Journal of Environmental Radioactivity 133 (2014) 86–91

Contents lists available at SciVerse ScienceDirect

Journal of Environmental Radioactivity

journal homepage: www.elsevier.com/locate/jenvrad

Radiation risk perception: a discrepancy between the experts and the general population

Tanja Perko*

Belgian Nuclear Research Centre SCK CEN, Boeretang 200, B-2400 Mol, Belgium

ARTICLE INFO

Article history:
Received 23 November 2012
Received in revised form
7 April 2013
Accepted 13 April 2013
Available online 15 May 2013

Keywords:
Radiological risk perception
Nuclear waste
X-rays
Nuclear accident
Natural radiation
Media

ABSTRACT

Determining the differences in the perception of risks between experts who are regularly exposed to radiation, and lay people provides important insights into how potential hazards may be effectively communicated to the public. In the present study we examined lay people's ($N = 1020$) and experts' ($N = 332$) perception of five different radiological risks: nuclear waste, medical x-rays, natural radiation, an accident at a nuclear installation in general, and the Fukushima accident in particular. In order to link risk perception with risk communication, media reporting about radiation risks is analysed using quantitative and qualitative content analyses. The results showed that experts perceive radiological risks differently from the general public. Experts' perception of medical X-rays and natural radiation is significantly higher than in general population, while for nuclear waste and an accident at a nuclear installation, experts have lower risk perception than the general population. In-depth research is conducted for a group of workers that received an effective dose higher than 0.5 mSv in the year before the study; for this group we identify predictors of risk perception. The results clearly show that mass media don't use the same language as technical experts in addressing radiological risks. The study demonstrates that the discrepancy in risk perception and the communication gap between the experts and the general population presents a big challenge in understanding each other.

1. Introduction

Human behaviour is primarily driven by perception and not by facts (Renn, 2008). The main communication challenge is that the experts and the public frequently disagree when it comes to risk assessment. Several studies related to these differences demonstrated that experts have in general a lower perception of risks than the general public (Slovic et al., 1980; Slovic, 1996). This has been highlighted in studies related for instance to nanotechnology hazards (Savadori et al., 2004) or biotechnology (Siegrist et al., 2007). Moreover, a few existing studies from the radiological field show large differences in the perception of radiation risks by the experts and the general population. These studies examined the perception of nuclear power (Hamalainen, 1991; Sjöberg and Drottz-Sjöberg, 1991; Kanda et al., 2012), nuclear testing (Purvis-Roberts et al., 2007) or nuclear waste (Sjöberg, 2002) or nuclear waste disposal by using mental models approach (Skarlatidou et al., 2012).

Nevertheless, the expert population in these studies was identified according to rather weak methodological standards (administrative support and persons who were not highly knowledgeable about radiation risk were included in the group of experts) and rather small population samples were compared, while the differences between the groups related to perception of non-industry related radiation risks, for instance medical use of radiation or natural radiation, was not investigated. In addition, the authors didn't make an empirical link between risk perception and risk communication.

Our empirical study adds on to previous research and highlights the risk communication challenges arising from the differences in risk perception identified between the experts and the lay public.

In our study, the group of experts consists of employees of a nuclear research center; this expert population was identified according to the real radiological exposure (participation at regular radiation protection trainings, educational programs, entering in controlled areas, obligatory use of dosimeters and regular medical check-up for possible internal contaminations). Taking into account the characteristics of the employees (presented in Section 2.2), for instance 10–20 years of working experiences or high level of education, they can be recognized as topical experts in the field of

* Tel.: +32 14 33 28 51.
E-mail address: tperko@sckcen.be.
URL: http://www.sckcen.be/

0265-931X/$ – see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.jenvrad.2013.04.005

ionizing radiation. The number of respondents in the expert population is in our research much higher than in any other radiological risk perception studies, comparing experts and lay population. In addition, radiological risk perception is studied for four different contexts, instead of a single one, as it is the case for similar studies. An empirical analysis of media use of radiation units in reporting about the Fukushima accident gives additional insight into risk communication performed by the experts and transmitted by mass media to the general population.

The study is divided in two parts. In the first part of the study we investigated the perception of radiation risks among employees at a Belgian nuclear research installation ($n = 332$) who are professionally exposed, among which, there were employees that received a dose higher than 0.5 mSv (effective dose) in the year before the empirical study ($n = 49$). The results obtained for these two categories were compared with the risk perception of the general population in Belgium ($n = 1020$). We also compared the perception of the following risks: an accident in a nuclear installation (including the Fukushima accident), natural radiation, medical X-rays and nuclear waste.

In this first part of the study we tested the following hypotheses:

H1. *The general population has a significantly higher perception of all radiological risks than employees of a nuclear research center.*

H2. *Familiarity and personal experience with low radiation doses decrease the perception of a radiation risks.*

H3. *Experts and general population use different mental models (an explanation of person's thought process) for the assessment of radiological risks and develop different latent constructs (variables that are not directly observed but are rather inferred from other variables and are measured as factor models).*

H4. *Among the employees at a nuclear research centre, a lower perception of radiological risks is influenced by the following hypothetical predictors: i) higher personal experiences with ionising radiation, ii) familiarity with ionising radiation, iii) strong feeling of being protected from risk, iv) higher perceived control by authorities on the safety of nuclear installations.*

In the second part of the study we investigated how are radiation risks communicated through mass media to the general population. The importance of this study lies in that information to the general public is a key factor in the governance of ionising radiation risks. Sound communication about ionising radiation with the general public is rather complex, especially due to the low public understanding and the perception of radiological risks which differs from that of the experts. Abstract and unfeeling language, for example reporting quantitative radiation units, often offends and confuses people (Covello, 2011), therefore the use of comparisons of risks is advised in order to develop sound communication (IAEA, 2012). This was highlighted also by the 2011 accident in Japan (Ropeik, 2011; Cantone et al., 2012; Kanda et al., 2012).

In this second part of the research reported here, we studied media reporting about radiological risks during the first commemoration of the Fukushima nuclear accident - one year after the accident. This time period was selected since journalists not only represent but also interpret and construct a reality. In doing so they often make use of a collective memory, for instance the collective memory related to the nuclear accident. For this case, we investigated how often were the radiological risks presented quantitatively – by using measurement units in media articles- and how often were qualitative (descriptive) comparisons used instead. For this purpose the content of eight Belgian newspapers was analyzed for the period of first commemoration of the Fukushima accident ($n = 51$ articles). The hypotheses tested are the following:

H5. *Although experts use technical language to communicate about radiological risks , using quantitative units to present risk, mass media don't use these units in their reporting.*

H6. *Mass media present radiological risks by qualitative comparisons with familiar radiological exposures.*

In the next section we describe the methods and the data, followed by the results and discussions.

2. Method and data

Three data sets and two data collection methods were used to obtain the results of the study. The first part of the research is based on a public opinion survey conducted for the general population in Belgium and a large sample of employees in a nuclear research centre; the second part of the research is based on the media content analysis of Belgian press. We describe the three datasets used in what follows.

2.1. General population

The results for the general population presented in this paper are based on a large scale public opinion survey in the Belgian population. The data collection method employed was *"Computer Assisted Personal Interviewing"*, consisting of personal interviews of about 45 min carried out at the home of the respondents in the period between 25 of May 2011 and 24 June 2011. The field work was performed by a market research company with professional interviewers.

The survey (Turcanu et al., 2011) included, among others, questions related to risk perception and the relevance of the accident in Fukushima for Belgium. The population sample consists of 1020 respondents and is representative for the Belgian adult population (18+) with respect to sex, age, region, province, habitat and social class.

In order to measure risk perception, respondents were asked to "evaluate the risks for an ordinary citizen of Belgium" for the following radiation risks: nuclear waste, an accident at a nuclear installation, natural radiation (e.g. cosmic radiation or radon) a medical x-rays. Answering categories ranged from "very low" (1) to "very high" (5). In a later section of the survey, the respondents were asked to state their level of agreement with the following statements: "What happened in Japan (the Fukushima accident) makes me more worried about the dangers from Belgian nuclear installations", "There is sufficient control by authorities on the safety in nuclear installations in Belgium" and "I feel well protected against risks from nuclear installations". The answering categories for these items ranged from "strongly disagree" (1) to "strongly agree" (5).

2.2. Experts – employees professionally exposed to radiological risks at a nuclear research installation

The data collected for the expert population are based on an opinion survey conducted in the Belgian Nuclear Research Centre SCK•CEN. The selected respondents were all employees who enter controlled areas (research reactors, plutonium laboratory, irradiation facility …) and are registered as such for monitoring. They are all wear dose-metres, measuring possible radiation doses received, are regularly checked for possible internal contamination and have all received a special radiation-protection training. These people are all regularly professionally exposed to radiological risks. The other employees of the research center were not invited to participate in the survey.