A Nordic questionnaire for assessing safety climate (NOSACQ)

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ABSTRACT
There is increasing scientific support for the causal relation between safety climate and safety performance. Many safety climate questionnaires are available, but their theoretical basis is sometimes unclear, and different types of psychological constructs intermixed. A questionnaire with documented validity and reliability in different contexts would make for better co-ordination of research in comparative studies. Theoretical advances concerning safety climate are also a prerequisite for effective practical use in working life. The aim of the present work was to develop a Nordic questionnaire for measuring safety climate, based on theory and previous empirical research. The Nordic development team of the Nordic Safety Climate Questionnaire (NOSACQ) had participants from all five Nordic countries. The work commenced in 2000 and was based on consensus meetings. Based on literature, safety climate was defined as shared perceptions among the members of a social unit, of policies, procedures and practices at management and group level, influencing safety in the organization at a given time. Dimensions to be included were to be selected on the criterion of substantial theoretical or empirical support for their validity for safety motivation or safety outcome. Items were compiled from literature and additional items were construed, when needed. The prototype questionnaire was administered in the construction industry in all five Nordic countries, in three consecutive pilot tests. The questionnaire was subsequently also tested in a sample of workers in the Swedish food processing industry. Instrument reliability was tested using structural equation modeling and Rasch analysis. The results of the pilot tests confirmed reliability and validity of the questionnaire. This supports the generic value of NOSACQ and that it has a potential for use in different industrial contexts. The instrument was also found to be valid for predicting self rated safety behavior, a proximal criterion of safety performance.

1. INTRODUCTION AND AIM

In the nineteen-hundreds the efforts to reduce the rate of occupational accidents were mainly concentrated on technical solutions, regulations and human factors. In recent years the awareness has increased of the importance for safety performance of organizational, managerial and social factors. The less than

satisfactory progress in reducing accident frequency in Europe indicates the continued need for such a broadened perspective on safety. The concepts of safety culture and safety climate are interesting contributions from the behavioral and social sciences in attaining a better understanding of safety. Denison (1996) stated that the concepts of organizational culture and climate both suggest the existence of a shared, holistic, collectively defined social context that emerges over time. Climate corresponds to how the social environment is apprehended by the actors (Denison, ibid.). Safety climate questionnaires are available in abundance, but the theoretical basis for many of these has not been sufficiently clear, and often different types of psychological constructs have been intermixed (Clarke, 2006a).

In a meta-analytic review of relations between safety climate and safety performance, Clarke (2006b) concluded that there was support for a relation between safety climate and employee safety behavior. In another meta-analysis Clarke (2006a) found support for a significant influence of safety climate perceptions on work accident involvement, although the effect was moderate. In a recent three stage measurement longitudinal study in the Swedish construction industry, Pousette et al (2008) found support for a causal influence of safety climate on safety behavior. Scientific support for the validity of safety climate for safety performance has also been found by others (e.g. Neal et al., 2000; Zohar, 2002; Nielsen and Mikkelsen, 2007). The above results indicate that safety climate is of importance for safety performance, and that this area deserves further exploration. One route for further theoretical advances in safety climate research is through questionnaire studies. For this there is a need for theoretically well grounded questionnaire instruments, based also on empirical results from previous research. Such a questionnaire, with documented validity and reliability in different contexts, would make for better co-ordination of research using the same instruments in comparative studies and offer the possibility of comparing results from different studies. Theoretical advances concerning safety climate are also a prerequisite for effectively putting the concept to practical use in working life. The aim of the present work was to develop a questionnaire for measuring safety climate in the Nordic countries, based on theory and previous empirical research.

2. METHODS

The Nordic team for development of the Nordic Safety Climate Questionnaire (NOSACQ) consisted of participants from all five Nordic countries[i]. The development work commenced in 2003 and was based on several consensus meetings within the development team, where certain main principles and technical outlines for the questionnaire were set. Based on literature (starting with Zohar, (1980) safety climate was defined as shared perceptions at a given time among the members of a social unit, of policies, procedures and practices at management and group level, influencing safety in the organization. Dimensions and facets of safety climate to be included in the questionnaire were to be selected on the criterion that there be substantial theoretical or empirical research support for their validity for safety motivation or safety outcome, i.e. safety behavior, perceived safety level or, when possible, accident involvement. The questionnaire should be comprehensive enough to cover a sufficient number of such dimensions and facets to effectively be able to evaluate safety climate status in working life, and to be used as a diagnostic tool and a tool for evaluating interventions.

Suitable items to represent the different dimensions and facets were compiled from the literature and additional items were construed, when needed. This resulted in an item pool concerning conditions at management level and workgroup level, respectively. The group level items were tested with regard to face validity, i.e. content consistency with the intended dimensions. Items with non-satisfactory face validity were scrutinized. Some were reworded, some moved to represent another dimension and some items were deleted. The remaining and revised items were used for the first pilot study, together with the management level items.

In order to ensure that dimensions and facets were sufficiently well represented, each facet of the prototype questionnaire comprised at least four items, with both positive and negatively worded/reverse coded items. A five-step Likert-type scale (Likert, 1932) was initially chosen for rating in the first pilot testing. The prototype questionnaire was administered in the construction industry in all five Nordic countries in the fall and winter of 2006-2007. In all, 753 construction workers participated in the first pilot-study. Reliability of NOSACQ was confirmed in all five Nordic countries. Rasch-analysis showed some reversed thresholds using the five-step response format. After some revisions a second pilot testing was performed comprising the responses from a convenience sample of 147 construction workers from six different work sites in three of the Nordic countries. Half of these responded on a four-step format and half on a five-step format. Scale properties were tested using Rasch analysis, which showed fewer reversed thresholds using a four-step response format, and since the loss in reliability was only marginal this strongly supported the use of the four-step format. NOSACQ with the four-step format was further tested in a third pilot study comprising respondents from four Nordic countries in four different occupational branches. The results confirmed the dimensionality and reliability was good. The results also showed significant relations with two outcome variables, Safety grade (1 item), and overall perceptions of safety (4 items), supporting validity.

The questionnaire was further tested in a sample of workers in the Swedish food processing industry. Also here the results confirmed the dimensionality and reliability was good. The instrument was in this study found to be valid also for predicting self-rated safety behavior, a proximal criterion of safety performance.

3. RESULTS AND CONCLUSIONS

The development work resulted in seven safety climate dimensions, comprising 50 items with 22 evaluating management level and 28 evaluating workgroup level conditions. The safety climate dimensions included in NOSACQ are: Management safety priority and ability (9 items); Management safety justice (6 items); Management safety empowerment (7 items); Workers' safety commitment (6 items); Workers' safety priority and risk non-acceptance (7 items); Peer safety communication, learning, and trust in safety ability (8 items); Workers' trust in efficacy of safety systems (7 items). In addition to the safety climate variables, information may be gathered on respondents' background variables, such as age, gender, years of experience in the relevant industry, employer, etc.

The results from the third pilot-study and from the Swedish food industry support the generic value of NOSACQ and that it has a clear potential for use in different occupational contexts.

The NOSACQ will enable comparative studies between different countries, industries, companies and groups, and is suitable for research purposes as well as for practical use, to evaluate safety climate status and effects of interventions. It is available in English and the five Nordic languages, after agreement with the authors.

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Footnote

[i] The Nordic team for development of NOSACQ consisted of the following persons: Pete Kines and Kim Lyngby Mikkelsen, National Research Centre for the Working Environment, Copenhagen, Denmark; Jorma Lappalainen and Simo Salminen, Finnish Institute of Occupational Health, Tampere, Finland; Susanna Larsson, Anders Pousette and Marianne Törner, Dept of Occupational and Environmental Medicine, Göteborg University, Sweden; Kari Anne Holte, Espen Olsen and Jorunn Tharaldsen, International Research Institute of Stavanger AS, Norway; Hans Magne Gravset, National Institute of Occupational Health, Oslo, Norway; Kristinn Tómasson, Iceland Administration for Occupational Health and Safety, Reykjavik.