Warning the Elderly: Understanding and Overcoming Barriers to Risk Communication

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Public risk communication messages are intended to supply laypeople with the information necessary to make informed decisions regarding hazards that pose a threat to health, safety, and/or the environment (Morgan, Fischhoff, Bostrom, & Atman, 2002). While a variety of hazards exist in the daily environment to threaten people of all ages, this document will focus specifically on the residential fire hazard posed to the elderly.

To adequately prepare all members of the public for potential fire hazards and warn them to take action when facing a fire, hazard researchers and practitioners must be aware of the needs, limitations, and capabilities of diverse populations. One notable demographic trend is that the population of the world is aging at an unprecedented rate (Mirkin & Weinberger, 2000; Ross, 1995). Population estimates indicate that by 2025, more than 82 million people in the United States alone will be over the age of 65 (U.S. Census Bureau, 2001) with some of the fastest growth occurring in the population of the oldest-old, those aged 80 years or older. Because these trends observed in the United States are also being observed elsewhere in the world, the utility of investigating the risk communication needs of this increasingly large segment of the global population is clear.

Older Adults are Especially Vulnerable to Residential Fire Hazards

A simple examination of mortality and injury data from the National Center for Health Statistics (NCHS) reveals that older adult (aged 65+) are especially vulnerable to fire hazards. Based on this data, a recent report from the U.S. Fire Administration (2011)

indicates that older adults are 2.6 times more likely to die in a fire when compared to other age groups. Although older adults only represent 13% of the US population, they suffer more than 30% of fire-related deaths. As age increases, the likelihood of fire-related death also increases such that people over 84 years of age are 4.4 times as likely to die in fires. Likewise, ethnic and gender differences in fire mortality for older adults have also been observed such that older African-Americans and American Indians are at greater risk than older Caucasians. Older men are 52% more likely to become fire casualties than older women.

Paradoxically, previous research suggests that older adults are aware of the fire hazard within their homes (Mayhorn, Nichols, Rogers, & Fisk, 2004). In this focus group study, older adults reported the most frequently occurring hazard as burns due to heat (19.4%) with people spontaneously making statements such as “my toaster started a fire in the kitchen.” If people are aware of this hazard, why are the costs of vulnerability so high with figures indicating that approximately 1,100 older Americans dying annually due to residential fires?

Based on data gleaned from the National Fire Incident Reporting System (NFIRS), it is possible to begin addressing vulnerability by understanding the causes and behavioral activities of older adults prior to their deaths. For instance, deaths were often caused by smoking (25%) and exposure to open flame fires such as candles or fireplaces (19%). Fire-related injuries to older adults were frequently associated with cooking (34.8) and exposure to open flames and smoking, 15.2% and 14.3%, respectively. With regard to behavioral activities that occurred immediately prior to death, older adults were often caught sleeping (39%) or engaging in unsuccessful escape maneuvers (32.5%). These

conclusions suggest that lessons learned from the risk communication literature might be important for reducing older adult fire causalities. For older adults to die in their sleep, this suggests that alerting warning systems were not effective in notifying them of the impending hazard. Likewise, unsuccessful escape activities might indicate that older adults could benefit from training prior to exposure to a fire hazard.

Two Supplementary Types of Risk Communication: Training and Warning Systems

The provision of general hazard information and warnings are two separable types of risk communication. General hazard information is typically disseminated during non-emergency time periods by public information sources for the purpose of increasing hazard awareness and emergency preparedness. For example, the Centers for Disease Control and Prevention (CDC, 2011) and the Federal Emergency Management Agency (FEMA) publishes a variety of checklists to educate homeowners about actions they can take to mitigate fire hazards (FEMA, 2010). By contrast, alerting systems or warnings are situation-specific in the sense that they are deployed when a threat has been detected. The message content of warnings usually includes protective action recommendations to advise those at risk how to protect themselves.

A number of theoretical frameworks have been used to describe public response to risk communication messages (Lindell & Perry, 2004; Rogers, Lamson, & Rousseau, 2000; Wogalter, 2006). The Communication-Human Information Processing (C-HIP) Model proposed by Wogalter (2006) utilized elements borrowed from classic persuasion models to describe the components of the risk communication process: (1) the *source* or sender is the originator of the information, (2) the *channel* represents the medium (e.g., visual or auditory) used to deliver the message, and (3) the *receiver* is the person at risk.

Chronological age is an important receiver characteristic because perceptual, motoric, and cognitive changes that co-occur with age can influence how an individual interacts with a warning (for comprehensive reviews of cognitive and perceptual aging phenomena, see Craik & Salthouse, 2000; Park & Schwartz, 2000). Moreover, a description of age-related motoric changes can be found in Vercruyssen (1997). Thus, it is important to tailor alerting systems and warnings to the target audiences' characteristics (Wogalter & Mayhorn, 2005).

While a comprehensive review of these age-related changes is beyond the scope of this document, practitioners should be aware of the following subset. One common age-related visual change is presbyopia, which is the reduced ability to focus on objects that are a short distance away. Other visual changes that co-occur with aging include reduced visual acuity, greater sensitivity to glare, and the diminished ability to discriminate between similarly colored objects, particularly in blue/green comparisons. Similarly, presbycusia is an age-related auditory change that results in decreased sensitivity at higher auditory frequencies (6-8 kHz). Older adults may also experience difficulty processing auditory information such as speech and demonstrate a reduced ability to filter out background noise (Kline & Scialfa, 1997).

With regard to cognitive changes, selective attention is used to filter out irrelevant information thereby allowing relevant information to be processed in memory (Rogers, 2000). Older adults are particularly susceptible to attentional distraction such that they fail to inhibit irrelevant information and attend to it rather than important information such as might be contained in a warning (McDowd & Shaw, 2000). Working memory tasks require temporary storage and manipulation of information in memory (Baddeley &

Hitch, 1974). Age-related differences in working memory are well documented (Craik, 2000) and there is some evidence that working memory decrements increase with task complexity (Craik, Morris, & Gick, 1990).

Coupled with these changes, practitioners should be aware that motoric changes may prevent older adults from employing generic escape maneuvers (Vercruyssen, 1997). Older adults are also likely to possess disabilities such as visual and/or hearing impairment beyond what was previously discussed. Thus, warnings should supply age-appropriate protective actions and alerting systems should be elder-friendly. To address fire hazards and older adults, we must consider two supplemental approaches consistent with the risk communication literature: training and warning.

Provide Elder-Friendly Training

Luckily for older adults, the U.S. Fire Administration has begun to educate this growing segment of the population using the "People 50-Plus" campaign. While this is an important beginning, the needs and capabilities of older learners must be considered when developing any type of training system. One approach to developing effective elder-friendly training programs is known as the systems approach (Mayhorn, Stronge, McLaughlin, & Rogers, 2004). In the systems approach, the characteristics of the person, the environment, and the technology itself are considered through a series of sequential stages.

The initial step of *needs assessment* determines the content of training materials by exploring whether training is necessary, what goals older adults wish to accomplish, what skills need to be taught, and the characteristics of those who will benefit most from training. Task and person analyses follow needs assessment and are conducted to

determine the functional characteristics of alerting technologies and people. Specifically, a *task analysis* defines the step-by-step procedure for operating a device such as a fire alert or suppression mechanism and yields a list of requirements and abilities that are essential to effectively operate that device. Of equal importance is the *person analysis* that defines the capabilities and limitations of the target of the training, in this case the individuals who will learn to use computers.

From the results of the task and person analyses, the most appropriate *design and selection of training* options can be used to facilitate learning. Once a training program is in place, *evaluation* of that program is necessary to ensure that training is effective. To evaluate a program, measures of successful learning such as retention of information and ease of computer use should be examined. If a training program is deemed ineffective, a needs assessment should be conducted and new training techniques should be considered.

Build Age-Appropriate Alerting and Warning Systems

When developing warnings for older adults, designers should tailor the physical characteristics of warnings to compensate for age-related changes in perception. Although chronological age is associated with declines in all sensory modalities (Schneider & Pichora-Fuller, 2000), the focus of the present discussion will be on vision and audition because these channels are the most likely avenues to be used during risk communication. One common age-related visual change is presbyopia, which is the reduced ability to focus on objects that are a short distance away. Other visual changes that co-occur with aging include reduced visual acuity, greater sensitivity to glare, and the diminished ability to discriminate between similarly colored objects, particularly in blue/green comparisons. The ability of the eye to adapt to darkness is also reduced with

age which may contribute to night vision problems, which are frequently experienced by older adults (Jackson, Owsley, & McGwin, 1999). Thus, the graphical characteristics of message presentation can influence the likelihood that an older adult can accurately perceive hazard-related content from media such as television, internet, and print.

Similarly, presbycusia is an age-related auditory change that results in decreased sensitivity at higher auditory frequencies (6-8 kHz). As presbycusia has an additive effect on noise-induced hearing loss which typically begins around 4 kHz and spreads to other nearby frequencies, older adults may not be able to perceive auditory warning sirens if they are transmitted at a frequency above 4 kHz. Older adults may also experience difficulty processing auditory information such as speech and demonstrate a reduced ability to filter out background noise (Kline & Scialfa, 1997). Deficits in speech perception are quite small when older adults are presented with auditory stimuli in a quiet environment; however, these deficits become substantial as background noise increases (Helfer, 1992). In this fashion, the effectiveness of hazard-related messages delivered via auditory media such as radio, telephone, and face-to-face might be impaired by the perceptual limitations of older adults.

To prevent cognitive overload, age-related changes in processing speed and working memory have to be considered. Because changes in working memory are well documented with age (Craik, 2000) and there is some evidence that working memory decrements increase with task complexity (Craik, Morris, & Gick, 1990), these limitations have to be considered in the context of warnings. Fire warnings that communicate a number of sequential (step-by-step), complex safety procedures may tax an older adult's working memory and decrease his or her ability to comply during

protective action implementation. During protective action assessment, older adults may choose a less effective protective action recommendation (PAR) with fewer steps rather than a more effective PAR that requires more steps because they are aware of their memory limitations.

While decision making as a cognitive process does not appear to be compromised with increased age in community-dwelling older adults, the feasible options available to older people may be reduced such that the decision set is smaller. For instance, evacuation as a PAR potentially entails significant financial (e.g., fuel, use of automobile, etc.) and social (e.g., reliance on relatives, etc.) costs. For those older adults with disabilities, the physical barriers to PAR implementation are even more compounded such that preferred protective actions may be unattainable. For these reasons, fire warnings should offer a number of PAR options such that everyone can protect themselves from harm regardless of the age and ability. As Eldar (1992) suggested, designers of warnings should be cognizant of older adults' functional limitations that might reduce their ability to take protective action and offer alternative recommendations.

Future Work and Conclusions

Clearly, the task of warning the public of likely or impending fire hazards represents a significant challenge to researchers and practitioners because segments of the public can differ quite substantially. This document demonstrates that the receiver characteristics of one particular segment of the population, older adults, encompasses a number of perceptual, motoric, and cognitive processes that might seriously impact how they process the information contained in fire warnings.

If the government agencies and other organizations responsible for warning the public are to promote fire hazard awareness and PAR compliance for older adults, they must first understand the limitations and capacities of this growing segment of the population. While the purpose of this document was not to compile a comprehensive list of interventions to improve fire hazard training and warning effectiveness for older adults, it is meant to inform hazard researchers and practitioners of the special needs of older adults. All members of the public, regardless of age, should be entitled to equal protection from residential fire hazards. Unfortunately, several changes that co-occur with age might differentially place older adults at risk for injury or death. Only with an increased understanding of these receiver characteristics will efforts to promote safety for older adults succeed (Young, Laughery, Wogalter, & Lovvoll, 1999).

With regard to creating elder-friendly training systems, evidence suggests that instructional vignettes might act as surrogates for personal experience to enhance hazard education in warnings systems (Mayhorn, Nichols, Rogers, & Fisk, 2004). The development of instructional vignettes might be further informed by data describing older adults' use of strategies to avoid hazards. For instance, older adults reported use of safety devices such as gloves when using cleaners or non-skid strips to secure rugs. Thus, vignettes that specify product-specific hazards might also suggest courses of action that reduce the likelihood of home injury. Moreover, the use of peer educations might also assist in demonstrating the credibility and importance of the training program.

One approach to improving the effectiveness of warnings systems is to develop a more participatory approach to warning system design that capitalizes on older adults' hazard awareness and knowledge by making them active partners in the design process.

An added societal benefit of enlisting the participation of older adults in the development of fire warning systems can be described by the Universal Design Principle (Vanderheiden, 1997) which states that increasing the usability of a product for groups with special needs often results in a more usable product for everyone. Thus, elder friendly risk communications and hazard preparedness programs represent a significant step towards reducing fire-related risk for all segments of the population.

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