



Safety climate and accidents at work: Cross-sectional study among 15,000 workers of the general working population



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ABSTRACT

Aim: Occupational safety climate is utilized as a way to measure the risk of accidents and injuries at work. This study investigates which factors are associated with safety climate and accidents at work.

Methods: In the 2012 round of the Danish Work Environment and Health Study, 15,144 workers from the general working population of Denmark replied to questions about safety climate and accidents at work. Mutually adjusted logistic regression analyses determined the association between variables.

Results: Within the last year, 5.7% had experienced an accident resulting in sickness absence. The number of safety climate problems was progressively associated with the odds ratio (OR) for accidents. For one safety climate problem the OR for accidents was 2.01 (95% CI 1.67–2.42), for four or more safety climate problems the OR was 4.57 (95% CI 3.64–5.74). Young workers (18–24 years) had higher odds of accidents (OR 1.36 [95% CI 1.02–1.81]). Using safety climate as outcome and excluding those who previously experienced an accident, the OR for experiencing safety climate problems was 1.98 (95% 1.66–2.36) among young workers. Using office and educational work as reference, transport or alone work, construction work, manufacturing work, and service and kitchen work had highest odds for experiencing safety climate problems.

Conclusion: A higher number of safety climate problems are progressively associated with increased odds for experiencing accidents. Young workers are more likely to experience safety climate problems and accidents at work. Especially transport, construction, manufacturing and service workers are more likely to experience safety climate problems.

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1. Introduction

Accidents at work represent a major societal challenge. According to the International Labour Organization (ILO), approximately 360,000 fatal and 337 million non-fatal work-related accidents occur worldwide every year. The estimated cost of major work-related accidents alone is estimated at US\$ 5 Billion worldwide. In addition such accidents cause incalculable suffering to workers and their families (ILO, 2010). Measuring occupational safety climate has become a well-established method for evaluating the link between organizational characteristics and safety at work, including the risk for accidents. Safety climate as a concept has its origins in theories of organizational climate, and was conceptualized as an

aspect of the organization by Zohar (1980), who argues that safety climate has particular characteristics in different organizations and work groups, in line with e.g. service- or innovation climate. Safety climate aims to capture employee's perceptions of safety behavior, policies, procedures and practices, as well as managerial commitment and attitudes towards safety (Zohar, 2002, 2000). The current paradigm for climate research discriminates between two attribute types, the generic and the facet-specific ones, where research in safety climate is mainly focusing on the latter. One basic assumption of the facet-specific climate approach is the emphasis on the relative priority among competing job facets or operational task demands, such as speed versus accuracy. Zohar emphasizes that safety climate should be interpreted as a multi-dimensional and facet specific concept, reflecting safety status through investigating management and workers' attitudes and commitment towards safety (Zohar, 1980).

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Numerous studies show that a 'positive' safety climate is associated with higher levels of work-place safety through improvement of workers' safety motivation and participation (Neal and Griffin, 2006), and utilization of protective equipment (Arcury et al., 2015). Furthermore, safety climate has been shown to predict workers' and management's safety commitment, and their compliance with safe working performance (Barbaranelli et al., 2015; Zohar, 2002). These studies also document a relation between positive safety climate and fewer accidents (Arcury et al., 2015; Barbaranelli et al., 2015; Neal and Griffin, 2006; Tholén et al., 2013; Zohar, 2000).

So far, no studies have documented the odds ratio for experiencing accidents as a function of an increasing number of safety climate problems. In this study we investigate this association in a large sample of people within seven job categories in the general working population: (1) construction and craft (furniture makers, jewelers ect.) work, (2) health, social work and child care, (3) transport/alone work, (4) manufacturing work, (5) service, retail and kitchen work, (6) military and rescue work, and (7) office and educational work. We used selected five items from the 50-item Nordic Occupational Safety Climate Questionnaire (NOSACQ-50; (Kines et al., 2011)) as used in the Danish 'Work Environment and Health survey' (NRCWE, 2012).

2. Methods

2.1. Population

Data on work environment and health in the study population was obtained from the 2012 round of the Danish Work Environment and Health Study (NRCWE, 2012). The NRCWE study consists of questionnaire items assessing work environment and health in the general working population of Denmark, and will be repeated every other year until 2020. The questions used for this study are specified below. A total of 15,144 workers replied to the 2012 questionnaire. The study has been notified to and registered by the Danish Data Protection Agency (datatilsynet; journal number 2015-57-0074). According to Danish law, questionnaire and register-based studies do not need approval by ethical and scientific committees, nor informed consent. All data was de-identified and analyzed anonymously.

2.2. Work categories

The workforce was divided into seven work categories. Grp 1: Construction and other craft (e.g. Jewel crafting and furniture making) work, Grp 2: Health, social work and child care work, Grp 3: Transport/alone work, Grp 4: manufacturing work, Grp 5: Service, retail and kitchen work, Grp 6: Military and rescue work, Grp 7: Office and educational work (reference category).

The work categories were divided into groups with similar overall work tasks and types of work setting. This provided seven meaningful groups that we considered relevant for the analysis of differences in safety climate perceptions. Construction work and other craft work (Grp 1) are characterized by activities related to handling and processing physical objects, and where the tasks are not industrial. Usually, this work is performed by skilled workers and carried out under dynamic and changing conditions. Health and Social work and child care work (Grp 2) are characterized by work tasks where the work 'objects' often are other human beings, i.e., subjects such as patients, residents, clients etc. These types of work are characterized by work where the workers interact with other people, and where special attention is paid to these people's needs and care. Transport work and working alone (Grp 3) are characterized by work where the worker is often on their own

and often at a distance from where instructions emanate. The work is also dynamic and changing in character, and the work situations are mobile. Lone workers also demonstrate a culture of safety (Grytnes et al., 2016). Manufacturing work (Grp 4) is characterized by work done in industrial settings, and where the work is often more static in character compared to grp 1 and grp 3. Service, retail and kitchen work (Grp 5) consists of various tasks related to providing services to other people, either directly as hairdressers, sales work, passenger service staff, as well as more indirect service work provided to people, e.g., kitchen work, cleaning and inspection work. Military and rescue work (Grp 6), including firefighters and police work, represent specific high risk work. People in this sector are usually trained to deal with high accident/injury risk situations. Finally, office and educational work (Grp 7, reference group) make up a group that is usually considered to do low accident/injury risk work tasks.

Each main category can yield a variety of job types, and it might be that it is not only in group 7 that we have administrative work, but also in e.g., health care and social work, either it be purely administrative work or administrative work as a sub function of other jobs. The suggested classification into seven main groups must be seen as a rough classification, in order to get the first overview of the relationships between types of work and variations in safety climate perceptions.

2.3. Safety climate

Safety climate was assessed by five items from the 50-item NOSACQ-50 (Kines et al., 2011). NOSACQ-50 is a reliable tool for measuring safety climate and valid for predicting safety motivation, perceived safety level, and self-related safety behavior (Kines et al., 2011). In this study five items were selected to be particularly indicative of the safety climate, as they address the main themes concerned in the literature: managerial and employee commitment, participation and engagement (Kines et al., 2011; Neal and Griffin, 2002; Zohar, 1980). The five questions were as follows: (1) "Management ensures that everyone receives the necessary information on safety", (2) "Management encourages employees here to work in accordance with safety rules - even when the work schedule is tight", (3) "Management involves employees in decisions regarding safety", (4) "We who work here help each other to work safely", (5) "We who work here consider minor accidents as a normal part of our daily work". For each question, respondents replied on a 4-point scale of "strongly agree", "agree", "disagree", or "strongly disagree". All responses of disagree or strongly disagree were interpreted as a safety climate problem, except for question 5 where agree or strongly agree was interpreted as a safety climate problem.

2.4. Accidents

To assess accidents we asked the question: "Have you experienced one or more work-related accidents that resulted in more than one day's absence within the past 12 months?" with the response options: "no accidents", "1 accident", "2 accidents", "3 accidents", or "4 or more accidents".

2.5. Statistical analyses

We used logistic regression analyses (Proc Logistic of SAS version 9.2) to determine the odds for: (1) accidents with sickness absence, and (2) safety climate among those who experienced an accident. In the first analysis with accidents as the dependent variable, the number of safety climate problems, age, work category and gender were independent explanatory variables. In the second analysis with safety climate as dependent variable, age, work

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