



A comparison of three methods to identify chemicals hazards in French research laboratories



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ABSTRACT

Objectives: Consensus methods are increasingly used as alternatives to traditional assessment methods, because of their low cost and high efficiency. The objective of our study was to investigate whether the assessment of occupational hazards linked to the use of carcinogenic, mutagenic and reprotoxic chemicals differed when done by two consensus methods, the nominal group method (based on a face-to-face group meeting) and the Delphi method (a questionnaire-based method) in comparison to direct observation. The CMR's have been chosen due to the specificity of substances used in the laboratories and due also to the lack of prevention practices.

Methods: 119 professionals from 13 French research laboratories were randomly allocated to use either the Delphi or nominal group methods. Direct observation of the presence and use of chemicals was done by an external occupational hygienist who used a standardized protocol. After data collection, chemicals identified by consensus methods but not by observation were checked by local hygiene and safety correspondents. The final combined list of the present and used chemicals was defined as the reference. Sensitivities (Se) and specificities (Sp) were estimated to assess the performance of the three methods to identify the presence, and the actual use of chemicals. Characteristics associated with performance were assessed using logistic regression models.

Results: The total number of chemicals listed in the initial lists was 360. Observation identified 50 additional chemicals, and consensus methods another two, which were neither on the lists nor observed. Performance of the nominal group (Se presence 0.57; Se use 0.86; Sp presence 0.65; Sp use 0.74) and Delphi method (Se presence 0.59; Se use 0.83; Sp presence 0.57; Sp use 0.57) was similar. Higher seniority of the participants was the main characteristic related to better performance.

Conclusions: Performance of both consensus methods was low. Because of their advantages over observation (local collective involvement and lower workload), these methods might be useful before and after a valid assessment based on observation, therefore contributing at presumably affordable cost to maintain accuracy of the list, as well as team awareness and prevention commitment.

Conclusions: Even if the observations are more burdensome to carry out, they make it possible to understand the complexity of the compromises made by operators when they face risks. In that perspective they can unearth accounts of incidents and strategies that would be otherwise difficult to verbalise through other methods. What is more, such observation methods can also help involve workers in a bottom-up approach and turn them into active stakeholders in the prevention process. It may thus be possible and relevant to develop an articulation between consensus methods and those centred on ergonomics observations.

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1. Introduction

Regulation of chemical risks and the need for health prevention have led to considerable progress in the promotion of health and prevention of safety risks in the workplace (Lotti, 1993; Makinen et al., 2002; Martel, 1997; Pickvance, 2007; Vecchio et al., 2003). However, national authorities, social partners and occupational health and safety organisations have only recently focused their attention on occupational hazards. Since 1991, in France a regulation requires all public and private organisations to assess their occupational hazards, yet many face logistical and methodological difficulties to carry out this assessment (Law n°91-1414, 1991). The method usually used is direct observation; observation of workers enables a trained occupational hygienist to obtain first-hand knowledge and information about hazards in the workplace. Observation requires formalizing the problem and data collection. It is also potentially worrying for those being observed, unless the observers have gained their trust. Data collection is time-consuming and requires skilled observers.

Interviewing can be rapidly conducted, consumes few resources other than time, and, if it is sensibly conducted, it is usually well accepted. Structured interviews used within consensus methods are therefore increasingly used to obtain shared views on specific issues at low cost. Consensus methods are most often used to make decisions, generate ideas or rank situations for which scientifically founded information is lacking or contradictory (Fink et al., 1984; Delbecq et al., 1975). Among these methods, the Delphi and nominal group techniques are reference methods (Jones and Hunter, 1995; Martino, 1993; Johnson et al., 1987). What mainly distinguishes the nominal group from the Delphi method is that the feedback in the former includes a face-to-face group meeting. In the latter, feedback is obtained only by means of questionnaires, so that no direct group interaction can influence responses of participants.

However, the information gathered is only based on the perception of hazards, leading to a representation bias, whereas the observation by an external investigator allows an objective assessment of the hazards. Biases may impact the assessment of hazard's nature, their frequency of use and how they are manipulated. To our knowledge, consensus methods have never been validated for the assessment of occupational hazards. The objective of our study was to investigate whether the assessment of occupational hazards linked to the use of carcinogenic, mutagenic and reprotoxic chemicals differed when done by the nominal group method or the Delphi method in comparison to direct observation.

2. Methods

2.1. Study design

Both consensus methods and direct observation were applied in research laboratories and were performed independently. Because the coordination of both consensus methods was done by the same researcher (FB), we randomly defined the order of implementation in the laboratories. The random order of conducting the consensus methods was based on the drawing of lots in each laboratory. Direct observation consisted in an on-site visit by a single, experienced, external occupational hygienist who assessed work environment tools, equipment used and relationships between workers and job complexity. The observation was systematically conducted after the consensus methods to avoid contamination and awareness biases: during the observation, the occupational hygienist questioned when necessary the workers, therefore raising awareness and providing information on the CMR hazards present and used.

The three methods were tested in a pilot laboratory with 15 professional staff before being applied in the participating laboratories. The objective was to finalise the data collection tools and modalities of the three collection methods.

The project was approved by the French Agency for Environmental and Occupational Health Safety (ANSES).

2.2. Sample

Organisations participating in the study were public academic laboratories linked to a university and a research institution, in most cases the National Institute for Health and Medical Research (INSERM). Twenty French laboratories were contacted and 13 agreed to participate. The laboratories were identified by a letter (A to M) to guarantee data confidentiality. They were characterised according to the following: median age of participants to the consensus methods; their median seniority (defined in *three categories*: <5 years; 5–10 years; >10 years); numbers of participants in the consensus methods (defined in *two categories*: 3–4 participants; or more); size of the laboratory (defined in *three categories*: <30; 30–50; or more persons).

A list of possible participants in the consensus methods was acquired after a briefing session was organised in each laboratory. The organisation committee asked for a list of 10 volunteers with two representatives from each of six job categories (Researcher/teacher; Engineer; Technical; Administrative person; Service person; Student). To avoid bias related to preference of participants for one consensus group, five participants were randomly allocated each of the consensus methods.

We excluded laboratory directors and occupational hygiene and safety correspondents from participating in the collection of data. Occupational hygiene and safety correspondents are laboratory staff whose role is to raise awareness about hygiene and safety issues, to make sure with the laboratory director that occupational laws and regulations are correctly applied and to advise on necessary changes. The hygiene and safety correspondent was our facilitator in the laboratory: he/she helped in the practical organisation of consensus methods and, at the end of the data collection, validated the findings in case of discordance between the methods.

2.3. Assessment criteria

In France, the hygiene and safety correspondents in research laboratories have to establish and update yearly the list of chemicals used. This list was provided to us. Assessment of carcinogenic, mutagenic and reprotoxic chemicals started from this list, thereafter called the “initial list”. The carcinogenic, mutagenic and reprotoxic products studied were from categories 1, 2 and 3, as defined by the Classification of the European Union (Institut National de recherche et de sécurité, 2006). A questionnaire, similar for the three methods, included the initial list and characteristics of chemicals to be assessed (Fig. 1). The first step was to define whether the chemicals were *present* and *used* (Gautret de la Moricière, 2006; Vincent and Bonthoux, 2000). Chemicals present were products physically present in the laboratory at the time of the assessment. Products used were those used in the laboratory in the course of the year preceding the assessment, as opposed to those *stocked* for more than a year.

Consensus

The nominal group technique was applied during a meeting on site, in each laboratory. The opening explanation clarified the objective and participants' roles (to list all carcinogenic, mutagenic and reprotoxic chemicals, and to define which chemicals were used). The moderator then presented the questionnaire to the group, and directed participants to list working silently and

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