away by the time of the second and third measurement. Third, the non-perfect randomization might have played a role, although the robustness checks of the quality of our sample (both vis-a-vis the population and based on background differences between groups) did not indicate large problems in this respect.

Some limitations and potential biases should also be pointed out. Although we verified the quality of our sample, the randomization process was only partial and participation could have been affected by selection bias. Similarly, our results are dependent on the four selected hospitals, although care was taken to select large hospitals from different regions. The results are also limited to the short timeframe of the study (19 months), limited participation (13-25% across waves, 7% completed all surveys) and to the use of self-assessed outcomes. Because self-assessed outcomes were used, in contrast to diagnostic information from occupational physicians, this study focused on the effectiveness of the intervention, not on its ability to detect health problems (eg, burnouts). The design and performance of the survey and algorithm was however taken up in a previous article (23). Finally, it is possible that the intervention (leaving out a face-to-face screening with the physician) had little effect because the employee and physician already had a long-standing bond, built up from past screenings and workplace visits. As shown in supplementary tables S1-2, about half the sample knew the occupational physician for five years or longer. A robustness analysis where this relation was added as a fixed covariate effect did not show substantial differences.

While COVID-19 might have increased the burden on personnel and gives an indication of long-term effects, the intervention's short-term effects might differ in a non-COVID-19 period, and the true long-term effects should be measured in further research. It is still possible that, as in other prevention studies, the benefits of face-to-face screening only become apparent in the long run (35) [eg, diseases with a long latency period such as silicosis (36)]. Nevertheless, the short-term impact of screening is far from irrelevant: turnover is traditionally high in the hospital sector (causing short employment periods), intermediate outcomes give an indication of long-term effects, and short-term changes can strongly affect cost-effectiveness (eg, a higher healthcare use in the short term without long-term improvements can point to overuse of care).

For policy-makers and practitioners, we want to emphasize that we did not compare physician screening with no screening but rather more targeted screening. This means we cannot make claims on the effectiveness of physician screening, but can only compare it to the intervention: screening after an additional risk selection. In addition, we wish to highlight that occupational health services and periodic health screenings can have other purposes - they can be used for primary, secondary, and tertiary prevention. Our conclusions are limited to the measured outcomes and timeframe of 19 months.

Concluding remarks

For those populations where physical consultations are not strictly necessary, a lower frequency of face-to-face health screening might prove at least as effective if combined with a more targeted approach to ensure those who really need it are still offered adequate care.

Acknowledgments

We wish to express our gratitude to Annouschka Laenen for her assistance with the statistical analyses. The authors report grants from Belgian Professional Association for Occupational Medicine, Idewe, Liantis &Mensura, during the conduct of the study (grant number EZG-D7685); and one of the authors became CEO of the occupational health service IDEWE after the study was completed. The funders had no role in the analyses or interpretation of data; in the writing of the manuscript, nor the decision to publish the results.

Sidebar

Steel JS, Godderis L, Luyten J. Short-term effectiveness of face-to-face periodic occupational health screening versus electronic screening with targeted follow-up: results from a quasi-randomized controlled trial in four Belgian hospitals. Scand J Work Environ Health. 2022;48(3):222-228. doi:10.5271/sjweh.4011

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Received for publication: 14 June 2021

DETAILS

Subject:	Occupational health; Long-term effects; Psychological stress; Health care; Physicians; Hospitals; Absenteeism; COVID-19; Experiments; Occupational exposure; Employees; Clinical trials; Medical screening; Coronaviruses; Health surveillance
Business indexing term:	Subject: Occupational health Employees
Location:	Belgium
Company / organization:	Name: Occupational Safety &Health Administration--OSHA; NAICS: 926150
Publication title:	Scandinavian Journal of Work, Environment &Health; Stockholm
Volume:	48
Issue:	3
Pages:	220-228
Publication year:	2022
Publication date:	2022
Section:	Original article
Publisher:	Scandinavian Journal of Work, Environment &Health
Place of publication:	Stockholm
Country of publication:	Finland, Stockholm
Publication subject:	Occupational Health And Safety
ISSN:	03553140
e-ISSN:	1795990X
Source type:	Scholarly Journal
Language of publication:	English

Cancer incidence in sites potentially related to occupational exposures: 58 years of follow-up of firefighters in the Norwegian Fire Departments Cohort

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ABSTRACT (ENGLISH)

Objectives Firefighters are exposed to a variety of known and suspected carcinogens through their work. However, the association with cancer risk has limited evidence. We examined cancer incidence among firefighters in the newly established Norwegian Fire Departments Cohort restricted to sites with established associations with carcinogens encountered during firefighting. This included sites within the respiratory, urinary, and lymphohematopoietic systems, and the skin and all sites combined. Methods Male firefighters (N=3881) in the cohort were linked to the Cancer Registry of Norway for incident cancer cases occurring during the period 1960-2018. We calculated standardized incidence ratios (SIR) with rates for the national male population as reference, and stratified SIR analyses by period of first employment, duration of employment, and time since first employment. Results Elevated risk was seen for all sites combined (SIR 1.15, 95% confidence interval 1.07-1.23). Elevated risk of urinary tract cancer was observed among firefighters who began working before 1950, and with observation >40 years since first employment. Risk of mesothelioma and laryngeal cancer were elevated with >40 years since first employment and with >30 years employment duration. Conclusions The observed associations between firefighting and urinary tract cancer, laryngeal cancer, and mesothelioma have been observed in some studies previously, and our results

suggest the observed elevated risks are related to carcinogenic occupational exposures. Differences in risk by period of employment potentially reflect changes in exposures from improved quality and use of personal protective equipment.

FULL TEXT

Headnote

Objectives Firefighters are exposed to a variety of known and suspected carcinogens through their work. However, the association with cancer risk has limited evidence. We examined cancer incidence among firefighters in the newly established Norwegian Fire Departments Cohort restricted to sites with established associations with carcinogens encountered during firefighting. This included sites within the respiratory, urinary, and lymphohematopoietic systems, and the skin and all sites combined.

Methods Male firefighters (N=3881) in the cohort were linked to the Cancer Registry of Norway for incident cancer cases occurring during the period 1960-2018. We calculated standardized incidence ratios (SIR) with rates for the national male population as reference, and stratified SIR analyses by period of first employment, duration of employment, and time since first employment.

Results Elevated risk was seen for all sites combined (SIR 1.15, 95% confidence interval 1.07-1.23). Elevated risk of urinary tract cancer was observed among firefighters who began working before 1950, and with observation >40 years since first employment. Risk of mesothelioma and laryngeal cancer were elevated with >40 years since first employment and with >30 years employment duration.

Conclusions The observed associations between firefighting and urinary tract cancer, laryngeal cancer, and mesothelioma have been observed in some studies previously, and our results suggest the observed elevated risks are related to carcinogenic occupational exposures. Differences in risk by period of employment potentially reflect changes in exposures from improved quality and use of personal protective equipment.

Key terms carcinogen; cohort study; firefighting; occupational epidemiology.

Firefighters can be exposed to a variety of known and suspected carcinogens through their work. At the fire scene, substances classified as Group 1 human carcinogens by the International Agency for Research on Cancer (IARC) may be present, such as benzene, polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), 1,3-butadiene, 2,3,7,8-tetrachlorodibenzo-paradioxin, asbestos, and formaldehyde (1-3). Firefighters' equipment can contain hazardous chemicals such as plasticizers (4) which when exposed to heat, may lead to the release of carcinogenic substances. Equipment can also become contaminated with carcinogens at the fire scene (5, 6), subsequently also contaminating the fire station (7). Both at the fire scene and station, firefighters can be exposed to carcinogenic diesel exhaust (1, 8). In addition to exposure to known carcinogens, simultaneous exposure to a multiplicity of chemicals not recognized as carcinogens alone have also been hypothesized to contribute to carcinogenic effects (9).

Inhalation and dermal absorption of carcinogens are the predominant exposure routes relevant to firefighters (1). Post-fire, elevated levels of PAH have been detected on the neck (3, 5), hands (5, 10), and in the urine (11-13) of firefighters. Post-fire breath samples have also detected elevated levels of benzene and other volatile organic compounds (3, 11, 14). Positive-pressure self-contained breathing apparatus (SCBA) offer firefighters a workplace protection factor of about 10 000 (15). However, systemic exposures have been detected even when SCBA was used, suggesting that exposure to carcinogens via dermal absorption and off-gassing from contaminated equipment can still occur (3, 11, 14). Further, in Norway, SCBA is not yet widely used through all stages of firefighting (16).

Exposure to carcinogens relevant to firefighters have been associated with sufficient evidence in humans with increased risk of various cancer sites within the respiratory tract, skin, urinary organs and lymphohematopoietic system, as well as to all sites combined (17, 18). Among these sites, recent meta-analyses of firefighter studies have reported elevated incidence of bladder cancer (19, 20), cutaneous melanoma (20), and mesothelioma (19). Again, among sites with established associations with relevant carcinogens, a study on Nordic firefighters found elevated incidence of lung adenocarcinoma, mesothelioma, cutaneous melanoma, non-melanoma skin cancer, and all sites

combined (21).
In 2007, an IARC working group classified occupational exposure as a firefighter as possibly carcinogenic (1). Based on the epidemiological evidence, the working group identified testicular cancer, prostate cancer, and non-Hodgkin lymphoma as the sites most consistently associated with firefighting. Carcinogenic exposures relevant to firefighting were reviewed, but existing epidemiological studies did not in general include information on such specific exposures. Thus, the precise role between firefighters' specific occupational exposures and cancer risk remains unclear.
The aim of our study was to assess cancer incidence in sites of a-priori interest based on established associations with carcinogenic exposures normally encountered during firefighting by linking firefighters in the newly established Norwegian Fire Departments Cohort to outcome registries.
Methods
The Norwegian Fire Departments Cohort
The Norwegian Fire Departments Cohort was established between 2017 and 2019 in cooperation with firefighting departments and firefighters' unions. With the intent of including all geographic regions and as many of the largest professional fire departments in Norway as possible, 21 fire departments were invited to participate in the cohort. Of those invited, 14 accepted, and 1 additional department self-selected. As of 2019, these 15 participating fire departments provided firefighting services for nearly 50% of the Norwegian population (16), and the geographical distribution of the participating fire departments reflected that of the general population.
All individuals who worked at the participating departments between 1950 and 2019 were sought to be included in the cohort. Data based on personnel records were recorded by fire department staff, partly assisted by research assistants. For each person, the following information was entered into a database designed for that purpose: birth date, national personal identification number, vocational education, department and station(s) at which they worked, positions and time periods for each position held, and whether or not the position involved smoke-diving.
The participating departments registered 4667 persons (figure 1). Those who could not be identified by their personal identification number (N=35) and foreign nationals (N=5) were excluded because they could not be followed up in national registries. Ultimately, the Norwegian Fire Departments Cohort included 4627 persons.
Study sample
Of the 4627 persons in the cohort, we excluded nonfirefighting personnel with positions only as chimney sweeps, fire inspectors, or office personnel (N=667). Female firefighters (N=43) were excluded from the present analyses due to their low numbers. Those who died before 1960 (N=27) or were first employed after 2018 (N=9) were excluded based on the study follow-up period (1 January 1960-31 December 2018). Thus, the final study sample included 3881 men with positions entailing present or former active firefighting.
Employment duration for each individual was calculated as the time from the beginning of their first employment period until the end of their final employment period or end of follow-up. For those missing the date but not year of their earliest registered employment period (N=3), 1 July of the registered year was used. For those missing the end date of their latest registered employment period, the earliest of the following was used: the first of the month in which the individual reached age 65 years (N=49), date of death (N=11), date of emigration (N=2), or end of follow-up (N=1226).
Follow-up
A person entered follow-up on the latter of 1 January 1960 or start of first employment, and was followed until the first date of emigration, death, or 31 December 2018. The cohort was linked to national outcome registries using the personal identification number given to all Norwegian citizens alive in 1960 or born later; therefore, follow-up began in 1960. Date of emigration was obtained from the Norwegian Population Register. Cause and date of death were obtained from the Cause of Death Registry. Date and diagnosis of cancer cases were obtained from the Cancer Registry of Norway (CRN). There has been mandatory reporting of all cancer cases in Norway since the start of the registry in 1952, and the degree of completeness and accuracy is considered high (22). Cancer diagnoses from the CRN are updated and classified according to the 10th revision of the International Classification of Diseases (ICD-

10) for the codes C00-C96.

The present study assessed the risk of cancer for sites with an established association with carcinogenic exposures that firefighters can face. Exposures were identified from the IARC Monograph (volume 98) on firefighting (1), and cancer sites associated with these exposures with sufficient evidence in humans were identified from a summary of carcinogenic associations (18). This included respiratory tract cancers (lung, larynx, and mesothelioma), cutaneous melanoma, non-melanoma skin cancer (excluding basal cell carcinoma), urinary tract cancer, and cancers in the lympho-hematopoietic system. We assessed kidney cancer alongside urinary tract cancers because of their close physiological association within the urinary system. We assessed the aforementioned sites - having established associations with carcinogenic exposures - combined in a group named "exposure-associated sites", as well as all sites combined. Cancers for which an increased risk is often seen among firefighters but evidence of association with known occupational exposures in humans is limited, such as prostate cancer, were not included in the analyses (18).

Statistical analysis

Standardized incidence ratios (SIR) were calculated as the ratio of the observed and expected number of cases, with the rates of the general Norwegian male population as the reference. Person-years in five-year age and one-year calendar period strata were multiplied with the respective reference rates to obtain the number of expected site-specific or overall cancer cases. The exact 95% confidence intervals (CI) were calculated assuming a Poisson distribution of the observed number of cases.

Three time-based stratifications were conducted to examine nuanced trends in cancer risk: by year of first employment (static; <1950, 1950-1969 and >1970), to reflect how occupational carcinogenic exposures have changed over time; by employment duration (dynamic; <10, 10-19, 20-29, and >30 years), as a proxy for cumulative exposure; and by time since first employment (dynamic; <20, 20-39 and >40 years) to account for the latency period of cancer.

All analyses were conducted using Stata 16 (Stata Corp, College Station, TX, USA).

Results

The 3881 men who had worked in positions entailing active firefighting at any of the 15 participating fire departments in Norway accrued a total of 108 358 person-years, with an average of 27.9 years of follow-up (table 1). Among them, there were 845 incident cancer cases. Year of birth ranged from 1885 to 1996, and start of employment from 1913 to 2018 (supplementary material, www.sjweh.fi/article/4009, figure S1). The mean age at first employment was 27.6 years, and the average duration of employment was 21.8 years, with 74% having >10 years of registered employment (supplementary figure S2). Of the firefighters, 103 (3%) had worked at >1 department, and 92% worked full time throughout their registered employment; 51 (1%) had employment periods only for positions entailing <5% of full time employment.

In the overall analysis (table 2), the highest risk was observed for mesothelioma (SIR 2.47, 95% CI 0.995.06). Cutaneous melanoma and cancers of the larynx, kidney, and urinary tract tended to occur more frequently than expected. For the exposure-associated sites taken together, SIR was 1.10 (95% CI 0.98-1.22), and for all sites combined the SIR was 1.15 (95% CI 1.07-1.23).

In analyses stratified by year of first employment, we observed elevated incidence of urinary tract cancer among those who began working before 1950 (SIR 1.71, 95% CI 1.19-2.38) (table 3). With later period of first employment, the SIR for urinary tract cancer decreased, and a similar trend was observed for kidney and lung cancer. For exposure-associated sites combined, the most prominently elevated risk was observed among those who began working before 1950 (SIR 1.36, 95% CI 1.14-1.62). For all sites combined, SIR was also highest among those who began working before 1950 (1.29, 95% CI 1.15-1.44).

In analyses stratified by time since first employment, with observation to >40 years, we observed elevated incidence of laryngeal cancer (SIR 3.33, 95% CI 1.60-6.13), mesothelioma (SIR 3.47, 95% CI 1.27-7.55), and urinary tract cancer (SIR 1.49, 95% CI 1.10-1.97) (table 3). Lung cancer, in the stratum 20-39 years since first employment, was the only site with significantly fewer observed cases than expected (SIR 0.64, 95% CI 0.40-0.98), but SIR >1 were

observed in the other two strata. For exposure- associated sites combined, we observed elevated risk in the stratum with >40 years since first employment (SIR 1.25, 95% CI 1.08-1.44). For all sites combined, SIR increased up to 1.18 (95% CI 1.08-1.29) in the stratum with >40 years since first employment.

In analyses stratified by duration of employment, we observed elevated incidence of laryngeal cancer with an employment duration >30 years (SIR 2.53, 95% CI 1.16-4.80) (table 3). Incidence of mesothelioma was also elevated with employment duration >30 years (SIR 3.09, 95% CI 1.00-7.20). For urinary tract cancers, there were more cases than expected for all lengths of employment except for 10-19 years (only three cases). For exposure-associated sites combined, we observed elevated incidence with >30 years employment duration (SIR 1.18, 95% CI 1.02-1.37). For all sites combined, we observed an expected incidence for the shortest employment duration group, and increasing SIR with increasing duration up to 1.19 (95% CI 1.09-1.30) with employment duration >30 years.

Discussion

This study evaluated cancer incidence in sites of a-priori interest based on established associations with known carcinogenic exposures which can occur during firefighting. The cohort included 3881 male firefighters, and through a follow-up of 58 years, overall cancer incidence was modestly elevated for all sites combined compared with the general male population. Elevated risk of urinary tract cancer was found among those who started as a firefighter before 1950 and those with >40 years since first employment. Increased incidence of mesothelioma and laryngeal cancer was observed among those with >30 years employment duration and >40 years since first employment.

Lung and laryngeal cancer

Lung and laryngeal cancers were of a-priori interest based on the risk of inhalation of toxic smoke during firefighting activities. Overall, we observed near-expected incidence of lung cancer and non-significantly elevated incidence of laryngeal cancer. Surprisingly, meta-analyses have also found near-expected incidence of these cancers previously (19, 20, 23). Stratifications revealed that the numbers of observed cases of laryngeal and lung cancer were higher than expected with an employment duration >30 years and with >40 years since first employment, though risk estimates were highest among those with first employment before 1950 and decreased thereafter, potentially pointing towards period-dependent differences in exposure.

Occupational exposures to carcinogens such as asbestos, diesel exhaust and some PAH, relevant for firefighters, are risk factors for lung and laryngeal cancer (24-26). Positive-pressure SCBA is the most important protection against inhalation of toxicants for firefighters, and in Norway, positive-pressure SCBA has been increasingly used since the 1980s (16).

Unfortunately, data on lifestyle habits among Norwegian firefighters were not available. Cigarette smoking is the main risk factor for lung cancer, and is also an important risk factor for laryngeal cancer alongside excess alcohol consumption (24, 27). Cancers for which smoking is a predominant risk factor are especially prone to bias by the healthy worker effect. Previous Norwegian studies reported SIR of 0.81 for lung and 0.74 for laryngeal cancer among employed men (28), and SIR of 1.15 for lung and 1.14 for laryngeal cancer among unemployed men (29) compared with the general male population. A lung cancer SIR close to unity as observed at present is in agreement with smoking habits somewhat similar to the general population, or a combined effect of less smoking and occupational exposure to carcinogens, as was suggested by the incidence pattern for laryngeal cancer.

Mesothelioma

The elevated incidence of mesothelioma found in our study is similar to that found previously for Norwegian firefighters (SIR 2.78, 95% CI 1.02-6.06) (21), and is in line with findings from recent meta-analyses (19, 20). Inhalation of asbestos dust is the main cause of mesothelioma (30). Consistent with the frequently seen 30- to 40-year latency period for mesothelioma development following first asbestos exposure (30), we observed elevated incidence of mesothelioma among firefighters observed >40 years since first employment (6 cases).

Though the use and import of asbestos practically ended in Norway in the late 1970s (31), the risk of exposure remains a concern during firefighting in older burning and collapsing buildings. More cases than expected were observed across all periods of first employment, although the CI were wide and SIR based on small numbers. Stratification by employment duration suggested elevated incidence with employment duration >30 years,

demonstrating that risk of asbestos exposure and mesothelioma may be increased with prolonged employment.

Skin cancer

Overall, we observed more cases of cutaneous melanoma than expected, and near expected number of cases of non-melanoma skin cancer. Elevated incidence of melanoma among firefighters has previously been reported in the meta-analysis by Jalilian et al (20) and the Nordic study (21). The latter also reported elevated incidence of non-melanoma skin cancer (21). However, country-specific studies across Scandinavia have had heterogeneous findings, reporting suggested increased risk for melanoma (32), decreased risk of melanoma (33), and increased risk of non-melanoma skin cancer with no positive association to work duration (34). No clear risk patterns were observed from the present stratified analyses.

Ultraviolet radiation exposure and host pigmentation factors are major risk factors for both melanoma (35) and non-melanoma skin cancer (36). In addition, exposure to PCB can cause melanoma (37), and PAHcontaining exposures such as coal tar pitch, mineral oils, and soot are classified as human carcinogens causing non-melanoma skin cancer (17). Variability in levels of PAH in skin wipe samples between firefighting job assignments (5) suggest that dermal exposures can vary widely, potentially explaining some of the observed variability in risk.

Urinary tract and kidney cancer

Overall, there were more cases than expected of urinary tract cancer (excluding the kidney) among the firefighters in our cohort. Upon stratification, we observed elevated incidence among firefighters with first employment before 1950 as well as among those with >40 years since first employment. Bladder cancer is the predominant urinary tract malignancy, and our findings are partially in line with findings from recent metaanalyses demonstrating elevated incidence of bladder cancer among firefighters (19, 20).

Occupational exposure to mixtures containing benzo[a]pyrene has been associated with bladder cancer (1, 26), as has exposure to diesel exhaust (8). The risk patterns we observed may be an indication that these exposures were greater among firefighters with earlier periods of first employment. Improvements through recent decades in the quality, use, and maintenance of SCBA and personal protective equipment and the installment of local exhaust removal systems in Norwegian fire departments may have contributed to reduced exposures (16), and may correspond to the near-expected incidence observed among firefighters who began working more recently. Nonetheless, recent studies have detected significantly elevated levels of PAH in the urine of firefighters after compared to before firefighting (11, 13), and accumulating PAH in the urine among firefighting instructors with repeated daily firefighting exercises (38) despite SCBA use during active firefighting. These exposures were determined to have occurred via dermal absorption or via inhalation when SCBA was not used, and may remain relevant modes of exposure to carcinogens for firefighters in the present study, as well. As latencybased trends were suggested alongside period-based trends and there were few (N=3) cases of urinary tract cancers in the stratum with <20 years since first employment, it may also be that these cancers have yet to present among firefighters with relatively recent first employment.

In line with the Nordic study (21) and the metaanalyses (19, 20, 23), no elevated risk for kidney cancer was found among firefighters in the present study, nor did any patterns emerge from the stratified analyses.

Lympho-hematopoietic cancers

We did not find elevated incidence of any subgroup of lympho-hematopoietic cancers, nor did any patterns arise from the stratified analyses. In line with our findings, meta-analyses also did not demonstrate elevated incidence of these cancers among firefighters (19, 20, 23), though elevated mortality and elevated summary risk estimates based on mortality studies have been reported for multiple myeloma (23) and non-Hodgkin lymphoma (20, 23). The Nordic study showed elevated incidence of multiple myeloma only among those >70 years of age at follow-up (21). Exposure to carcinogens such as benzene, 1,3-butadiene, formaldehyde, styrene, and diesel exhaust, all relevant to firefighters, have established or suspected associations with specific groups of lympho-hematopoietic cancers (1, 18). Firefighters in Norway may not be at elevated risk for these cancers, or this risk may have dissipated over time alongside improved protection from associated exposures. Alternatively, the present findings may be related to a low number of cases and thus a lower statistical power for detecting small excesses in these cancers.

All sites combined

Overall, incidence of all cancers combined was significantly elevated by 15% among firefighters in the present study. Our findings are in line with the study on Nordic firefighters which also reported elevated incidence of all sites combined (21), but contrast earlier meta-analyses and other Scandinavian country-specific studies which reported at level with expected (19, 20, 23, 32, 34) or decreased (33) incidence of all sites combined.

We also observed a non-significant 10% elevated incidence for the group exposure-associated sites, which combined the sites of a-priori interest with established associations with specified exposures. The trends in the stratified analyses for exposure-associated sites combined were slightly more pronounced than the trends for all sites combined, though both followed similar patterns with most prominently elevated risk among those with first employment before 1950, with >40 years since first employment, and with employment duration >30 years. Exposure to 2,3,7,8-tetrachlorodibenzo-para-dioxin, a group 1 carcinogen detected at the fire scene, has been associated with elevated risk of all sites combined (1, 26). In addition, firefighters' exposures are diverse and variable, and represent chronic and simultaneous exposure to a multitude of site-specific carcinogens and other chemicals. Potential synergistic, cumulative, and/or otherwise interactive effects of exposure to a variety of compounds not classified as carcinogens, but still with the ability to change cells in the same direction (39), are difficult to assess and are not yet well established (9). However, exposure to such a "cocktail" of chemicals, even at low levels, has been hypothesized to have effects similar to those from carcinogens (9), and may have contributed to the elevated incidence of exposureassociated sites or all sites combined. Differences with previous studies reiterate that firefighters' exposures and risks are complex and variable.

Strengths and limitations

The population in Norway was 3.6 million in 1960 (median age 33 years), and 5.3 million in 2018 (median age 39 years) (40). Given the population size and limited number of firefighters in Norway, the study sample identified from the cohort is relatively large, including almost exclusively full time professional firefighters from the largest departments over a long follow-up period. The present study sample includes 3881 male firefighters actively employed for an average of more than 20 years between 1950 and 2018, compared to the 2579 Norwegian self-reported firefighters included in a previous study identified by census data from 1960, 1970 and 1980 (21). With limited between-department transfers and low emigration rates in our cohort, the likelihood that we lacked employment history and/or incidence data that could essentially change the observed results is low. Further, with the high degree of coverage and strict quality control measures at the CRN (22), we can expect that the incidence rates for the cohort and reference population are valid. However, risk estimates based on few observed or expected cases may still be vulnerable to random variation, and the low number of cases for some sites in the cohort limits the statistical power and the precision in the estimates.

As firefighters are required to be in good health at first employment and to stay in good health during their work, a healthy worker effect may have biased our results. While cancer outcomes are usually not considered to be strongly affected by this and the effect diminishes over time, previous studies have provided a complex picture of the potential impact of the healthy worker effect in Norway, particularly for cancer sites where cigarette smoking is a predominant risk factor (28, 29). If present, the effect may disguise true elevated risks from occupational exposure to carcinogens and contribute to underestimations of firefighters' occupational cancer risk. Unfortunately, we had no information about lifestyle factors of firefighters.

Like almost all other studies on firefighters' cancer risk, this study is limited by its lack of specific data on exposures as only exposure surrogates were used. The carcinogens that firefighters can be exposed to through their work are complex and dynamic and are particularly difficult to measure during active firefighting duties. Further, fire contents and exposures may vary regionally, and recent measurements may not reflect historical exposures or variation in use of protective equipment. This is partly compensated by the focus on a quite homogenous group of fulltime workers that can reasonably be expected to have had principally common occupational exposures. Studies with more detailed exposure assessments would be valuable for a better understanding of differences in risk.

Concluding remarks

We found increased incidence of all cancer sites combined among firefighters in the Norwegian Fire Departments Cohort compared to the general population, and increased incidence of the group of exposure-associated sites combined was suggested overall. Incidence of urinary tract cancer was increased among those with first employment in earlier periods and with longer time since first employment. With longer duration of employment and with longer time since first employment, we also observed higher incidence of laryngeal cancer and mesothelioma. Our findings are partly in line with those from previous meta-analyses showing elevated incidence of bladder cancer and mesothelioma and of all sites combined in the study on Nordic firefighters. This suggests that the elevated risks observed are associated with firefighters' occupational exposures. Differences in risk by period of first employment may primarily reflect changes in exposures from improved quality and use of personal protective equipment.

Acknowledgements

We would like to thank the participating fire departments, Ronnie Babigumira and Marie Danielsen for the work they put into establishing the Norwegian Fire Departments Cohort.

Funding

The Research Council of Norway funded this project (project number: 299172).

Conflicts of interest

The authors declare no conflicts of interest.

Ethical approval

The project was approved by the Regional Committee for Medical and Health Research Ethics (reference number: 5646).

Sidebar

Marjerrison N, Jakobsen J, Grimsrud TK, Hansen J, Martinsen JI, Nordby K-C, Veierød MB, Kjærheim K. Cancer incidence in sites potentially related to occupational exposures: 58 years of follow-up of firefighters in the Norwegian Fire Departments Cohort. Scand J Work Environ Health. 2022;48(3):210-219. doi:10.5271/sjweh.4009

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Received for publication: 9 July 2021

DETAILS

Subject:	Urinary tract; Mesothelioma; Carcinogens; Employment; Firefighters; Risk; Protective equipment; Fire services; Fires; Confidence intervals; Cancer; Exposure; Skin cancer; Males; Occupational health; Laryngeal cancer; Fire fighting; Health risks
Business indexing term:	Subject: Employment
Location:	Norway

Publication title:	Scandinavian Journal of Work, Environment &Health; Stockholm
Volume:	48
Issue:	3
Pages:	210-219
Publication year:	2022
Publication date:	2022
Section:	Original article
Publisher:	Scandinavian Journal of Work, Environment &Health
Place of publication:	Stockholm
Country of publication:	Finland, Stockholm
Publication subject:	Occupational Health And Safety
ISSN:	03553140
e-ISSN:	1795990X
Source type:	Schola rly Journal
Language of publication:	English
Document type:	Journal Article
DOI:	https://doi.org/10.5271/sjweh.4009
ProQuest document ID:	2652912074
Document URL:	https://www.proquest.com/scholarly-journals/cancer-incidence-sites-potentially-related/docview/2652912074/se-2?accountid=211160
Copyright:	Copyright Scandinavian Journal of Work, Environment &Health 2022
Last updated:	2023-07-11
Database:	Public Health Database

Night-shift work and psychiatric treatment. A follow-up study among employees in Denmark

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ABSTRACT (ENGLISH)

Objectives We aimed to test the hypotheses that night-shift work is associated with an increased incidence of (i) redeemed prescriptions for psychotropic medicine and (ii) psychiatric hospital treatment due to mood, anxiety or stress-related disease. Moreover, we aimed to assess whether (iii) the effect of night-shift work on the rates of antidepressants differs from the effects on the rates of anxiolytics and (iv) the association between night-shift work and psychotropic medicine is affected by long working hours. Methods Full-time employees who participated in the Danish Labor Force Survey sometime in the period 2000-2013 (N=131 321) were followed for up to five years in national registers for redeemed prescriptions and psychiatric hospital treatment. The analyses were controlled for sex, age, weekly working hours, calendar time of the interview and socioeconomic status. Results We detected 15 826 cases of psychotropic drug use in 521 976 person-years at risk and 1480 cases of hospitalization in 636 673 person-years at risk. The rate ratio (RR) for psychotropic drugs was estimated to be 1.09 [99% confidence interval (CI) 1.02-1.16] for night-shift versus no night-shift work. The corresponding RR for psychiatric hospital treatment was 1.11 (95% CI 0.95-1.29). The odds of redeeming a prescription for antidepressants rather than anxiolytics was independent of night-shift work: 1.09 (95% CI 0.96-1.24), and we found no interaction effect between night-shift work and working hours (P=0.26). Conclusion As it appears in the general working population in Denmark, night-shift work is not an important predictor of mental ill health.

FULL TEXT

Headnote

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Conclusion As it appears in the general working population in Denmark, night-shift work is not an important predictor of mental ill health.

Key terms antidepressant; anxiolytics mental health; mood disorder; night work; occupational health; prescription drug; psychiatric hospital treatment; psychotropic medicine; shift work; stress-related disorder.

Shift work is common in many industries, eg, within manufacturing, transportation and healthcare, and therefore possible negative health outcomes will potentially affect many workers. It is estimated that around 20% of the

working population in Europe are working in shifts and work the night shift at least once per month (1). Health outcomes associated with shift work have been studied intensively, and shift work has been associated with a range of negative health consequences (2). Also, the possible link between working in shifts and decreased mental health has been examined in a range of studies (3-5).

Biological as well as social and environmental factors may interact as underlying mechanisms behind an association between shift work and mental health. Sleep disturbances, circadian misalignment (6), and abnormal stress responses (7) may affect mood, and vigilance (8) and in turn the regulation of emotions (7). Working in shifts may impact the work-life balance (8), marital satisfaction (10), and social life (11) negatively. Furthermore, increased risk for exposure to traumatic events is prevalent in some of the sectors where shift work is common, eg, healthcare and protective services (12, 13). Traumatic events are to some degree inherent to the work demands within these sectors, and not caused by shift work, but often associated with - and to some degree not possible to disentangle totally from - the effect of shift work.

The association between shift work and mental health issues is well documented in cross-sectional studies. A recent review based on 21 cross-sectional and 4 prospective studies found shift work to be associated with increases in depressive symptoms (12 studies), anxiety (2 studies), and depression and anxiety (7 studies) (4). A meta-analysis conducted on 9 cross-sectional and 2 prospective studies also concluded that night-shift work was significantly associated with an increased risk of depression (14).

All though, shift work has been associated with the development of mental health issues also in prospective studies (15), other studies have not prospectively found any association between shift work and mental ill health (16-20).

A recent meta-analysis included data from seven longitudinal studies (covering 28 431 unique participants) and found shift work to be associated with increased overall risk of adverse mental health outcomes and particularly with depression (3). They also found that the heterogeneity in effects among the studies was substantial, and mainly due to sex differences, with higher risk among female than among male shift workers. The authors mentioned that the difference may be partly explained by the higher risk of depression among women than men in the general population. Further they mentioned the lack of occupational information in most studies as an important limitation to study potential moderating effects.

Thus, despite many studies, and a couple of reviews and meta-analyses in the field, it is still essential to investigate possible effects of shift work on mental health issues in large, prospective studies in order to obtain more clarity on potential effect sizes among men and women and to pay attention to potential differential effects eg, according to different diagnoses, occupational groups and nations. In a previous study (20) (not included in any of the previously mentioned meta-studies), we estimated the prospective associations between shift work and use of psychotropics in a large (N=19 259) Danish sample and found the rate ratio for incidence of redeemed prescriptions for psychotropic drugs among shift workers to be 1.09 [95% confidence interval (CI) 0.99-1.21] (20, 21).

Results from our secondary (hypothesis-generating) analyses in the same study suggested that excessive overtime work (>48 hours/week) may be an important risk factor for mental disorders among shift workers [rate ratio (RR) 1.51, 95% CI 1.15-1.98], although studies do not suggest overtime work as a risk factor for mental disorder in the general working population in Denmark (21-23, 34). Further, results from the secondary analyses suggested increased incidence of use of hypnotics, sedatives and antidepressants and decreased incidence of use of anxiolytics among shift workers (20). To our knowledge, the results of the abovementioned secondary analyses have not been observed in any other study.

Based on these secondary analyses (20), we generated four different hypotheses:

1. Overtime work (> 48 hours/week) increases the risk of mental health problems among shift workers.
2. Results from a previous study showed increased use of hypnotics, sedatives and antidepressants among shift workers, suggesting that shift work increases the incidence of sleeping problems and depression while at the same time results showed decreased incidence of use of anxiolytics among shift workers, suggesting that shift work decreases the incidence of anxiety. These oppositely directed effects cancel out each other and give a non-significant total effect. According to this interpretation, different incidences of diagnoses among shift workers versus

others should be hypothesized.
3. Anxiety may be treated with anxiolytics as well as with antidepressants. Since workers on night shifts needs to stay awake and one of the side-effects of anxiolytics may be drowsiness, there may be an increased likelihood that a night-shift worker with anxiety will be prescribed antidepressants rather than anxiolytics. Diagnosis associated with hospital treatment are based on the clinical picture and not side-effects of drugs, so this hypothesis will get support if the odds ratio (OR) for antidepressants versus anxiolytics is increased while the OR for hospital treatment due to depression versus anxiety among shift workers versus non-shift workers is not.
4. The increased incidence of use of hypnotics, sedatives and antidepressants and decreased incidence of use of anxiolytics among shift workers that we found in our previous study (20) may be a coincidence.
The present study aimed at testing the hypotheses that night-shift work is associated with an increased incidence of redeemed prescriptions for psychotropic drugs, and psychiatric hospital treatment due to mood, anxiety or stress-related disease.
Another aim was to test the hypotheses that were generated from our previous study in a dataset that is independent of and larger than those previously used. Firstly, we investigated the prospective association between night-shift work and incident use of psychotropic medicine and tested for effects of interactions between night-shift work and age, sex and socio-eco- nomic status (SES), respectively. Secondly, we investigated whether excessive overtime work was an important risk factor among night-shift workers. Thirdly, we tested differential prospective effects on anxiolytics versus hypnotics, sedatives, and antidepressants, and on psychiatric hospital treatment for mood versus anxiety and stress-related disorders.

Method

We include here a brief description of the material and methods of the study. A detailed description can be found in the study protocol (22), which was peer-reviewed and published before we conducted the analysis. The protocol defines two major studies, one of them focuses on effects of night-shift work (results reported here), the other focuses on effects of long working hours (23).

The data material

Individual participant data on night-shift work were retrieved from the Danish Labor Force Survey (DLFS) (24). The DLFS data were linked to person-based data from national registers, which cover the entire population of Denmark. Data from the Central Person Registry (25) were used for the linking of data. The National Prescription Registry (26) provided data on prescriptions of psychotropic medicine. The Psychiatric Central Research Register (27) provided data on psychiatric hospital treatments, and the Employment Classification Module (28) on industry, socioeconomic status, migrations, and deaths. The DLFS is based on random samples drawn each quarter of each calendar year since 1994. Data were collected by means of telephone interviews during the time-period spanned by the present study. Participants were 15-74-year old inhabitants of Denmark and invited to be interviewed four times during a period of approximately 1.5 years. The response rates have decreased from 70% in 2002 to 53% in 2013. The primary analyses of the present study are based on the participants' first interview in the calendar period 2000-2013.

Inclusion criteria

The study included people who: were 20-59 years old at the start of the follow-up period; responded to DLFS sometime during the calendar years 2000-2013; were employed with 32-100 usual working hours a week at the time of the interview; did not redeem a prescription for any type of psychotropic drug (ATC: N05-N06) and did not receive hospital treatment for a primary diagnosis of any type of mental disorder (ICD-10: F00F99) during a one-year period preceding the start of the follow-up. As they reported >100 working hours per week, 297 persons were excluded. Only 1.2% of the included participants worked >60 hours a week. Figure 1 presents a flowchart over the exclusion and inclusion of participants.

Clinical endpoints

The following outcomes were regarded each at a time (i): redeemed prescriptions for any type of psychotropic medicine, ie, drugs in the ATC-code category N05 (psycholeptica) or N06 (psychoanaleptica); and (ii) psychiatric hospital treatment with a mood, anxiety or stress-related disorder (ICD-10: F30 - F41 or F43) as principal diagnosis.

Night-shift work

Participants who responded either "yes, regularly" or "yes, occasionally" to the question about night-shift work at baseline were defined as being exposed. Those who responded "no..." were defined as being unexposed to nighttime work. Before 2001, the participants were simply asked whether they worked at night, but from 2001 onward, the question has been whether they worked at night during the last four weeks. Until 2006 the response categories were "yes, regularly," "yes, occasionally," and "no, never". From 2007 and onward the response categories were expanded to "yes, regularly" (ie, more than half of the working days in the last four weeks), "yes occasionally" (ie, at least once within the last four weeks, but less than half of the working days), and "no, not within the last four weeks."..... The exposure categories were based on the status at baseline; changes in exposure status over time were not taken into consideration in the primary analyses.

Follow-up

The follow-up started at the end of the same year as the baseline interview with the participant was conducted. Follow-up ended when one of the following events occurred: the subject reached the clinical endpoint of the analysis; the subject emigrated; the subject died; five years had passed since start of follow-up; or the study period ended (31 December 2014 for psychotropic medicine; 31 December 2017 for psychiatric hospital treatment). Hence, the participants were followed for a maximal period of five years. The reason for stopping at five years was that a too long follow-up period would dilute the effect, since night workers may become day workers and vice versa during the follow-up.

Statistical analyses

Poisson regression was used to estimate rates of redeemed prescriptions for psychotropic medicine and psychiatric hospital treatment due to mood, anxiety, or stress-related disorders, separately, as a function of night-shift work (yes versus no). The analyses were controlled for weekly working hours (32-40; 41-48; >48 hours/week), sex, age (10-year classes), calendar time of the interview (2000-2004; 2005-2009; 2010-2013) and SES (legislators, senior officials and managers; professionals; technicians and associate professionals; workers in occupations that require skills at a basic level; workers in elementary occupations; and gainfully occupied people with an unknown occupation).

The logarithm of person years at risk was used as offset. Likelihood ratios were used to test for statistical significance. For redeemed prescriptions of psychotropic medicine, we tested the following effects, each at the significance level 0.01: (i) main effect of nightshift work; (ii) effect of interaction between age and night-shift work; (iii) effect of interaction between sex and night-shift work; (iv) effect of interaction between SES and night-shift work; and (v) effect of interaction between weekly working hours and night-shift work. In order to avoid publication bias in future meta-analyses, we have chosen to present results of all stratified analyses, even though the interaction effects were not significant. If eg, gender differences were only presented if the difference were statistically significant, this would lead to over-estimation in potential meta-analyses.

For psychiatric hospital treatment due to mood, anxiety or stress-related disorders, we tested for a main effect of night-shift work at the significance level 0.05. As the incidence of hospital treatment is substantially lower than the incidence of medical treatment, we did not have the statistical power necessary to test for interaction effects. We chose a significance level at 0.01 for the analyses of psychotropic medicine to correct for multiple testing. For the analysis of hospitalizations, we only tested one hypothesis and could therefore use a significance level of 0.05.

A sensitivity analysis was conducted to find out if the estimated strength of the association between nightshift work and redeemed prescriptions for psychotropic drugs would increase when exposure is more stable over time. In this analysis, we only included employees who were employed >32 working hours a week according to their first as well as their last interview and belonged to the same category in relation to night-shift work (yes versus no) during their last interview as they did during their first interview (over a period of 1.5 year, see data material). In another sensitivity analysis, we estimated relapse rate ratios among employees with a past record of psychiatric treatment. Sensitivity analyses were, moreover, conducted to compare results obtained (i) with and without exclusion of former and current cases of psychiatric treatment, and (ii) with and without control for industrial sector. The methods and

results of the sensitivity analyses are given in the supplementary material (www.sjweh.fi/article/4008).
In the sensitivity analyses, we estimated a series of RR and presented these with 99% CI. It should be noted that we do not regard the sensitivity analyses and their CI as statistical significance tests. They may, however, strengthen, weaken, or invalidate statistical conclusions of the primary analyses.

Results

The criteria for inclusion in the primary analyses were fulfilled by 131 321 participants (figure 1). Among the included, we observed a total of 15 826 cases of redeemed prescriptions for psychotropic drugs in 521 976 person years at risk and 1480 cases of psychiatric hospital treatment due to mood, anxiety or stress-related disease in 636 673 person years at risk. Of the hospital treatment cases, 22% were inpatients, 53% were outpatients and 25% were emergency ward patients. The diagnoses among the cases were distributed as follows: F30 manic episode 0.5%; F31 bipolar affective disorder 2.4%; F32 depressive episode 25.8%; F33 recurrent depressive disorder 10.2%; F34, F38, F39 persistent, other or unspecified affective mood disorders 0.5%; F40 phobic anxiety disorders 3.0%; F41 other anxiety disorders 8.6%; F43 reaction to severe stress, and adjustment disorders 48.9%.
In the main analyses, we found that night-shift work was statistically significantly associated with redeemed prescriptions for psychotropic drugs (P=0.0007), with RR estimated at 1.09 (99% CI 1.02-1.16) (see table 1). We did not find any increased incidence in the group working very long hours (>48 hours/week), but we did find indication of an increased risk among those working in night-shifts and 41-48 hours/week; RR 1.20 (99% CI 1.00-1.44).
The association between night-shift work and chiatric treatment due to mood, anxiety or stress-related disease was estimated at RR 1.11 (95% CI 0.95-1.29) (table 2).
Secondly, we tested interaction effects on redeemed prescriptions for psychotropic drugs and did not find any statistically significant interaction between night-shift work and age (P=0.83), sex (P=0.48), SES (P=0.61), or weekly working hours (P=0.26).
Compared to non-shift workers, night-shift workers did not have higher odds to receive antidepressants rather than anxiolytics [OR 1.09 (95% CI 0.96-1.24)] (table 3). The same holds for the odds of receiving hospital treatment due to mood versus anxiety and stress-related disorders [OR 0.93 (95% CI 0.68-1.26)] (table 4).

Supplementary analyses

Results from all supplementary analyses can be found in the supplementary material.
Amount of exposure. In the first supplementary analysis (table S1), we studied whether the strength of the association between night-shift work and redeemed prescriptions for psychotropic drugs increased when the exposure was more stable over time. Result showed an increased risk among night-shift workers with stable exposure from first to last interview, slightly higher than the risk found in the main analyses [RR 1.13 (99% CI 1.02-1.25)].
A further supplementary analysis (see table S2) showed a higher risk for redeemed prescriptions of psychotropic drugs among employees with regular night- shift work (RR 1.14, 99% CI 1.05-1.24) than among employees with occasional night-shift work (RR 1.03, 99% CI 0.94-1.12).
Taken together, the supplementary analyses thus supported that more stable and more frequent exposure to night shift work may increase the risk for a redeemed prescriptions for psychotropic drugs.
There are relatively large groups of night-shift workers in nursing homes, home care etc. in Denmark, whose standard full-time work schedules imply an average of only 28 working hours a week. We therefore also tried to redefine the inclusion criterion from >32 hours a week to >28 hours a week and redefined the reference group to 28-40 hours a week. The statistical model was otherwise the same as in the primary analysis. The estimate decreased marginally after inclusion of this group, from 1.09 (table 1) to 1.08 (table S3).
Relapse rates among employees with a past record of psychiatric treatment. Among participants who received psychiatric treatment within the second to fifth but not within the first year prior to the start of follow up, we estimated the relapse RR for prescribed psychotropic drugs between employees with versus without nightshift work to be 0.97 (99% CI 0.83- 1.13) (Table S4).
With and without exclusion of former and current cases of psychiatric treatment. In the primary analysis, we

excluded participants who received psychiatric hospital treatment or redeemed a prescription for psychotropic drugs during the calendar year preceding the start of the follow-up period. It is, however, possible that the results were influenced by cases that occurred earlier than one year prior to baseline. To explore this possibility, we conducted a sensitivity analysis in which we excluded all participants who received psychiatric treatment at any time within a five-year period prior to the start of follow-up. The results showed similar estimates in the cohort with exclusion of all previous cases as in the cohort used in the main analyses, and they showed no increased risk in the cohort of previously excluded cases (table S4).

Further, we repeated the main analysis without exclusion of prevalent cases, resulting in a marginally decreased estimate.

Controlling for industrial sector. We wanted to know if the results of the present study would change if we added industrial sector to the existing model, including the occupational-based SES. We conducted a sensitivity analysis, firstly controlling for (table S5) and secondly stratified by industrial sector (table S6 and Table 5). After control for industrial sector, the overall estimate decreased slightly and became insignificant (RR 1.06, 99% CI 0.99-1.13). The results of the industry-stratified analysis are given in table 5. As seen in the table, the confidence interval of each industry overlaps the confidence intervals of every other industry.

Discussion

In the primary analyses, we found night-shift workers to have a small but statistically significant, increased risk for mental health issues causing a redeemed prescription of psychotropic drugs (all types combined). Results from previous, prospective studies of shift work and mental health issues have used different outcome measures and reported estimates of different sizes. Bildt &Michelsen (15) found the odds for sub-clinical depression over a 5-year period to be 2.4 (95% CI 1.0-5.8) among females working in shift versus not working in shifts and 2.9 (95% CI 1.2-7.2) among men working in shifts. Other prospective studies have not found any significantly increased risk for mental health issues among shift workers (17-19). Driesen et al (17) reported, over a 10-years period the hazard ratio for the development of incident depressed mood among male shift workers to be 0.86 (95% CI 0.69-1.08) after adjustment for psychosocial work-related factors. Suwazano et al (18) found the odds for self-perceived mental conditions among men working in shifts versus not working in shifts to be 0.91 (95% CI 0.74-1.11) and among women to be OR 0.98 (95% CI 0.82- 1.18); and Lasalle et al (19) found in a mixed sample the odds for psychotropic drug use to be 1.05 (95% CI 0.80-1.39) among shift workers versus non shift workers (19). In our own previous study, we found the RR for prescription of psychotropic drugs among shift workers versus non shift workers to be of same size as in the present study but with a larger CI: 1.09 (95% CI 0.99-1.21). As it appears from the wide CI, the statistical power of most of these studies were not strong.

The meta-analyses by Tonquati et al (3) included both prospective and retrospective studies and found an overall effect for all adverse self-reported mental health outcomes combined to be 1.28 (95% CI 1.02-1.62). They found estimates for depressive symptoms, anxiety symptoms and poor general mental health symptoms on 1.33, 1.20 and 1.18 respectively, but with highly overlapping CI. The authors mention that, beside the substantial heterogeneity of estimates, the risk of bias was high due to exposure assessment and attrition. Furthermore, different outcome measures may have contributed to the different effect sizes, and the wide CI also in the overall meta-analyses still suggest too small sample size.

Compared to the previously conducted prospective studies, the sample used in this study is, to our knowledge, the largest used to study the association between night shift work and mental health issues, making the estimates very precise and making it possible to study differential effects and provide a range of supplementary analyses.

It has previously been suggested that the association between shift work and adverse mental health depends on sex (15, 17). We tested for but did not find any interaction effect with sex. We also tested for but did not find any interaction effects with age, SES or working hours/week.

Based on our previous study, we had hypothesized that very long hours (>48 hours a week) might be an important risk factor among shift workers. In the stratified analyses (table 1) we did not find a statistically significant increased risk among those who worked >48 hours a week, but we found increased risk among those working 41-48 hours a

week. Thus, the hypothesis that "overtime work (>48 hours/week) increases the risk of mental health problems among shift workers" was not confirmed, but results suggested that moderate overtime work may be associated with increased risk for use of psychotropic drugs among night-shift workers. We do not have an explanation for this. However, a possible reason why we did not find any increased risk among those who worked >48 hours may be that this group comprise a small, selective, and particularly healthy group of workers.

We were not able to replicate the finding of differential effects of night-shift work on the rates of antidepressants versus the rates of anxiolytics, and accordingly, we cannot reject that the differential effects we found in our previous study (20) was a coincidence.

Results from the supplementary analyses yielded support for the statement that a more stable and frequent exposure to night shift work may increase the risk for a prescription for psychotropic drugs. We found a higher estimate for employees regularly working in night shifts, but not among those who worked occasionally in shifts. To our knowledge these relationships have not previously been found.

We found no indication that the results were biased by employees treated for former mental health problems, and we found no indication that working in night shifts should increase the risk of relapse for employees with previous use of psychiatric drugs. Neither of these findings have previously been shown.

Results suggested slightly different effects among different industrial groups, with a weaker association among employees in human health and social work activities, and stronger associations among employees within construction work or within the group of 'other' industries. Results were, however, not statistically significant for any of the groups and should be replicated in future studies to gain support.

The results from this study should be considered within the national context of shift work in Denmark, where the working environment including shift work is relatively well regulated compared to many other parts of the international labor market. There is in general a high level of influence on decisions important for own work in Denmark (29) and this may have protective features against negative effects of shiftwork. It has been shown that increased influence over one's own schedule for employees in shiftwork can reduce the adverse consequences on health (30), work-life balance and social life (31).

Strengths and weaknesses

The study population was followed in national registers covering the entire target population, and accordingly had minimal bias from missing follow up. The problem with reversed causality was minimized through the prospective design and the exclusion of prevalent cases.

Another advantage of the present study is that the number of participants was large enough to (i) focus on shiftwork including night and differentiate between regular and occasional night-shift work (ii) supplement the analysis of psychotropic drug usage with estimated RR for psychiatric hospital treatment and (iii) supplement the analysis of incident use of psychotropic drugs with an analysis of relapse rates among employees with a past record of psychiatric treatment (iv) explore potential interaction effects and provide stratified analyses for gender, age, SES and working hours.

Within-study selection bias was eliminated through our study protocol (23), in which hypotheses and statistical models were specified, peer reviewed, and published before the questionnaire data were linked to the registers.

As suggested by results from previous research, selection processes into (32) and out of shift work (33) are well known, and it is likely that perception of mental health and sleep quality will play a role in both selection processes. Thus, employees experiencing sleeping problems may be less likely to take a job including night shift work, anticipating that it will cause increased sleeping problems. Some employees with mental health issues may likewise avoid night shift work because they fear negative effects, while others (eg, with social phobia) may prefer night shift work. At the same time, employees experiencing increasing mental health problems or sleeping problems while they are working in shift may be less likely to continue working in shifts. These selection processes are likely to have influenced our results in direction of lower estimates of effects than would have been the case if these voluntary selection processes had not taken place.

A drawback of the study is that the response rates have decreased from 70% in 2002 to 53% during the time of

inclusion. There were, however, no bias from missing follow-up data, since the endpoints of the study were ascertained in national registers, which covers all residents of Denmark. Previous studies have shown that the response rates to public health questionnaires in Denmark are lower among young men, unmarried people, people with a low educational level and people with an ethnic background other than Danish (35, 36). It is possible that the response rates as well as the reasons for nonresponse in the present study differ between the exposed and unexposed workers.

Furthermore, there may be relevant confounders that were not included in the study. For example, household composition and marital status (37)

Another drawback is, that there may potentially have been classification errors of shift versus day workers in the main analysis. Night-shift workers may have stopped working in night shifts after inclusion and have still been included as a night-shift worker in the analysis until follow-up. And day workers may have started to work night shifts after inclusion but are still included as day workers in the analysis. This drawback may have weakened the contrast between the group of exposed and not exposed workers, and potentially decreased the effect. As results from the first sensitivity analyses showed, the effect was slightly higher for the group who had night-shift work both at the first and the last of their baseline interview rounds, and it was higher for the group with regular night shift work than among those with occasional night-shift work, thus suggesting that a more stable or a more frequent exposure for night shift work may increase the risk. Furthermore, the comparability of findings from this study to our previous study of shift work and psychotropic drug usage has been diminished because we did not use the same categories of shift work as we did in our previous study but analyzed "schedules that include night-shift work" versus "other work schedules (including non-night-shift work and evening work)".

For further methodological considerations see Hannerz et al (22, 23).

Concluding remarks

Results from this large prospective study showed a slightly increased incidence for overall psychotropic medicine use among night-shift workers in Denmark, and a slightly higher incidence among night-shift workers with long hours (41-48 hours/week). Although the estimated association in the main analysis was statistically significant, it was still weak (RR <1.2), which implies that night-shift work is not an important predictor of mental ill health in the general working population in Denmark. We found no indication of differential effects for different drugs, but we found some support for higher risk for psychotropic medicine use among those with more stable or more frequent exposure for night shift work.

The current study adds to evidence regarding associations between night shift work and psychiatric treatment. The implication for practice is two-fold. On the one hand, the results suggest that, in a Danish public health perspective, there is no need to be highly concerned about a substantially higher incidence of mental ill health due to night shift work. On the other hand, attention should be paid when mental health issues occur among shift workers and particularly among workers in regular night shift work. Offering opportunities to change from shift to day work for the individual worker may be an important piece of the puzzle to prevent negative mental health issues due to shift work.

The relatively rough categorization of night shift work did not give the opportunity for more detailed analysis of eg, what schedules are associated with less risk. Therefore, future research should use more detailed information on night shift work eg, from payroll data (38).

Acknowledgement

The project was funded by the Velliv Association, grant number 18-4247. The data were supplied by the Danish Health Data Authority and Statistics Denmark. International registered report identifier (irrid): DERR210.2196/18236.

The study complies with The Act on Processing of Personal Data (Act No. 429 of May 31, 2000), which implements the European Union Directive 95/46/EC on the protection of individuals.

The authors declare no conflicts of interest. The writing of the report and the submission of the paper for publication in a peer-reviewed journal was promised in the grant application. The funder has, however, not been involved in the writing of the report nor in the interpretation of the results.

Sidebar

Albertsen K, Hannerz H, Nielsen ML, Garde AH. Night-shift work and psychiatric treatment. A follow-up study among employees in Denmark. Scand J Work Environ Health. 2022;48(3):200-209. doi:10.5271/sjweh.4008
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Submitted for publication: 10 August 2021

DETAILS

Subject:	Socioeconomic factors; Antidepressants; Anxiolytics; Psychotropic drugs; Working conditions; Confidence intervals; Socioeconomics; Night; Mental depression; Shift work; Medicine; Working hours; Prescription drugs; Sleep deprivation
Location:	Denmark
Publication title:	Scandinavian Journal of Work, Environment &Health; Stockholm
Volume:	48
Issue:	3
Pages:	200-209
Publication year:	2022
Publication date:	2022
Section:	Original article
Publisher:	Scandinavian Journal of Work, Environment &Health
Place of publication:	Stockholm
Country of publication:	Finland, Stockholm
Publication subject:	Occupational Health And Safety
ISSN:	03553140
e-ISSN:	1795990X
Source type:	Scholarly Journal
Language of publication:	English
Document type:	Journal Article

Occupational stress and pregnancy-related hypertension and diabetes: Results from a nationwide prospective cohort

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ABSTRACT (ENGLISH)

Objectives Using a large, national, prospective cohort, while adjusting for other work exposures, this study aims to investigate whether exposure to occupational stress during pregnancy is associated with hypertensive disorders of pregnancy (HDP) and gestational diabetes. Methods Our cohort consisted of 1 102 230 singleton births between 1994-2014 in Sweden, based on highquality register data of Swedish pregnancies. Exposure to occupational stress was obtained from a job exposure matrix (JEM) constructed from 12 questions pertaining to the psychosocial work environment from the 19972013 cycles of Swedish Work Environment Survey, including approximately 75 000 individuals. We utilized the decision authority, demands, and social support indices. Decision authority and demands were combined to categorize occupations into low, active, passive, and high strain work. We estimated relative risks (RR) and adjusted for relevant confounders, such as age, smoking and other work exposures. Results Occupations with lower levels of decision authority were associated with increased risks of 12-23% for HDP and preeclampsia and 36-58% for gestational diabetes compared to occupations with the highest levels of decision authority. Passive occupations had increased risks of 10% for HDP and preeclampsia and 15% for gestational diabetes when compared to low strain jobs. No significant associations were found for high strain occupations. Conclusions As a whole, occupational stress was not consistently associated with pregnancy outcomes in our study. However, decision authority was associated with an increased risk for pregnancy-related complications. Further studies should investigate whether improvements in working conditions can help decrease these risks.

FULL TEXT

Headnote

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Conclusions As a whole, occupational stress was not consistently associated with pregnancy outcomes in our study. However, decision authority was associated with an increased risk for pregnancy-related complications. Further studies should investigate whether improvements in working conditions can help decrease these risks.

Key terms employment; gestational diabetes; gestational hypertension; preeclampsia; job exposure; job exposure matrix; psychosocial work environment; Sweden; workplace stress.

Hypertensive disorders of pregnancy (HDP), which includes gestational hypertension and preeclampsia, affect 5-10% of pregnant women (1) and accounts for an estimated 14% of maternal mortality worldwide (2), with high income countries having lower estimates than developing countries. Preeclampsia is the more severe form of HDP, affecting an estimated 2-5% of pregnancies around the world (3). HDP can result in negative birth outcomes, such as preterm and small-forgestational-age birth (4). Another condition that occurs in pregnancy is gestational diabetes (GDM), which is thought to affect 0.6-15% of pregnancies and can also lead to similar adverse birth outcomes (5). Furthermore, studies have reported an increased risk of developing cardiovascular disease and type 2 diabetes (T2D) later in life among women who had HDP (4) and GDM (5). The causes of HDP and GDM are not well understood. However, the two conditions share some of the same risk factors, such as parity, maternal race/ethnicity, obesity, increased age, and insulin resistance (4, 5), indicating a related etiology.

Stress has been suggested as a potential factor in the development of HDP and GDM. One recent meta-analysis summarized the effects of general stress on pregnancy and reported an increased association between stress and both gestational hypertension and preeclampsia (6). Other studies have linked stress to glucose intolerance in pregnancy (7) as well as to GDM (8). However, one understudied source of stress in relation to pregnancy disorders is occupational.

One of the most well-studied methods of quantifying psychosocial working conditions is Karasek's job demand-control (JDC) model (9). The JDC model attempts to characterize the psychosocial work environment through control and demands. Jobs with high levels of demands and low levels of control, so-called high strain jobs, are considered to have high levels of stress (9). The JDC model has been extensively used for a variety of outcomes and studies have shown that high strain jobs can have detrimental health effects, such as cardiovascular disease (10), obesity (11), and T2D (12).

However, few studies investigate how job demands and control affect HDP. Existing studies report positive associations (13-18), but only one reports statistically significant findings (15). However, these studies are limited by their small sample sizes, which leads to a very low number of exposed cases in certain categories and increased risk of chance findings. Furthermore, only one of these studies investigated the impact of the different dimensions included in the JDC model (18), and only two adjusted for other work exposures (14, 17). The exposures included

were obtained by self-reports, which can be subject to variation and misclassification due to individuals' perceptions. Furthermore, one study used retrospective reports (17), which can introduce recall bias. To our knowledge this is the first large-scale prospective study using register data to investigate the impact of occupational stress on HDP and the first to investigate its effects on GDM.

Using a large, national, prospective, register-based cohort, while adjusting for other work exposures, this study aims to investigate whether exposure to occupational stress during pregnancy is associated with HDP and GDM.

Methods

Data collection

To form the prospective cohort for this study, we obtained pregnancy data from the Swedish Medical Birth Register (MBR) for all births between 1994-2014. Data were recorded from visits to the prenatal care unit from week 10 of pregnancy until the birth of the child. Background characteristics collected in early pregnancy, such as mother's age, occupation, nationality, smoking status, weight, height, parity, and diagnoses, are included in this register. We included women who had singleton pregnancies and reported working full- or part-time at the first prenatal care unit appointment, occurring around gestational week 10. We excluded women who were pregnant with more than one child (twins, triplets), reported not working, listed a non-working occupation (eg, homemaker or student), had an occupation listed that could not be coded, or had missing occupation. Of the 1 431 015 pregnancies included in the MBR listed as working at least part-time, 1 102 230 fulfilled the criteria and were included in this study and 1 080 850 had no missing covariate data.

Data on mother's highest education at the time of delivery and marital status were obtained from the Longitudinal Integration Database for Health Insurance and Labor Market Studies (Swedish acronym LISA), covering all individuals aged >16, and were merged to MBR data utilizing the unique personal identification number given to Swedish residents.

Exposure to occupational stress

To examine exposure to occupational stress, we used a job exposure matrix (JEM) for psychosocial workload. The JEM has been described elsewhere (19). Briefly, the JEM utilizes 12 items from the 1997-2013 cycles of the biennial Swedish Work Environment Survey, which sampled over 75 000 men and women. Response categories were scaled from 0-10 indicating the amount of time each person experienced the situation in question. For each item, an average response was created and divided into indices for each job category, separately for men and women, of which we only use measurements taken from women respondents. Details on the items included in each index are found in the supplementary material (www.sjweh.fi/article/4004). In this study, we utilized the decision authority, psychological demands, and social support indices. Each index was categorized according to their quartile distribution in the study population.

We created a variable to investigate job strain as proposed in the JDC model (9) with decision authority and demand split at the median. Those with the values above the median were considered to have high decision authority and/or demand, while those with levels below the median were considered to have low. These two variables were then combined to form four categories: low strain (high decision authority/low demand), active (high decision authority/high demand), passive (low decision authority/low demand), and high strain (low decision authority/high demand).

The JEM was linked to the cohort data using occupational codes. Each woman provided her occupational title during gestational week 10. An occupational hygienist recorded this as free text and then coded it according to the ISCO-88-based Swedish occupational classification 96 (SSYK96) coding system (20). SSYK96 is formatted in a 4-digit hierarchical level, with each digit, from left to right, providing more detail on the occupation. For most occupations, the 4-digit code was available and were matched to the JEM index values to which it corresponds. However, for a few (23 685 of 1 102 230), only the less-detailed 2- or 3-level SSYK96 code indicating occupational group was available and were merged to average measurements of the 4-digit JEM values.

Outcome

Diagnosis codes came from the MBR and were reported at the time of delivery for each pregnancy using the

International Classification of Diseases, ninth and tenth revisions (ICD-9 and ICD-10). In our data ICD-9 codes were found until 1996, after which ICD-10 was adopted. For HDP, we used ICD-9 codes '642', '642D', 642E', '642F', '642G', and '642H'; and ICD-10 codes '011', '013', '014.0', '014.1', '014.2', '0149', '015.0', '015.1', '015.2', and '015.9'. To determine outcomes of preeclampsia only, we used ICD-9 '642E', '642F', and '642H'; and ICD-10 codes '0119', '014.0', '014.1', '014.2', '0149', '015.0', '015.1', '015.2', and '015.9'. For GDM, we used ICD-9 codes '648A' and '648W', and ICD-10 codes '024.4' and '024.9'.

Potential confounders

We chose several confounders that have been shown to be associated with HDP and, by extension, preeclampsia and GDM (4, 21) as well as individual factors that can affect occupational stress (22, 23): maternal age at delivery (<25, 25-30, 30-35, or >35 years), smoking status at gestational week 10 (non-smokers, smokers), educational level (some high school or less, high school graduate, some university or higher), marital status (not in a registered partnership or living alone, married or in a registered partnership), family situation (living with the father, living alone or another arrangement), body mass index (BMI) calculated using height and weight [underweight (<18.5 kg/m2), normal weight (18.5-25 kg/m2), overweight (25-30 kg/m2), obese (>30 kg/m2)], country of birth (Sweden, Europe excluding Sweden, and rest of the world), parity (primipara, multipara), and employment status (full-time, part-time). In addition, we considered several occupational exposures obtained from other JEM: physical workload, noise, whole-body vibrations, and 46 different chemicals and particles, which were matched based on occupational code and year of exposure, where applicable. Scores of 8 different physical exposures from the physical workload JEM (24) (heavy lifting [>15 kg], physically strenuous work, fast breathing due to physically strenuous work, forward bent position, twisted position, working with hands above shoulder level, repetitive work, and frequent bending and twisting) were summed and averaged to create the physical load index, which was then divided into quartiles. The noise JEM included information on annual average 8-hr occupational noise level in decibels [dB(A)] in five categories: <70, 70-74, 75-79, 80-84, and >85 dB(A) (25). Whole body vibration was categorized as 0-0.1, 0.1-0.3, 0.3-0.5, and >0.5 m/s2. Exposure to chemicals and particles were calculated by multiplying the proportion within an occupational group considered exposed by the estimated level exposed (26). All chemical and particles exposures were considered, but ultimately only aromatic hydrocarbon (ARHC) and chlorinated hydrocarbon (CHC) solvents and polycyclic aromatic hydrocarbons (PAH) were chosen as indicators for solvent and combustion-related exposures, respectively.

Data analyses

All analyses were performed using SAS version 9.4 (SAS Institute, Cary, NC, USA). For each outcome, the confounders listed above were selected into the model based on their placement on a causal diagram. BMI was concluded to be part of the causal pathway; therefore it was excluded from the final model. In order to create a parsimonious model, we checked whether confounders changed the association between exposures and outcomes by >5%. Neither marital status nor family situation met this criteria and thus were left out of the models. No variables were added at this step. The final model consisted of the following: maternal age at delivery, smoking status, educational level, country of birth, parity, employment status, physical workload, noise, whole-body vibrations, and exposure to ARHC, CHC, and PAH.

For women with multiple births, we could not assume independence; therefore, we estimated relative risks (RR) using a modified Poisson regression for correlated binary data (27). Crude and adjusted models were created for each outcome (HDP, preeclampsia, GDM). Because some women who had a previous complication may change duties, go on leave, or reduce working hours, we conducted a sensitivity analysis by restricting the sample to women with a first-time pregnancy who reported full-time employment. A sensitivity analysis was done including year of birth and results remained the same.

This study was conducted with approval from the Stockholm ethical review board (no. 2018/1298-31/2).

Results

0f 1 102 230 pregnancies included in this study, 1 080 850 had no missing information on covariates. Baseline characteristics are described in table 1. Women who reported working in jobs with lowest quartiles of decision

authority and demands were more often <30 years old, smokers, reporting lower education, born outside of Sweden, and part-time workers than those in the highest quartile. The same pattern was seen for those working in jobs with a high level of support, with the exception that there were no differences in support between women who were born in Sweden or elsewhere.

Results of the crude and adjusted analyses for all working women are shown in table 2. Compared to the highest level of decision authority, lower decision authority was associated with an increased risk of all three outcomes after adjusting for confounders. However, no dose-response patterns were indicated. The first quartile of decision authority was associated with a 1.12 greater risk (95% CI 1.08-1.15), the second quartile with a 1.23 greater risk (95% CI 1.19-1.27), and the third with a 1.13 greater risk (95% CI 1.09-1.16) of HDP than the highest quartile. Results were similar for preeclampsia. For GDM, women who reported working in occupations found in the first quartile of decision authority had a 1.36 greater risk (95% CI 1.28-1.46), the second quartile a 1.58 greater risk (95% CI 1.47-1.70), and the third a 1.37 greater risk (95% CI 1.28-1.47) than women who work in occupations with the highest levels of decision authority.

Working in occupations with the two lowest levels of demands (first and second quartile) were also associated with an increased risk of all three outcomes compared to the highest level of demands (fourth quartile). There was no clear increase in the risk of any of the outcomes associated with working in occupations falling in the third quartile of demands.

Decreasing levels of support showed a higher risk for all three outcomes, but only for the second and third quartiles, whereas the lowest quartile of support was associated with a statistically significant decrease in HDP, preeclampsia only, and GDM when compared to women who worked in occupations with the greatest level of support (table 2).

Table 3 shows the results when restricting the analyses to women who were in their first pregnancy and working full-time. Compared to the highest quartile of decision authority, all lower quartiles were associated with an increase in HDP, preeclampsia, and GDM. For demands, the second quartile was associated with an increased risk of all three outcomes. The lowest quartile of support continued to show a decreased risk for HDP, preeclampsia, and GDM. However, the second quartile of support showed an increased risk for GDM only.

Table 4 shows the results for the combination of decision authority and demands into a job strain variable. Those with active occupations had 0.93 lower risk (95% CI 0.90-0.96), and those with passive occupations a 1.10 higher risk (95% CI 1.07-1.14) of HDP compared to those with low strain jobs. A similar pattern was observed for preeclampsia. For GDM, working in an active occupation was associated with a 0.80 lower risk (95% CI 0.75-0.86), passive occupations were associated with a 1.15 increased risk (95% CI 1.07-1.23), and high strain occupations were associated with no increased risk when compared to low strain jobs. Effect sizes were similar in the analyses restricted to women pregnant for the first time and working full-time.

Discussion

In our prospective, nationwide cohort, having an occupation with lower levels of decision authority was associated with approximately a 12-20% increase in the risk of HDP and preeclampsia and approximately a 35-60% increase in GDM compared to occupations with the highest levels of decision authority. No clear associations were found for occupational stress as a whole. Our results were corroborated by sensitivity analyses of the subsample of women in their first pregnancies working full-time. To our knowledge, this is the first large, prospective study to investigate the impact of occupational stress on these pregnancy outcomes while adjusting for a wide variety of occupational exposures.

A few smaller studies have focused on job stress and pregnancy-related hypertension and preeclampsia. Mostly, these studies use only JDC model and do not explore individual dimensions of job strain. One exception has found that jobs with moderate and low control were associated with a non-statistically significant increased risk for preeclampsia, but not gestational hypertension (18). We also found that lower demand was associated with an increased risk of all three outcomes, with the similar risks in the two lowest quartiles. In contrast, one previous study has investigated workload in connection to gestational hypertension and preeclampsia and found that for preeclampsia, both moderate and high workload were associated with increased odds, whereas for gestational

hypertension only moderate was associated with increased odds when compared to low (18).
Of the studies that investigate job strain, only two report statistical significance (15, 16); however, all show that working in high strain jobs is associated with an increase in pregnancy-related hypertensive disorders (13-18). Of two studies investigating the impact of other types of job strain (15, 17) on preeclampsia and gestational hypertension, both find increased, but not statistically significant, risks of preeclampsia associated with passive and active work, as well as high strain, when compared to low strain work. The present study also finds an increased risk for both HDP and preeclampsia for passive jobs, but not for high strain jobs.
Although there are no previous studies on GDM and occupational stress, some studies have investigated its impact on diabetes. One pooled study of European countries has found that high strain jobs were associated with a 1.13 increased risk of T2D (12). Another Swedish study found that for middle-aged women, increased work demands were not associated with increased odds of T2D, and in fact, the middle category of work demands had non-statistically significant decreased odds (28). This study also found that low decision latitude jobs were associated with 2.4 times increased odds of T2D compared to high. GDM has been found to predict development of T2D later in life (5). Thus, it is plausible that low decision authority begins to affect glucose tolerance as early as pregnancy.
The differences in results from previous research may be due to differences in exposure measurement. In the present study, measurements do not come from individual-level exposures, which may affect the comparability to previous research. We also do not investigate the effects of skill discretion, since the questions from the survey that were regarded as skill discretion are included in the calculation of the physical load index, a variable we adjust for in the analysis. Decision authority has been used without skill discretion in a prior study, as it has been thought to be the more pertinent part of control in the context of the Swedish labor market (29). Moreover, it is possible that the demands explored in our study are so-called "challenge stressors" as opposed to "hindrance stressors," the former of which is thought to be beneficial to personal growth and achievement at work (30), and may elicit different stress responses than the latter. In other words, jobs in the highest demand category can also offer opportunities that can increase satisfaction and commitment and mitigate the risk of stress. This may also explain why, our study found increased risks for passive work only (low control/ low demands). Similarly, we found a slightly protective effect of active work, which may be due to the combined protective effect of high demands and control, and no effect due to high job strain (low control, high demands).
We did not find a dose-response relationship for decision authority. Only one study was able to investigate dose-response and found that decreasing control was associated with increased, albeit non-statistically significant, risks of preeclampsia (18). Furthermore, one recent Swedish study using the JEM to explore depressive outcomes also found a lack of dose-response relationship for decision authority for women only (19). These similar results may be due to the types of occupations held by women in the lowest control category in the JEM. In Almroth et al (19), the lowest control category included some highly educated women, such as those in the educational and healthcare sectors, which can indicate that the risk associated with job control is potentially mitigated by having jobs with higher social status. Even though we do not see a dose-response, we still see an increased effect of lower levels of control on these outcomes.
The mechanism via which decreased control can affect the development of HDP and GDM is thought to be via physiological responses to stress. Long-term stress activates the hypothalamus-pituitary-adrenal axis, increasing the concentration of corticotropin-releasing hormones, which have been found to be increased in women with HDP (31), and cortisol, an insulinantagonist that can contribute to insulin resistance (32). Stress can also increase pro-inflammatory cytokines, which are associated with pregnancy complications like preeclampsia and GDM (5, 33). Stress may result in poorer health behaviors during pregnancy, such as substance abuse and overeating, as well as affecting sleep quality (34). Lastly, working in occupations with low levels of control can prevent women from adapting their work tasks, schedule, and pace to their changing circumstances, and thus leading women to work when they are not feeling well and affecting their overall health and pregnancy.
Given this mechanism, we would also expect to see an increased risk with high strain occupations. This was not the case in our study. However, as we mentioned previously, high demands may elicit a positive stress response that

mitigates the negative effects of low control. It is possible that for young women, having a demanding job that challenges one professionally, in a positive way, may be more important for well-being than the negative effects of the low control they may experience. This area should be further explored in future studies.

An extension of the JDC model suggests that the inclusion of social support in a three-way interaction can mitigate the detrimental effects of high strain jobs (35). However, in this study we decided to not test for the role social support on job strain as the simple JDC model has been more explored in the past and we found no clear patterns in our data to indicate that we should investigate further. From our results, it appears that having a low amount of support is associated with a small decrease in the risk for all three outcomes when compared to the highest support. One possibility is that women who have low support work in occupations that do not need any support, while conversely, higher levels of support are indicative of a decreased ability to meet job requirements, ie, support is provided because support is needed. Alternatively, for jobs characterized by the middle quartiles of support, where there is some evidence for increased risk of HDP and GDM, the extent or type of support provided may not be enough to mitigate detrimental effects on health.

This study has limitations. First, the exposure was not ascertained at the individual level nor was it specific to pregnant women only; therefore, there is possible misclassification. Individual-level ascertainment is unfeasible in a study of this size. The JEM was developed for general use and data were collected from a sample representing the general working population. Thus, misclassification between individuals is likely to be non-differential, which would attenuate the risk. Additionally, job exposure was determined around gestational week 10, which is early enough in the pregnancy that we believe psychosocial working conditions would be experienced in a similar manner to nonpregnant women. Second, we did not include information on leave and could not account for duration of exposure. All diagnoses were given at the end of the pregnancy, and we could not ensure that the leave taken preceded issues related to HDP or GDM. Similarly, we could not ensure that women who were classified as exposed were actively performing the job reported at gestational week 10 for the entirety of their pregnancy. Lastly, it is likely that some diagnoses such as gestational hypertension and GDM are underreported in the registers, which would result in our totals not reflecting all the cases among Swedish pregnant women between 1994 and 2014. However, all diagnostic codes used were routinely reported by a physician after the child was born, making it highly unlikely that assignment of ICD codes was associated with occupations, thus attenuating the results.

Some of the strengths of our study include its large sample and prospective design. Data came from a national register, which includes nearly complete data on approximately 99% of Swedish pregnancies (36), making this generalizable the entire Swedish population of pregnant women. Because outcomes are relatively rare, a large sample size is needed to obtain enough power to detect differences. Our study also benefitted from using data collected as part of routine prenatal care, which increases the consistency and accuracy. The data also included several confounders for which we were able to control. The JEM constructed to measure psychosocial work exposures had separate measures for men and women, which makes exposure measurements more applicable to the women in our study than general measures would. Finally, we were able to test whether many other occupational exposures were potential confounders, which has not been done in previous research. The JEM used for these tests, as well as for the main exposure definition, were developed by occupational health experts on Swedish working conditions. This is an important and unique strength of our study in that it provides a more objective measurement of exposure than could be obtained through self-report.

In conclusion, our results show an increased risk in HDP and GDM for women working in jobs with low levels of decision authority, but a protective effect for those working in jobs with high demands. Results remained the same for women who were in their first pregnancy and working full-time. We recommend that studies investigate whether improvements in psycho- social working conditions and increased control over work tasks for pregnant women can mitigate these risks.

Acknowledgements

The authors acknowledge Anette Linnersjö, Filip Norlén, and Annika Gustavsson at the Institute of Environmental Medicine, Karolínska Institutet for their contributions with data collection. We are also grateful to Mattias Sjöström

and Pernilla Wiebert from the Institute of Environmental Medicine, Karolinska Institutet, and Hans Pettersson from Umeå University for their contributions in developing the JEM used for confounding control. AFA Försäkring provided funding for this research.

Conflicts of interest

The authors declare no conflicts of interest. The source of funding has played no role in the study design, collection, analyses, interpretation of the data, drafting of the manuscript, and decision to submit for publication.

Sidebar

Lissåker C, Hemmingsson T, Kjellberg K, Lindfors P, Selander J. Occupational stress and pregnancy-related hypertension and diabetes: Results from a nationwide prospective cohort. Scand J Work Environ Health. 2022;48(3):239-247.

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Received for publication: 2 September 2021

DETAILS

Subject:	Occupational stress; Womens health; Working conditions; Work environment; Psychological stress; Pregnancy; Employment; Hypertension; Complications; Pregnancy complications; Codes; Births; Exposure; Risk assessment; Occupations; Pre-eclampsia; Age; Diabetes mellitus; Gestational diabetes; Cardiovascular disease; Occupational health; Preeclampsia; Social interactions; Strain; Stress; Prenatal care; Occupational exposure
Business indexing term:	Subject: Occupational stress Work environment Employment Working conditions
Location:	Sweden
Publication title:	Scandinavian Journal of Work, Environment &Health; Stockholm
Volume:	48
Issue:	3
Pages:	239-247
Publication year:	2022
Publication date:	2022
Section:	Original article
Publisher:	Scandinavian Journal of Work, Environment &Health
Place of publication:	Stockholm

Country of publication:	Finland, Stockholm
Publication subject:	Occupational Health And Safety
ISSN:	03553140
e-ISSN:	1795990X
Source type:	Scholarly Journal
Language of publication:	English
Document type:	Journal Article
DOI:	https://doi.org/10.5271/sjweh.4004
ProQuest document ID:	2652911989
Document URL:	https://www.proquest.com/scholarly-journals/occupational-stress-pregnancy-related/docview/2652911989/se-2?accountid=211160
Copyright:	Copyright Scandinavian Journal of Work, Environment &Health 2022
Last updated:	2022-04-21
Database:	Public Health Database

Associations of combining paid work and family care with gender-specific differences in depressive symptoms among older workers and the role of work characteristics

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ABSTRACT (ENGLISH)

Objectives This study aims to provide insight into (i) how the combination of paid work and family care is longitudinally associated with gender-related differences in depressive symptoms and (ii) the role of work characteristics in this association. Methods Data were derived from STREAM, a Dutch prospective cohort study of older workers aged 45-64 years. Respondents were included if they were employed in at least one measurement between 2015 and 2017 (N=12 447). Mixed-models were applied to disentangle between-person (BP) and within-person (WP) effects of family caregiving on depressive symptoms. Analyses were stratified by gender. Work characteristics (social support, autonomy, emotional and mental workload) were separately added to the multivariable models. Results For older employees, family caregiving was positively associated with depressive symptoms between and within persons for both women [BP B=0.80, 95% confidence interval (CI) 0.52-1.08; WP B=0.32, 95% CI 0.08-0.56] and men (BP B=0.75, 95% CI 0.45-1.05; WP B=0.25, 95% CI 0.01-0.48). Social support at work reduced the adverse effect of family care on depressive symptoms for women (BP) and men (BP and WP). Emotional workload partly explained the effect of family care for both women and men (BP). Conclusions The longitudinal association between family care and mental health was similar for male and female employees. Resources at work (ie, social support) could protect caregiving employees against depressive symptoms. More research is needed regarding the relative impact of the care context compared to the work context of working family caregivers.

FULL TEXT

Headnote

Objectives This study aims to provide insight into (i) how the combination of paid work and family care is longitudinally associated with gender-related differences in depressive symptoms and (ii) the role of work characteristics in this association.
Methods Data were derived from STREAM, a Dutch prospective cohort study of older workers aged 45-64 years. Respondents were included if they were employed in at least one measurement between 2015 and 2017 (N=12 447). Mixed-models were applied to disentangle between-person (BP) and within-person (WP) effects of family caregiving on depressive symptoms. Analyses were stratified by gender. Work characteristics (social support, autonomy, emotional and mental workload) were separately added to the multivariable models.
Results For older employees, family caregiving was positively associated with depressive symptoms between and within persons for both women [BP B=0.80, 95% confidence interval (CI) 0.52-1.08; WP B=0.32, 95% CI 0.08-0.56] and men (BP B=0.75, 95% CI 0.45-1.05; WP B=0.25, 95% CI 0.01-0.48). Social support at work reduced the adverse effect of family care on depressive symptoms for women (BP) and men (BP and WP). Emotional workload partly explained the effect of family care for both women and men (BP).
Conclusions The longitudinal association between family care and mental health was similar for male and female employees. Resources at work (ie, social support) could protect caregiving employees against depressive symptoms. More research is needed regarding the relative impact of the care context compared to the work context of working family caregivers.

Key terms employment; gender; mental health; The Netherlands.

Due to population ageing and cutbacks in residential care, there is an increased demand for family caregivers, resulting in that more people will need to combine paid work and family care at a certain point in their working career. This combination occurs in particular during midlife, when older parents increasingly need care or when a partner becomes ill at a relatively young age. Concomitantly, older workers experience a societal push to prolong their work participation until higher age by the abolishment of early retirement schemes and an increased statutory retirement age. Since health around retirement is an important predictor of healthy ageing (1), reaching the retirement age in good health is important. However, providing family care has been associated with stress, depression, and sick leave (2, 3). Research has shown that working family caregivers experienced more mental fatigue than non-caregiving workers (4, 5). About one in five working family caregivers experienced a heavy burden, and about one in seven workers who had started with family care reported deteriorated health (4). Hence, the increasing demand to combine paid work with family care could negatively impact the mental health of older

workers.

In addition, research has shown that the association between mental health and work participation, family care and the combination of work and family caregiving is different for women and men (6-8). Pressure related to combining roles has been linked to an increased risk of burn-out in women (9), and working women were at greater risk of emotional difficulties by caregiving than working men (10). A meta-analysis has shown that family caregiving increased gender differences in depression and physical health, because women experienced more care-related stressors (6). Overall, women and men have different social roles, which may contribute to differences in mental health and differences in how family caregiving impacts mental health over time. Even in today's society, gender roles predict that women generally feel more responsible for significant others, and are more willing to provide intensive family care compared to men (2, 11). Moreover, they are more often involved in family care in combination with paid work than men (2, 12).

There are also gender differences in work that could impact the combination of paid work and family care. Since women generally work fewer hours than men (2, 11), they might have more time to fulfil caregiving tasks. However, women more often work in jobs with lower autonomy and in sectors with high mental or emotional workload (eg, education or healthcare) compared to men (13, 14). Poor work characteristics may increase the challenge to combine paid work and family care as it may be more difficult to combine work schedules with caregiving. As a result, stress from work and caregiving may build up quickly. Contrarily, having a job with high autonomy might make it easier to reconcile care and work demands, which might protect against mental health deterioration. Thus, women might be at greater risk of mental health deterioration when providing family care if their workplace is not conducive to it. Further, social support at work may also play a role in the association between family care and mental health. Research has shown that having little social support contributed stronger to mental fatigue for working family caregivers than non-caregiving workers (4). Receiving social support at work is an important predictor of mental health among workers (15) and might protect against the potential negative impact of family caregiving. Prior research has indicated that social support from supervisors had a larger effect on reducing burn-out for women compared to men (16) In this sense, women might obtain more benefits from social support at work to reduce mental health issues by the combination of family care and work than men.

Gaining insight into the complex role of gender related to the effects of combining paid work and family care on health will increase the understanding of gender-related health inequalities. A lot of studies focus on associations between a combination of paid work and family caregiving and health, but many of these are based on cross-sectional data. Little is known about whether and how changes in mental health following the combination of family caregiving and work influence gender differences in mental health over time. Also, the role of work characteristics has received limited attention in former studies, while poor work characteristics (eg, low autonomy or no social support) could impact the ability to combine work and family care, and could lead to poorer mental health.

In addition, former longitudinal studies did not distinguish between inter-personal differences (context factors) and within-individual changes, while the impact of family caregiving on mental health might differ in direction or magnitude between- and within-persons for both genders. To fill this research gap, the current study used a mixed-model approach and disentangled between-person effects (the effect of caregiving versus non-caregiving on mental health) and within-person effects (the effect of starting/stopping with caregiving on mental health) for women and men separately (17). Moreover, the current study explored the role of work characteristics in both the between- and within-person associations between family care and mental health. This study aims to answer the following research questions: (i) Does the longitudinal association between family care and mental health differ between older male and female workers? (ii) What is the role of work characteristics in the longitudinal association between family care and mental health among older workers?

Methods

Study design and sample

Data were derived from the Study on Transitions in Employment, Ability and Motivation (STREAM). STREAM is a prospective cohort study that includes workers in The Netherlands aged >45 years and aims to identify under which

circumstances persons participate in employment while maintaining in good health (18). All persons included in STREAM participated in the Intomart GfK Online Panel. At baseline (2010) 15 118 persons participated in the online questionnaire (response 71.5%). The study population was stratified according to 5-year age groups and employment status (eg, employed, self-employed, and non-employed). The data collection of STREAM started in October 2010 with yearly follow-up measurements onwards (with exception of 2014 and 2018). In 2015, a new sample was included in STREAM to refill the 45-49 years category (N=6752, response 62%) (19). Also, new respondents were added to the age groups 50-54, 55-59 and 60-64 years to ensure sufficient numbers in these groups.

In the current study, respondents were selected if they were employed for >1 hour per week in >1 measurement between 2015 and 2017 (see supplementary material www.sjweh.fi/artide/4014, table S1). Measurements were only included when someone was an employee in that year. The final sample included 12 447 employees aged >45 years: employees with family caregiving tasks (2015 N=2730; 2016 N=2374; 2017 N=2171; 7275 observations) and employees without family caregiving tasks (2015 N=8484; 2016 N=6698; 2017 N=6014; 28 196 observations).

Measurements

Depressive symptoms. Mental health was the primary outcome and was assessed by the presence of depressive symptoms. Depressive symptoms were defined as the presence of the symptoms dreariness, dejection, fatigue and low self-appreciation (20) and was measured using the short form of the Center for Epidemiological Studies Depression (CES-D) (21, 22). The short form CES-D consists of 10 items covering depressive symptoms experienced in the past week, by statements such as "During the past week I was bothered by things that usually don't bother me" (22). Respondents could answer on a 4-point scale how often they experienced depressive symptoms (0=rarely or never to 3=mostly or always). The total score of the 10 items ranged from 0-30, with a higher score indicating more depressive symptoms (Cronbach's a=0.84).

Family caregiving. Respondents were labeled as family caregivers if they had spent time on family caregiving in the past 12 months (yes/no). Family caregiving was defined in the questionnaire as "providing unpaid care for a person in the close environment, excluding care for healthy children". This could include family members, as well as friends or neighbors (23), but we prefer to use the term family caregiver throughout the manuscript as this covers the large majority of caregivers.

Work characteristics. Work characteristics included hours of paid work per week (including overtime), autonomy, social support, emotional and mental workload. Autonomy was measured using the Job Content Questionnaire (JCQ) (24, 25) and consisted of five items, such as "Are you able to make decisions about your work on your own?". Social support at work from supervisor and colleagues was based on the Copenhagen Psychosocial Questionnaire (COPSOQ) (26) and included two items regarding supervisors "How often is your supervisor willing to listen to your work-related problems?" and "How often do you receive help and support from your supervisor?", and two items regarding colleagues (same questions with 'supervisor' replaced by 'colleagues'). Emotional workload was measured using the COPSOQ (26) including three items, such as "Is your job emotionally demanding?". Mental workload was based on the Netherlands Working Conditions Survey (NWCS) (27) and included three items such as "Does your work require a lot of your attention?". The items regarding autonomy, social support and workload could be answered on a 5-point scale ranging from 1=always to 5=(almost) never. The answers were reversed and a mean score was calculated per subscale. A higher score indicated more autonomy, social support, emotional and mental workload.

Socio-demographics. Characteristics of the respondents included gender, age (in years) and partner status (yes/no). The highest level of education completed at baseline was categorized into low (pre-primary, primary and lower secondary) or moderate/high (upper secondary and post-secondary) education.

Analyses

Descriptive statistics were presented separately for men and women at all time points.

To assess the longitudinal association between family caregiving and depressive symptoms, mixed-models were performed with family caregiving as the main independent variable and depressive symptoms as the dependent

variable, stratified by gender. Between- and within-person effects were estimated separately. The between-person part of the association compared depressive symptoms between workers with and without family caregiving tasks and was based on the individual mean values of the time varying independent variables (yu=ßo + ¾=1?/?j + ?) (28). The withinperson part of the association provided insight into the changes in depressive symptoms when family caregiving changed (eg, when an individual started or stopped with caregiving tasks) and was based on the differences between the observations and the individual mean value (ht=Ä) + ¾=1/V,·(Xijt-Xij)+ eit) (28). The crude between- and within-person effects of family caregiving on depressive symptoms were calculated in separate univariable models. In separate multivariable models the between- and within-person effects were adjusted for age, partner status and education, since they might influence the association between family caregiving and depressive symptoms. Random intercepts were included in all models to adjust for the correlated observations within the respondents. The xtreg (be/fe) procedure in STATA V.15.1 was used for the analyses. Respondents with one observation only contributed to the betweenperson effects. Respondents with more than one observation contributed to both the between- and withinperson effects. No additional missing data analysis was performed, since the percentage of missing data was <5% for all variables (29). Also, research showed that imputation of missing values is not necessary before performing a longitudinal mixed-model analyses, regardless of the missing data mechanism (30).

To test for gender differences, the crude and adjusted between- and within-person regression coefficients of family caregiving were tested by a linear contrast (31). Z-scores were computed by dividing the difference between coefficients by its standard error, which was defined as the square root of the sum of the variances of t? tw° coefficients (?m?-??V^¾^e2 + ^ale2) (31). Z-scores >|1.96| indicated gender differences. A sensitivity analysis with interaction terms between gender and family care was performed in supplementary table S2.

Next, we explored the role of work characteristics in the longitudinal association between family care and depressive symptoms among older workers by adding them separately to the multivariable models. Because all analyses were stratified by gender, the role of work characteristics was assessed separately for men and women.

Results

The characteristics of the sample are presented in table 1. Across the three measurements, women (32%) provided family care more often than men (20%). About 7% of women provided family care for one year, about 6% provided family care for two years and more than 19% provided family care in all three years. Men provided family care for one year in about 6% of the cases, about 4% provided family care in two years, and almost 11% provided family care in all three years. For respondents with observations in all three years, changes in family caregiving are presented in table 2. The presence of depressive symptoms was higher for women across the three measurements compared to men (5.8 versus 5). Across all measurements, men had higher scores for autonomy in work (3.8 versus 3.6) and mental workload (4.2 versus 4.1), and worked more hours per week on average (38.2 versus 27.3) compared to women. Women had higher scores for social support at work (3.6 versus 3.5, but only in 2016) and for emotional workload (2.5 versus 2.3) than men.

Gender differences in depressive symptoms by combining paid work and family care

The models showed that family caregiving was positively associated with depressive symptoms betweenand within persons for both women and men (table 3). The adjusted between-person effect showed that employed family caregivers experienced more depressive symptoms compared to non-caregiving employees. The effect sizes were similar for women and men (women B= 0.80, 95% CI 0.52-1.08; men B=0.75, 95% CI 0.45-1.05; Z-score 0.24). The adjusted within-person effect indicated that a change in family care was related to changes in depressive symptoms (eg, starting with family caregiving tasks was associated with an increase in depressive symptoms, while stopping caregiving was associated with reduced depressive symptoms). The effect sizes did not differ between women and men (women B=0.32, 95% CI 0.08-0.56; men B=0.25, 95% CI 0.01-0.48; Z-score 0.41).

The role of work characteristics in the association between family care and depressive symptoms

Correcting for working hours did not influence the effect of family caregiving between- and within-persons for women. For men, the effect of family caregiving somewhat reduced on the within-person level (table 4, model 2).

Working more hours was associated with fewer depressive symptoms for men on the between-person level, while an increase in working hours was related to an increase in depressive symptoms for men on the within-person level. For women, working hours was not associated with depressive symptoms. Adding autonomy in work to the model slightly reduced the effect of family caregiving within-persons for men (model 3). Higher levels of autonomy in work were associated with fewer depressive symptoms for women (between- and within-person) and men (between-person).

Social support at work (model 4) reduced the effect of family caregiving on depressive symptoms for women (between-person) and men (between- and within-person). This indicated that the unfavorable effect of family caregiving was partly compensated for by the favorable effect of social support. Receiving more social support at work was related to fewer depressive symptoms for women (between- and within-person) and men (between-person).

Emotional workload reduced the effect of family caregiving for women and men on the between-person level (model 5). This indicated that the effect of family caregiving on depressive symptoms was partly due to the unfavorable effect of emotional workload on depressive symptoms. Having higher levels of emotional workload were associated with more depressive symptoms for women and men on between-persons and withinpersons. The Z-score (-4.65) indicated that the effect of emotional workload was stronger for men compared to women at the between-person level.

Mental workload slightly reduced the effect of family caregiving on depressive symptoms for men on the within-person level (model 6). Higher levels of mental workload were related to more depressive symptoms for women (between-persons) and men (between-persons and within-persons). The Z-score (-1.99) indicated that the effect of mental workload was stronger for men than for women.

Discussion

This study showed that employed family caregivers experienced more depressive symptoms than non-caregiving employees, and beginning or ending family caregiving was associated with a change in depressive symptoms for both women and men. Social support at work and emotional workload reduced the effect of family care on depressive symptoms for women and men. Autonomy in work, mental workload and working hours only slightly reduced the association between family care and depressive symptoms.

No clear gender differences in mental health when combining paid work and family care

The longitudinal association between family care and mental health was similar for male and female employees. This is in line with findings from a longitudinal study that linked family caregiving to worsened mental health for both men and women (32). On the contrary, the results differ from a meta-analysis that reported small gender differences in burden and depressive symptoms caused by family caregiving (6), and a cohort study that showed that men's depressive state was less sensitive to family caregiving than that of women (7). However, these studies did not specifically focus on employees. Having occupational responsibilities next to caregiving tasks could be a double burden for both men and women (33). Conversely, a meta-review has shown that work can be beneficial for employees' mental health (34), and spending time at work could offer respite from caregiving demands (35). Hence, it could be that there are less gender-related differences in mental health by family caregiving in the working population compared to a general population.

In line with prior findings, women provided family care more often than men (12), but when men did provide family care the effect of caregiving on mental health was comparable. On the one hand, it could be that gender differences are less pronounced within the group that already combines paid work and family care, but are particularly present in the decision to take on care responsibilities. This possibly decreases differences within the group of family caregivers and may explain why no differences in mental health between women and men were found.

On the other hand, it is possible that gender differences in mental health by family caregiving are decreasing due to changing gender roles (36). Pinquart and colleagues (6) argued that caregiving experiences of men and women have become more similar over the years. Also, about three quarter of the employed women and men in this study were highly educated. Hence, gender differences in mental health resulting from family caregiving may be limited

among older workers in white-collar jobs. An alternative explanation could be that mental health is more strongly determined by care demands and the availability of additional caregivers than by gender differences (6). When interpreting the results, we should bear in mind that the effect sizes of family care on depressive symptoms among older employees were relatively small. However, a small average effect on population level could still mean that there are subgroups in which the effects are larger (eg, those involved in intensive care situations). Future research could assess the role of care characteristics (eg, intensity, illness trajectory, sharing care tasks with others) in addition to work characteristics to identify subgroups that experience mental health issues by combining family caregiving and work. Furthermore, it should be considered that the mean score of depressive symptoms was relatively low. Although women experienced slightly more depressive symptoms than men, the mean score was for both below the cut-off point of ten that is advised to identify clinically relevant depression (22, 37). This could be a 'healthy worker effect', ie, employees tend to have better health status compared to the general population (38). However, the results showed that family caregiving contributed to depressive symptoms. This indicates that family caregiving is a relevant issue for the mental health of older employees.

The importance of work characteristics

In line with former research (4, 39), the results showed that social support at work could protect employees against depressive symptoms. Inclusion of social support reduced the effect of family caregiving in the between-person models, for both men and women, which may reflect that people who provide care are, compared to non-caregivers, more likely to have less social support. However, in contrast to our findings, Earle and colleagues (39) found that the protecting effects of work characteristics were somewhat larger for women. An explanation for this difference could be that the women in their sample worked about 39 hours per week on average, while women in the current study approximately worked 27 hours per week on average. Work characteristics such as social support possibly have a stronger protecting effect on mental health of women who combine family care with a fulltime job. From previous research (40), it is known that autonomy in work can also protect employees against depressive symptoms. However, in our study, autonomy in work only slightly reduced the association between family care and depressive symptoms. An explanation could be that, autonomy in the current study, reflects autonomy in work tasks (eg, deciding how to perform work tasks) rather than having control over work arrangements, such as the decision to come in late or leave early. The latter might be of more importance in accommodating work and family care responsibilities (41). Other work resources (eg, flexible work hours, social support) might be more important in explaining - and preventing - depressive symptoms among working family caregivers. The results indicated that emotional and mental workload were risk factors for adverse mental health. Only emotional workload played a role in the association between family care and depressive symptoms for both women and men. This suggests that people who provide care are, compared to non-caregivers, more likely to take on emotional workloads, whether at work or in caregiving. As employees who combine paid work and family care often have jobs with high emotional workload (42-44), they could benefit from support by employers to prevent mental health problems. Gender effects could play a role here, since jobs with high emotional workload (eg, healthcare) are often fulfilled by women or men with feminine traits (42, 45). Working hours only slightly influenced the association between family care and depressive symptoms. Although men worked more hours than women, differences in depressive symptoms between women and men with caregiving tasks were not found. In line with social role theory (46), an explanation could be that women generally work fewer hours per week but more often combine their paid work with other responsibilities, such as family care or volunteer work, while men usually work more hours but often are less engaged in other roles. Also, research has shown that hours spent in roles was more important in relation to mental health than the role combination in itself (47). Future research could also include the intensity of caregiving and time spent in other societal roles fulfilled by employed women and men in relation to mental health.

Methodological considerations

The strength of the longitudinal design is that information about family caregiving and mental health was available for a large number of employees in subsequent years of the prospective cohort, which made it possible to assess changes over time. Another strong point is that the between- and within-person effects were estimated separately,

which enabled comparison of depressive symptoms between caregivers and non-caregivers, as well as determine changes in depressive symptoms when someone took up or ended caregiving tasks. The results showed that the between-person effects were often larger than the within-person effects. This confirms previous findings that the magnitude of effects could differ between- and within-persons (17, 48). Work characteristics were not specifically measured in the context of family caregiving. Social support at work mainly included support in work-related problems and not problems related to the combination of work and family care per se. Although we could argue that employees who receive support in work-related problems are likely to also receive support in other types of problems, the role of social support at work might be underestimated. Future studies could specifically include work characteristics (eg, social support, autonomy in work) in the context of family caregiving.

Practical implications

Our findings indicated that family caregiving was positively associated with depressive symptoms over time, underlining the need to prevent mental health problems. One-fifth of male employees and one-third of female employees combined work with family care, and these numbers are likely to increase in the coming years. Hence, older workers with family caregiving tasks could benefit from more social support in work. To realize this, more attention is needed for employees with caregiving tasks from employers, supervisors and colleagues, in which open communication about family caregiving is important. In addition, supervisors can be better informed by their organization about support options for family caregivers (49).

Concluding remarks

Caregiving demands can impact the mental health of older employees in a negative way. Although women provide family care more often than men, the longitudinal association between family care and mental health was similar for male and female employees. Resources at work (ie, social support) could protect older employees who give family care against depressive symptoms. Employed family caregivers who have jobs with high emotional workload could in particular benefit from support by employers to prevent mental health problems. This study underlines the need for support from employers to prevent mental health problems among employees with caregiving tasks. More research is needed regarding the relative impact of the care context compared to the work context of working family caregivers.

Ethics approval

The Medical Ethical Committee of the VU University Medical Center (Amsterdam, the Netherlands) declared that the Medical Research Involving Human Subjects Act does not apply to the STREAM study and indicated to have no objection to the execution of this research (reference number 2012/080). The TNO Institutional Review Board has expressed a positive recommendation based on the research design, privacy and ethical aspects and the burden and the risks to the research participants (reference number 2019-100).

Funding

The ZonMw Gender and Health programme funded this work (grant number 80-84900-98-321). ZonMw was not involved in the analysis or writing of this paper.

Sidebar

Bijnsdorp FM, van der Beek AJ, Broese van Groenou MI, Proper KI, van den Heuvel SG, Boot CRL. Associations of combining paid work and family care with gender-specific differences in depressive symptoms among older workers and the role of work characteristics. Scand J Work Environ Health. 2022;28(3):190-199. doi:10.5271/sjweh.4014

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Received for publication: 27 May 2021

DETAILS

Subject:	Gender differences; Mental health; Older workers; Context; Employment; Women; Autonomy; Mental depression; Workloads; Emotions; Sex differences; Men; Gender; Social support; Confidence intervals; Employees; Workload; Age groups; Social interactions; Caregivers; Roles
Business indexing term:	Subject: Older workers Employment Workloads Employees
Location:	Netherlands
Publication title:	Scandinavian Journal of Work, Environment &Health; Stockholm
Volume:	48
Issue:	3
Pages:	190-199
Publication year:	2022
Publication date:	2022
Section:	Original article
Publisher:	Scandinavian Journal of Work, Environment &Health

Place of publication:	Stockholm
Country of publication:	Finland, Stockholm
Publication subject:	Occupational Health And Safety
ISSN:	03553140
e-ISSN:	1795990X
Source type:	Scholarly Journal
Language of publication:	English
Document type:	Journal Article
DOI:	https://doi.org/10.5271/sjweh.4014
ProQuest document ID:	2652911781
Document URL:	https://www.proquest.com/scholarly-journals/associations-combining-paid-work-family-care-with/docview/2652911781/se-2?accountid=211160
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Last updated:	2022-04-21
Database:	Public Health Database

van Hees, Suzanne GM, MSC, Carlier, B. E., PhD., Vossen, E., PhD., Blonk, R. W. B., PhD., & Oomens, S., PhD. (2022). Towards a better understanding of work participation among employees with common mental health problems: A systematic realist review. Scandinavian Journal of Work, Environment & Health, 48(3), 173-189. doi:https://doi.org/10.5271/sjweh.4005

Objectives Common mental health problems (CMHP) represent a major health issue and burden to employees and employers. Under certain conditions work contributes to wellbeing and participation of employees with CMHP. Promoting work participation is important, however the specific conditions in which work participation occurs is complex and largely unclear. This calls for a novel, realistic approach to unravel the complex relationship between outcomes, context and underlying mechanisms of work participation. Methods In the present realist review, peer-reviewed studies conducted between 1995 and 2020 were systematically reviewed on the outcome measures 'stay at work' (SAW) and 'work performance' (WP). The database search from seven databases identified 2235 records, of which 61 studies met the selection criteria and methodological rigor. Results The synthesis demonstrates how work participation is promoted by the following mechanisms and contextual factors: (i) organizational climate and leadership, (ii) social support, (iii) perceived job characteristics, (iv) coping styles, (v) health symptoms and severity, (vi) personal characteristics, and (vii) features of interventions. An explanatory framework, based on the Capability-for-Work model, presents a new set of capabilities leading to SAW and WP. Conclusions This systematic realist review revealed mechanisms and contextual factors that promote both SAW and WP among employees with CMHP. These show how the organizational climate, social support in the work context, job characteristics and certain capabilities enable employees with CMHP to participate at work. Our contributions and practical implications are discussed, providing valuable insights for employers, professionals and researchers in the development of evidence-based interventions.

Macpherson, R. A., PhD., He, A., PhD., Amick, B. C.,I.I.I.PhD., Koehoorn, M., PhD., & McLeod, C. B., PhD. (2022). Evaluating effectiveness of an integrated return-to-work and vocational rehabilitation program on work disability duration in the construction sector. Scandinavian Journal of Work, Environment & Health, 48(3), 229-238. doi:https://doi.org/10.5271/sjweh.4006

Objective The aim of this study was to investigate whether an integrated return-to-work (RTW) and vocational rehabilitation (VR) program - the Work Reintegration (WR) program - was associated with reduced work disability duration in the construction sector in Ontario, Canada. Methods Workers' compensation data from the Ontario Workplace Safety and Insurance Board were extracted for lost-time construction worker claims following work-related injuries between 2009 and 2015. Claims receiving referrals to RTW and VR specialists (treatments) were matched with claims receiving no referrals (controls) during the periods before and after the WR program introduction. Multivariable difference-in-differences linear and quantile regression models were used to examine differences in cumulative disability days paid during twoyears post-injury between treatment and control groups before and after the program change and the difference in these differences, overall, and at different disability distribution percentiles. Results The WR program introduction was associated with reductions in cumulative disability days paid for all claims but most notably among longer duration claims referred to RTW specialists (reduction of 274 days at the 90th percentile in the disability distribution) and shorter duration claims referred to VR specialists (reductions of 255 and 214 days at the 25th and 50th percentiles in the disability distribution, respectively). Conclusions The WR program introduction was effective in reducing cumulative disability days paid for construction worker claims but the effects varied at different percentiles in the disability distribution, as well as by specialist referral. The findings highlight the benefits of better integrated RTW and VR services to injured workers in the construction sector.

Benavides, F. G., Silva-Peñaherrera, M., & Vives, A. (2022). Informal employment, precariousness, and decent work: From research to preventive action. Scandinavian Journal of Work, Environment & Health, 48(3), 169-172. doi:https://doi.org/10.5271/sjweh.4024

Informal employment--that is work without a contract, legal protection or social security--is the most common employment arrangement in the world. According to the International Labor Organization, its share of total employment (SDG indicator 8.3.1) was 61% (2 billion workers) by 2016. While globally the proportion of informal workers is larger among men (63% versus 58% for women), there are more countries (55%) where the share of women in informal employment exceeds that of men. In fact, informal employment constitutes a persistent, structural pillar of labor markets, especially in low- and middle-income countries. And while in the USA and the EU, informal employment is around 18% and 15% of the occupied labor force, respectively, figures are 53% for Latin America, and 88% and 77% in Africa and Asia (excluding China), respectively. Here, Benavides et al examine the health impact of informal employment.

Steel, J. S., PhD., Godderis, Lode,M.D., PhD., & Luyten, J., PhD. (2022). Short-term effectiveness of face-to-face periodic occupational health screening versus electronic screening with targeted follow-up: Results from a quasi-randomized controlled trial in four belgian hospitals. Scandinavian Journal of Work, Environment & Health, 48(3), 220-228. doi:https://doi.org/10.5271/sjweh.4011

Objectives In many countries, organisations are legally obliged to have occupational physicians screen employees regularly. However, this system is time-intensive, and there may be more cost-effective alternatives. Our objective is to compare the short-term effectiveness of periodic occupational health screening of hospital employees by an occupational physician with a system of electronic screening with targeted follow-up. Methods A randomized controlled trial was set up among personnel of four Belgian hospitals, with three measurement moments between June 2019 and December 2020, to compare differences in self-assessed health, healthcare use, productivity and intermediate outcomes over 19 months. Mixed effects models were used to assess differences in effectiveness. Superiority and non-inferiority post-hoc tests were used as a robustness check. The experiment coincided with the first two COVID-19 waves during which hospital employees were exposed to an exceptional period of occupational stress. Results In total, 1077 employees (34% of the target population) participated. Although we observed some immediate effects of the intervention (less trust in the physician, absenteeism, and healthcare use), all these effects disappeared over time. After 19 months, including two waves of COVID-19 hospitalizations, no significant differences were observed between employees screened through face-to-face contact and those screened electronically. Conclusions Our study finds no indication that, in the short-term, substituting physician screening of the workforce with a quicker survey-based screening with targeted follow-up has different effects on the studied endpoints. However, as health and disease are often the result of a long-term process, more evidence is needed to determine long-term effects.