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Evaluating the application of research-based guidance to the design of an emergency preparedness leaflet

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ABSTRACT

Guidelines for the design of emergency communications were derived from primary research and interrogation of the literature. The guidelines were used to re-design a nuclear emergency preparedness leaflet routinely distributed to households in the local area. Pre-test measures of memory for, and self-reported understanding of, nuclear safety information were collected. The findings revealed high levels of non-receipt of the leaflet, and among those who did receive it, memory for safety advice was poor. Subjective evaluations of the trial leaflet suggested that it was preferred and judged easier to understand than the original. Objective measures of memory for the two leaflets were also recorded, once after the study period, and again one week or four weeks later. Memory for the advice was better, at all time periods, when participants studied the trial leaflet. The findings showcase evaluation of emergency preparedness literature and suggest that extant research findings can be applied to the design of communications to improve memory and understandability.

Statement of relevance: Studies are described that showcase the use of research-based guidelines to design emergency communications and provide both subjective and objective data to support designing emergency communications in this way. In addition, the research evaluates the effectiveness of emergency preparedness leaflets that are routinely distributed to households. This work is of relevance to academics interested in risk communication and to practitioners involved in civil protection and emergency preparedness.

1. Introduction

The 2001 Radiation Emergency Preparedness and Public Information Regulations (REPPIR) require that UK installations which have the potential to release specified levels of radiation warn and inform the general public about health protection measures in the event of an emergency. The distribution of emergency preparedness literature is a common means of fulfilling this requirement to warn and inform the public in preparedness for nuclear and other civil emergencies. Such literature is often produced to fulfil mandatory requirements, with little known about how effective it is in terms of being understandable, informative, useful, and encouraging the desirable compliant behaviour(s). The content, design and format of such literature tends to be ad hoc, rather than being based on research evidence to guide the design and presentation of information. While there are guidelines for the design of emergency communications (e.g. REPPIR, 2001; Centres for Disease Control & Prevention, 2002; Covello, 2003; Wray et al., 2004), in the UK they tend to focus on the statutory requirements to include particular pieces of information (such as technical information), rather than being based on research evidence as to what people need to know, how it should be presented, and how best to encourage compliant behaviour(s). In the US the guidelines are based on what is considered best practice and lessons learnt from prior incidents, and what can be predicated on the basis of theories such as Mileti and Sorensen's Warning Response Model (Sorensen et al., 1987; Sorensen, 2000; Peek and Mileti, 2002) and the Protective Action Decision Model (Lindell and Perry, 1992, 2004, 2012), along with risk communication and behavioural perspectives (Wray et al., 2004). In the wake of events such as 9/11 and the anthrax attacks in 2001, there is a growing literature base from the US on the design and development of emergency communications based on case studies (e.g. Shore, 2003; Vanderford, 2003), and also on experience of hazard communication for environmental hazards such as hurricanes (e.g. Lindell and Perry, 2004; Kang et al., 2007). There is also a

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body of primary research emerging that seeks to address information needs and preferences specifically with regard to emergency communications (e.g. Henderson et al., 2004; Wray and Jupka, 2004; Becker, 2004). There still remains a need for rigorous evaluation of practice guidelines and the communications derived from them, and also to add to the research database that underpins guidelines (e.g. Rudd et al., 2003). One way of contributing to this effort is to incorporate extant research from other fields that is applicable to the design of emergency communications and can contribute to the evidence-base underpinning guidelines, from fields such as the design of warning labels, signs and leaflets, risk perception, and persuasive communications.

For example there is a great deal of research exploring the influence of design variables on the effectiveness of risk communications focused on warning labels, signs and leaflets. The contexts have varied from on-product warning labels, through workplace warning signs to longer text-based warning information such as patient information leaflets. This research has identified a range of design variables that influence the effectiveness of the communication, including information content (e.g. Wogalter et al., 1987; Mileti and Sorensen, 1990; Wogalter et al., 2002; Edworthy et al., 2004), use of colour and pictorials (e.g. Chapanis, 1994; Adams and Edworthy, 1995; Braun and Silver, 1995; Costello et al., 2002; Wogalter et al., 2002; O'Hegarty et al., 2006), and general formatting issues such as font size (e.g. Adams and Edworthy, 1995; Bernardini et al., 2001) and numerical vs. linguistic -based presentation of risk likelihood (e.g. Berry et al., 2004; Knapp et al., 2004). The way in which a warning communication is worded has also been shown to be an important determinant of outcomes such as believability, perceived hazard, trust and compliance. Important wording variables associated with these outcomes include explicitness (Laughery et al., 1991; Frantz, 1994; Taylor and Bower, 2004); framing (e.g. deTurck and Goldhaber, 1989; Levin et al., 1998; Krishnamurthy et al., 2001; Shiv et al., 2004); reading level (e.g Harrison and Bakker, 1998; Bradley et al., 1994) and the use of probabilistic or definitive statements (e.g. Heaps and Henley, 1999; Costello et al., 2002; Edworthy et al., 2004).

Other research has considered the relative merits of print, audio and audiovisual communication media for delivering risk communications (e.g. Furnham et al., 1990; Wogalter and Young, 1991; Barlow and Wogalter, 1993; Moseley et al., 2006) as well as the population's access to different media (e.g. Davie et al., 2004). Research has also consistently shown that different possible attributed sources of risk information differ in perceived characteristics such as trustworthiness, credibility, and expertise (e.g. Slovic, 1993).

Another important set of factors for consideration in the design of emergency communications are those associated with characteristics of the intended recipients. The prior understanding that recipients have of a particular risk (their mental model) as well as more general tendencies that they exhibit in terms of the way they perceive risk have been shown to be important likely determinants of subsequent behaviour (e.g. Pidgeon et al., 1992; Atman et al., 1994; Bostrom et al., 1994; MacGregor et al., 1994; Lemyre et al., 2006). In addition, individual differences such as gender and age affect how a communication is received (e.g. Davidson and Freudenburg, 1996; Bier, 2001; Grabe and Kamhawi, 2006), as does recipients' memory capacity for it (e.g. Singh et al., 1994; Morrow et al., 1999; Leahy et al., 2003; Hancock et al., 2005). Individuals' literacy levels have also been identified as a potential barrier to understanding emergency communications, with calls to match communications to the reading level of the target population (e.g. Parker and Gazmararian, 2003; Rudd et al., 2003).

It is evident then that there is well documented research evidence from a variety of other domains available to guide the design of emergency preparedness information. Here we studied the emergency preparedness literature routinely distributed by a nuclear site operator to houses within a 2 km radius of the site. The nuclear safety information leaflet (NSIL) they distributed was designed to satisfy the requirements of REPPIR which require that the public are regularly informed about possible risks associated with radiation, but does not offer guidance on how the information is best presented. The NSIL was used as a tool to test the efficacy of guidelines derived from extant research and used to design an alternative leaflet. Thus we aim to add to the evidence-base underpinning guidance for effective emergency communications, and to respond to calls for the effectiveness of such communications, and the guidelines that underpin them, to be evaluated (Bartholomew et al., 2001; Wogalter et al., 2002; Becker, 2011). In addition we were able to explore the effectiveness of leaflet distribution as a means of encouraging emergency preparedness.

Initial baseline measures were collected to record the target population's memory for, and self-reported understanding of, nuclear safety information. This understanding was based upon their general knowledge and also upon the previous NSIL distribution of 2005, and so these measures afforded an opportunity to evaluate the effectiveness of periodic distributions of emergency preparedness information to households. During the intervention phase, a trial leaflet was designed on the basis of research evidence and focus group evaluations of the original NSIL. The trial leaflet that was developed incorporated much of what would be predicted, on the basis of research evidence, to be best practice in the design of emergency communications. A field evaluation of the trial leaflet was conducted by asking respondents who had received both the trial leaflet and the NSIL to compare them on subjective dimensions. Objective measures of memory for the two leaflets were also recorded. The three phases of study, the baseline measurement, the intervention, and the evaluations, are described below.

2. Baseline measurement

The site operators are required by the 2001 REPPIR to deliver nuclear safety information to all households within a 2 km radius of the site (the public information zone, PIZ) every 3 years. The purpose of these deliveries is to ensure that local residents are informed about possible risks from the site and the appropriate measures to take in the event of an incident. The aim of this phase of study was to record baseline measures of memory for the nuclear safety information and compliance with the preparedness instructions among the population who received the last leaflet delivery (July 2005) prior to our measures. In this way it was possible to evaluate the effectiveness of periodic distributions of emergency preparedness literature.

2.1. Method

2.1.1. Participants

A sample of 3886 households in the PIZ was selected. Households were selected so that higher and lower income households were equally represented. This was achieved using super output areas (SOAs). A SOA is the smallest geographical area for which UK Government Census data is available, and on the basis of census data a SOA can be defined in terms of the socioeconomic status of the households within it. There were 16 SOAs completely within the PIZ. A sample of SOAs was selected for study, three representing higher income households and three representing lower income households. The assignment of an SOA as indicating higher or lower income was determined on the basis of the 2001 Census by considering variables such as employment status, home ownership, level of unemployment, and educational qualifications. A full list of