PRACTICAL REPORT

Disaster vulnerability of elderly and medically frail populations

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Abstract

Aim: To synthesize relevant literature specific to disaster vulnerability of elderly and medically frail individuals in the USA and investigate the role of the public health nurse in mitigating the problem.

Methods: Focused review of the literature, including peer-reviewed research, journal articles, news articles, education materials and reports from governmental and senior advocacy groups.

Results: Disaster vulnerability of the elderly and the medically frail is related to sociodemographic factors such as advanced age, low socioeconomic status, female gender, low education and language barriers. The presence of chronic illnesses, deficits in mobility, cognitive, and sensory capacity, reliance on others and devices, lack of social support, and previous experience with disaster also contribute to their vulnerability.

Conclusions: The elderly and the medically frail are highly vulnerable to the negative consequences of disaster. Implications for public health nursing practice before, during and after disaster, as well as nursing research, are highlighted.

Key words: disaster preparedness, elderly, medically frail, public health, disaster response

INTRODUCTION

According to the FEMA Emergency Management Institute (2014), individuals with access or functional needs during a disaster include: (a) those with disabilities (physical, sensory, behavioral, mental health, intellectual, developmental and cognitive); (b) seniors with or without disabilities; (c) those with pharmacological dependence; (d) pregnant women; and (e) individuals with limited access to transportation and financial resources to prepare for, respond to, and recover from the disaster. Elderly and medically frail individuals have access and functional problems and are thus considered vulnerable in disasters. Medically frail people include those with serious and complex medical conditions and those with physical or mental disabilities that significantly impair their ability to perform one or more activities of daily living (Clay, Goetschius, Papas, & Kendra, 2014; Heslin, Gin, Afable, Ricci, & Dobalian, 2013; Jhung et al., 2007). Elderly and medically frail individuals are considered the most vulnerable in disaster situations because of their greater likelihood to suffer negative effects.

Worldwide, there is a growing frequency of extreme weather events, man-made disasters and humanitarian crises (Crook & Vu, 2011; Powell, Plouffe, & Gorr, 2009). Since 1975, the number of Americans being affected, injured and killed by disaster has steadily risen (Miller & Arquilla, 2008). More people are developing and living in coastal areas, which increases disaster risks of hurricanes, flooding and tsunamis (DeVos, 2011). From 2004 to 2014, the U.S. experienced 178 natural disasters and 32 man-made disasters (Ko, Allweiss, & Strine, 2014). Since 1995, the frequency of hurricanes on the East Coast of the USA has increased by almost 40% (Chemianck, Sandals, Brooks, & Mintzer, 2008).

Like many developed countries, the elderly population in the USA continues to grow. Care of elderly and
medically frail individuals is increasingly being provided at home (Fernandez, Byard, Lin, Benson, & Barbera, 2002). Approximately 54.5 million medically frail individuals live in the community with the assistance of home health care instead of in long-term care centers (Jan & Lurie, 2012). An estimated 47.5 million people with disabilities may not be able to take appropriate protective measures for an impending disaster (Bethel, Foreman, & Burke, 2011). There are 133 million people living with chronic illness that could be exacerbated with disaster conditions, such as temperature extremes, and lack of water, food, medications, supplemental oxygen sources, medical supplies or electricity (Bethel et al., 2011).

While disaster situations can increase cardiovascular-associated morbidity and mortality among healthy individuals (Miller & Arquilla, 2008), the effect of disasters is worse on the elderly and the medically frail. It is critical to address their needs before, during and after a disaster.

Five professional nursing associations’ (the American Nurses Association, New Jersey State Nurses Association, Association of Public Health Nurses, Visiting Nurses Associations of America and Society for the Advancement of Disaster Nursing) Internet content on disaster preparedness revealed more of a focus on the nurse’s role in disaster response and recovery, rather than preparedness. In a historical and global textbook (Keeling & Mann-Wall, 2015) about nurses and disasters, again the focus was on the role of nursing in response and relief efforts. When disaster preparedness is discussed in nursing literature, it is often mentioned that nurses should be educated about disaster response and recovery as undergrads and via continuing education (American Nurses Association, 2017; Gable, 2017; Goodwin Veenema et al., 2016; Minami, 2007; Schmidt et al., 2011). Preparing vulnerable community members as a prevention intervention is not discussed as a role of the nurse in disaster preparedness. Nurses are advised to prepare for the surge of patients that place a toll on compromised healthcare facilities in the disaster setting. Perhaps some of this surge can be avoided by adequately preparing the elderly and medically frail community members prior to the disaster.

This article should motivate nurses to prepare their vulnerable community members prior to disaster as a prevention measure. This article summarizes the current literature regarding elderly and medically frail individuals’ disaster-related vulnerabilities and the role of public health nurses in mitigating these vulnerabilities.

**METHODS**

A focused review of the literature was conducted to understand what is known about the vulnerability of the elderly and the medically frail in disasters using these databases: Elton B. Stephens Company; Cumulative Index of Nursing and Allied Health Literature; Scopus; and Medline. The key terms used in the search were: disaster planning; household emergency preparedness; emergency preparedness; preparedness; older; elderly; elders; adult; ill; frail; vulnerable; disability; disabilities; disabled; disaster kit; emergency supply kit; quantitative; and qualitative. The searches included: peer-reviewed research; journal articles; news articles; education materials; governmental reports; and reports from senior advocacy groups. Eligible materials had abstracts in the English language and were published between 2001 and 2016. Citation trails were also followed. A list of explanations of why the elderly and the medically frail are vulnerable in disaster, along with situational impediments and facilitators to household emergency preparedness, was compiled for each resource. The lists were then synthesized and summarized across all of the resources.

**RESULTS**

Higher incidence of post-disaster morbidity and mortality

Compared to the rest of the population residing in the same disaster zone, the elderly and the medically frail disproportionately experience greater morbidity and mortality during a disaster (Benson, 2007; Cherniack et al., 2008; Colten, Kates, & Laska, 2008; Doran et al., 2016; Fernandez et al., 2002; Nicogossian et al., 2012; Powell et al., 2009; Tuohy, Johnston, & Stephens, 2014; Tuohy & Stephens, 2015; Tuohy, Stephens, & Johnston, 2014). During the 1995 heat wave in Chicago, 73% of the people who died were elderly (Crook & Vu, 2011). A rapid-needs assessment conducted in Florida after the 2004 Hurricane Charley found that one-third of the households that participated in the interviews had one or more adults with a chronic health condition exacerbated by disaster conditions (Pekovic, Seff, & Rothman, 2007). During Hurricane Katrina in 2005, three-quarters of those who died in the Gulf Coast region were aged older than 60 years; 24.3% of emergency room visits in New Orleans were related to chronic conditions; and nearly 70% of all medications dispensed in one shelter were for chronic illnesses (Al-Rousan, Rubenstein, & Wallace, 2014; Bethel et al., 2011; Heslin et al., 2013).

In 2012, the East Coast suffered the catastrophic impact of Hurricane Sandy, paralyzing home-based medical care services because of transportation issues, fuel shortages and lack of electricity (Christopher &
Goldstein, 2014; Plan NYC, 2013; Trento & Allen, 2014). In New York City, thousands of elderly and medically frail residents were trapped on the upper floors of high-rise buildings for days, often without functioning plumbing (Manuel, 2013). In New Jersey, the few medical-needs shelters that were established for community members were underutilized because services were not available for several days after the storm, lack of clarity and confusion regarding eligibility for available services, and shelters being situated in inconvenient and distant locations from residents’ homes (O’Dowd, 2012; Ryan, 2012). The shelters were also challenged by lack of space and beds, unclear policies on medical waste disposal and the inability to meet diverse dietary needs of the population (Gibbs & Holloway, 2013).

Exacerbated medical conditions of the elderly and the medically frail further strain the limited resources available during a disaster (Baker & Cormier, 2013; DeSalvo et al., 2014; Fernandez et al., 2002; Ko et al., 2014; Lamb, O’Brien, & Fenza, 2008; True, Adedoyin, Shofer, Hasty, & Brice, 2013; L. Uscher-Pines, Chandra, Acosta, & Kellerman, 2012). Shelters provided services for community members, as well as individuals from institutionalized care settings. The majority of these individuals required personal attendants, prescription medication, or electricity to operate devices needed for daily activities; most of them presented without medical records or medications (Gibbs & Holloway, 2013; Jan & Lurie, 2012). Others proceeded to emergency rooms for methadone services; dialysis; oxygen tank refills; respiratory treatments; medication refills; medical supplies; and recharging batteries of medical devices (Doran et al., 2016; Gibbs & Holloway, 2013; Jan & Lurie, 2012; O’Dowd, 2012; Ryan, 2012).

Determinants of vulnerability

The focused review of the literature revealed major determinants of vulnerability of the elderly and the medically frail in disasters. Table 1 describes how each variable contributes to the vulnerability of the individual.

| Table 1 Determinants of vulnerability |
|---------------------------------------|
| Determinant                           |

| Determinant | References |
|-------------|------------|
| Advanced age: | Al-Rousan et al., 2014; Ardalan et al., 2010; Cranmer & McKay, 2011; Crook & Vu, 2011; Durant, 2011; HelpAge International, 1999, 2012; Henderson et al., 2010; Lamb et al., 2008; Mayhorn, 2005; Pekovic et al., 2007; Powell et al., 2009; Prasad, 2012; Smith & Notaro, 2009; Tuohy, Johnston, et al., 2015; Tuohy & Stephens, 2015 |
| Female gender: | Cranmer & McKay, 2011; Durant, 2011; Powell et al., 2009; Seplaki et al., 2006 |
| Low socioeconomic status: | Abramson et al., 2015a; Abramson et al., 2015b; Ardalan et al., 2010; Benson, 2007; Christensen & Castaneda, 2014; DeVos, 2011; Durant, 2011; Fernandez et al., 2002; Fonseca et al., 2009; HelpAge International, 1999; Henderson et al., 2010; Hoopes-Haplin, 2013; Jhung et al., 2007; Lamb et al., 2008; Mokdad et al., 2005; Nicogossian et al., 2012; Pekovic et al., 2007; Powell et al., 2009; Prasad, 2012; Seplaki et al., 2006; Smith & Notaro, 2009; Tuohy et al., 2015; Zakour, 2015 |
| Low education: | Durant, 2011; Seplaki et al., 2006 |

Continued on next page.
Language barriers: Individuals with language barriers experience the same lack of access to quality information resources as those with low education level. Continued:

Experience with disaster: Individuals who have survived a previous disaster with minimal negative effects may underestimate the consequences of future disasters and not take appropriate protective actions. Additionally, failure to recover from a recent disaster compounds the vulnerabilities for subsequent disasters.

2. Chronic illnesses

Chronic illnesses: Individuals with chronic illnesses are at risk due to disruptions in their routine medical care because of difficulty in accessing their care providers and healthcare facilities. Stress related to the disaster may have considerable effects on glycemic control resulting in negative health outcomes among individuals with diabetes.

3. Mobility, cognitive and sensory deficits

Mobility deficits: Mobility deficits impede an individual’s ability to quickly evacuate or take cover in sudden-onset disasters. Individuals with mobility deficits may be forced to leave behind their mobility aids (e.g. wheelchair, walker or cane) during evacuation, rendering them incapable of being self-sufficient even after a successful evacuation.

Cognitive deficits: Cognitive deficits, such as memory disorders, dementia, delayed reaction times and psychological distress, were cited as predictors of disaster vulnerability.

Sensory deficits: Sensory deficits hinder one’s ability to see, hear, taste or smell, which can impair an individual’s ability to see warning signs, hear emergency instructions and alerts, and navigate in unfamiliar environments. Individuals with sensory impairments are also more likely to eat contaminated or spoiled food during the disaster.

4. Dependence on others or devices

Reliance refers to the need for assistance with activities of daily living (e.g. bathing, dressing, grooming, using the toilet); meals or medical care; electricity for medical devices, supplemental oxygen or refrigeration for medications (e.g. insulin). Individuals who rely on others or devices are at risk due to disruptions in their routine care because of difficulty in accessing their home care and social services providers and disruptions to their basic utility services.
Continued.

5. Lack of social support

Lack of social support: Elderly and medically frail individuals with adequate social support receive assistance from family, friends and the community to obtain disaster information, evacuate, find shelter and food, access health care and rebuild after disaster situations. House-bound and socially isolated individuals are less likely to receive disaster information or ask for assistance, which can render them invisible to responders.

6. Environmental conditions

High-risk geographical location: Disaster vulnerability is increased among those living in high-risk geographical areas that are isolated, urban and flood-prone. Climate change has resulted in more frequent and intense hurricanes, while at the same time, structures are constructed closer to the shoreline, leaving people more vulnerable to the effects of natural disasters. Some high-risk areas have poorly developed physical infrastructure, a high concentration of poverty and limited social services and resources.

Shelter conditions: Shelters may lack ramps, railings, health services, medications, medical equipment, accessible toilets, adequate lighting, decent beds and appropriate food. Shelters may be excessively noisy and create separation of the individual from family support. Individuals may choose to stay home instead of endure the shelter conditions.

Condition of home: Older people tend to live in older homes of low structural quality because they lack means to make storm-resilient improvements.

Sociodemographic determinants of disaster vulnerability include: advanced age; gender; low socioeconomic status; low education; language barriers; and previous experience with disasters. Physical determinants of disaster vulnerability include: presence of chronic illnesses; and mobility, cognitive and sensory deficits. Reliance on others or devices, lack of social support and environmental conditions (i.e., residing in high-risk geographical locations, shelter conditions and home conditions) also contribute to their vulnerability.

Household emergency preparedness impediments

The foundational assumptions of household emergency preparedness based on the literature emphasize the role of community members to have knowledge about how to prepare for disasters, take responsibility for their household emergency preparedness and not expect federal assistance for at least 3 days post-disaster. The literature indicated that public health and emergency management professionals expect community members to prepare adequately for disaster in order to mitigate their vulnerabilities. Individuals or households are prepared for a disaster if they have thought about and planned for the types of disasters for which they are at most risk, developed a family communication and evacuation plan in the event of a disaster and assembled a complete disaster supply kit (Federal Emergency Management Agency, 2014).

A disaster supply kit is comprised of a battery-powered weather radio, flashlight and extra batteries, first aid kit, whistle, dust mask, plastic sheeting, duct tape, personal sanitation items, wrench, pliers, manual can opener and local maps. The supply kit is designed to sustain each member of the household with food, water and medications for up to 3 days without any outside assistance (Federal Emergency Management Agency, 2014).

Another assumption found in the literature is that adequate household emergency preparedness prevents the need for rescue, exacerbation of chronic conditions and loss of life. However, these expectations may not be fair or realistic for elderly and medically frail individuals given their physical and social vulnerabilities.
There are several barriers to disaster preparedness and the assembling of a disaster supply kit. Impediments include: the lack of knowledge on how to best prepare; the inconvenience of maintaining supplies and lack of space to store supplies; lack of consensus in household emergency preparedness information; and individual beliefs (Heagele, 2016). Individuals who are already struggling to survive may not take the extra burden of preparing for an event that may never happen (Lindell & Perry, 2012; Thompson et al., 2014). Loss of personal valuables from a previous disaster may reduce motivation to prepare for future disasters because cherished items have already been lost (Tuohy, Johnston, & Stephens, 2015). Older adults may feel that their lives are drawing to an end and accept death as a result from the disaster (Tuohy & Stephens, 2015).

Evacuation impediments

The literature also revealed impediments to evacuation of the elderly and the medically frail. Some of them may not have accessible transportation or the financial resources to evacuate (Tuohy & Stephens, 2015). Most people do not want to leave their pets or service animals behind (Benson, 2007; Thompson et al., 2014). Resistance to evacuation may be due to lack of trust or confidence in scientific or political authorities (Abramson et al., 2015b), and the ability of shelters to meet their health needs (Christopher & Goldstein, 2014). Individuals may not evacuate because they feel that asking for evacuation assistance would place responders at risk (Tuohy et al., 2015).

Responsibility for disaster preparedness

Nine articles advocated self-responsibility of individual elderly and medically frail community members for disaster preparation (Miller & Arquilla, 2008; Mokdad et al., 2005; Render-Cohen & Render-Dinerstein, 2005; Rooney & White, 2007; Tuohy, Johnston, et al., 2014; Tuohy et al., 2015; Tuohy, Stephens, et al., 2014; Uscher-Pines et al., 2012). Eleven articles advocated for family, friends, neighbors, community- and faith-based organizations and non-governmental organizations to ensure the safety of their elderly and medically frail community members before, during and after disaster (DeVos, 2011; Durant, 2011; Fernandez et al., 2002; Ko et al., 2014; Lamb et al., 2008; Mokdad et al., 2005; Rooney & White, 2007; Smith & Anderscavage, 2011; Tuohy et al., 2015; Tuohy, Stephens, et al., 2014; Uscher-Pines et al., 2012). Legislators were identified as responsible for enacting policies to protect the elderly and the medically frail during disaster (Mokdad et al., 2005).

DISCUSSION

Implications for practice

Recommended public health nursing and emergency management practices are divided into different phases of a disaster.

Predisaster interventions

Predisaster interventions include: locating vulnerable community members; assessing their resources and capabilities for household emergency preparedness; educating them about household emergency preparedness; including them in emergency planning; and assuring them that evacuation assistance, medications, health care and appropriate shelters will be accessible to them in a disaster.

Locating vulnerable community members

Locating vulnerable community members can be achieved by seeking the assistance of providers and organizations involved in the routine care of these individuals, such as dialysis centers, senior centers, home delivery of meals organizations, home healthcare programs, ambulance companies, church-based service groups, retirement community managers, insurance companies and utility companies who have lists of life support equipment customers (Cherniack et al., 2008; Christopher & Goldstein, 2014; Clay et al., 2014; DeSalvo et al., 2014; Fernandez et al., 2002; Henderson, Roberto, & Kamo, 2010; True et al., 2013). If sharing client information is against policy, public health nurses can emphasize the responsibility of social service agencies to prepare their clients before disaster and continue their services immediately after the disaster (Colten et al., 2008; Lamb et al., 2008). Population surveys conducted with Geographical Information Systems can map the locations of the elderly and the medically frail in the community (Benson, 2007; Fernandez et al., 2002; Lamb et al., 2008), as well as optimal shelters locations.

Selecting shelter sites

Appropriate selection of shelter sites is important, as individuals may be housed longer than a few days. It is particularly important that special needs of the elderly and the medically frail are considered. Buildings should be clutter free, equipped with ramps, adequate lighting, grab bars, handrails and be handicapped accessible (HelpAge International, 2012; Jones, 2010; Lamb et al., 2008). Currently, many shelters are not pet friendly. People may risk their lives and refuse evacuation in order to be with their service animals and pets. Public health
and emergency management professionals should consider designating pet friendly shelters (Jones, 2010).

Medical-needs shelters should be made mandatory and opened as soon as disasters are predicted. The scope of care in a medical-needs shelter will likely be very limited and sub-acute in nature, including urinary catheter maintenance, medication management, blood pressure monitoring, ostomy care, oxygen, nebulizer treatments, provision of medical supplies, minor wound care, glucose monitoring, obtaining orders for prescription refills and assistance with activities of daily living (Medical Reserve Corps, 2014; New Jersey Department of Health, 2013).

People eligible to have access to medical-needs shelters include: (a) people in hospice and home health; (b) people with draining wounds, tracheostomies, feeding tubes or intravenous catheters; (c) people who need oxygen and electrical medical devices; (d) people with diabetes; (e) frail and elderly people; (f) people who require assistance with activities of daily living; (g) people who have undergone recent major surgery; and; (h) those whose mental status requires continuous monitoring or a secure environment (New Jersey Department of Health, 2013). Medications used to treat chronic illnesses must be stocked, as most medication needs post-disaster are for chronic conditions (HelpAge International, 1999, 2012; Mokdad et al., 2005; Seplaki, Goldman, Weinstein, & Lin, 2006). Before a disaster occurs, public health professionals should form partnerships with medication manufacturers, distributors and retail pharmacies to ensure the supply of needed medications during a disaster (Ko et al., 2014).

Household emergency preparedness education
Disaster preparedness should be integrated in school so that children can educate their families (Clay et al., 2014). Thompson et al. (2014) suggested using animal networks, like service pet associations, veterinarian offices or rabies clinics to distribute disaster preparedness information for both the pet and the family. Healthcare providers are trusted messengers who can routinely speak to medically frail patients and mentally ill patients about disaster preparedness (Al-Rousan et al., 2014; Ardalan et al., 2010; Bethel et al., 2011; Clay et al., 2014; Colten et al., 2008; Eisenman et al., 2014; Fernandez et al., 2002; Ko et al., 2014; Tuohy, Johnston, et al., 2014). Patients dependent on electronic medical devices or peritoneal dialysis should be advised to register with the water and power companies for priority service (Miller & Arquilla, 2008; Trento & Allen, 2014). Patients living with end-stage renal disease should be advised to arrange for their dialysis treatments before predicted disasters (Render-Cohen & Render-Dinerstein, 2005). Elderly and medically frail patients should keep their medical history and medication list on their person at all times (Lamb et al., 2008; Miller & Arquilla, 2008; Trento & Allen, 2014). Reminders to check on elderly neighbors should be included in all public service announcements concerning disaster (Colten et al., 2008).

Interdisciplinary collaboration
Protection of the elderly and the medically frail is an interdisciplinary responsibility, with collaboration needed among public health, emergency management, healthcare and community- and faith-based organizations (Benson, 2007; Christopher & Goldstein, 2014; DeVos, 2011; Smith & Anderscavage, 2011; Trento & Allen, 2014; Tuohy, Stephens, et al., 2014). Elderly and medically frail individuals also need to be on the team because they will contribute valuable information about meeting their needs for emergency planning and response decisions (Benson, 2007; DeSalvo et al., 2014; HelpAge International, 1999, 2012; Henderson et al., 2010; Jones, 2010; Powell et al., 2009; Rooney & White, 2007; Tuohy, Stephens, et al., 2014). Public health nurses can also lobby policymakers to establish emergency evacuation building standards for people with mobility deficits and support efforts to develop affordable alternative energy sources to be used in power outages (Rooney & White, 2007).

Disaster interventions

Evacuation
Elderly and medically frail individuals in danger zones should be evacuated in advance of disasters with their necessary assistive devices (Benson, 2007; Cranmer & McKay, 2011; HelpAge International, 2012; Lamb et al., 2008; Miller & Arquilla, 2008). Evacuation assistance is best accomplished by providing elderly and medically frail individuals with transportation and a host site (HelpAge International, 2012; Jones, 2010; Tuohy & Stephens, 2015). Thompson et al. (2014) caution public health and emergency management professionals that separating an owner from his or her pet can produce the same grief reaction as the death of a family member. If pets are not evacuated, owners may risk their lives by refusing evacuation or returning too soon after the disaster to find their pets.

Post-disaster interventions
Post-disaster interventions include ensuring equitable distribution of supplies, providing psychological care
and assisting individuals in obtaining governmental assistance. Central to both pre- and post-disaster periods is the need to maintain effective communication with community members and other agencies.

**Food and nutrition**

Meals distributed particularly to elderly, frail and chronically ill individuals should be heart-healthy and low in sodium (Miller & Arquilla, 2008). Meals that are in ready-to-eat packages offered in disaster situations are too high in glucose and sodium for people with chronic diseases (Benson, 2007). During distribution of meals, or any disaster relief supplies, the elderly and the medically frail need to be in a fast-track queue, as they are unable to tolerate standing in long lines (DeSalvo et al., 2014).

**Psychological interventions**

The stress associated with the disaster can exacerbate chronic illnesses by causing confusion, elevating blood pressure and altering blood glucose control. Psychosocial interventions, such as grief counseling, should be provided (HelpAge International, 1999; Lamb et al., 2008). Assistance with filling out forms to obtain governmental assistance should be provided to the elderly and the medically frail, especially if they are online documents.

**Risk communication**

One of the core competencies for public health and emergency management professionals is the ability to apply principles of crisis and risk communication. Public health nurses must take into account potential visual, auditory and cognitive impairments, and offer unambiguous, concise and redundant messages via print, television, radio, the Internet and social and religious networks (Bea, 2007; Colten et al., 2008; Crook & Vu, 2011; Fernandez et al., 2002; HelpAge International, 2012; Mayhorn, 2005). Age and disability-appropriate messages should be printed in large font on non-glare paper (Jan & Lurie, 2012; Lamb et al., 2008; Tuohy, Stephens, et al., 2014). Auditory alert sounds should be broadcasted at frequencies that older adults with hearing loss can perceive (Mayhorn, 2005).

**Implications**

Disaster preparedness is based on a comprehensive knowledge of populations, the geographic location where elderly and medically frail community members live, and their strengths and vulnerabilities. Population and geographic characteristics are the basis for anticipating potential disaster risks and response capacity to these risks. Public health nurses should identify disaster risks in health assessments of individuals, families and communities. Assessments should include the vulnerability associated with the natural and built environment, along with social determinants that affect elderly and medically frail community members’ capacity to prevent and respond to disasters. Determination of the level of resources to match the extent of needs during disasters must be conducted in collaboration with experts, as solutions are more likely to require changes in social policies and public investment in infrastructure and services. Public health nurses play a key role in building assessment data at the microsystem level, which can form the basis for macrosocial changes. Thus, nurses working in community and public health must be cognizant of the connections between individual/family level factors and macrosocial and environmental influences on health and disaster vulnerability.

Currently, disaster response is largely based on anecdotal evidence. Public health professionals should actively participate in research on the effectiveness of disaster interventions (Bethel et al., 2011; Cherniack et al., 2008; Clay et al., 2014; Eisenman et al., 2014; Prasad, 2012; Thompson et al., 2014; Tuohy et al., 2015). Evidence is needed to convince stakeholders to improve policies and allocate funds for disaster prevention and response. For example, a cost-benefit analysis of adequately staffed medical-needs shelters could instruct decisions regarding funding and construction of these shelters. Public health nurses and emergency management professionals need evidence to inform household emergency preparedness recommendations to effectively mitigate the impact of a disaster (Al-Rousan et al., 2014; Clay et al., 2014; Uscher-Pines et al., 2012).

Evidence from mixed-methods research can foster greater understanding of disasters. Qualitative research can generate knowledge of factors influencing how individuals prepare for a disaster (Rooney & White, 2007; Tuohy, Johnston, et al., 2014; Tuohy, Stephens, et al., 2014) and the reasons why they do or do not prepare for disasters (Henderson et al., 2010; Tuohy, Stephens, et al., 2014). In particular, more studies are needed to determine the effect of household emergency preparedness on elderly and medically frail individuals living in the community (Baker & Cormier, 2013; Bethel et al., 2011; Fernandez et al., 2002; Ko et al., 2014; Thompson et al., 2014; Tuohy, Johnston, et al., 2014; Tuohy et al., 2015; Tuohy & Stephens, 2015; Uscher-Pines et al., 2012). Research can further elucidate how morbidity and mortality rates from chronic illnesses are exacerbated by disaster conditions (Mokdad et al., 2005;
Powell et al., 2009). Research can identify social and cultural influences on behaviors during disasters.

SUMMARY
This article has synthesized the current literature specific to elderly and medically frail individuals’ vulnerabilities to disaster and the role of the public health nurse in mitigating these vulnerabilities. However, the elderly and the medically frail can also be assets in disaster and should not be viewed as helpless and vulnerable. Emergency managers should consult them when developing emergency plans (FEMA Emergency Management Institute, 2014; Jones, 2010). They can be trusted messengers for risk communication to their families and communities (HelpAge International, 1999; Powell et al., 2009) by sharing their advice and experience from past disasters and instilling hope for the future (Ardalan et al., 2010; Benson, 2007; HelpAge International, 1999; Henderson et al., 2010; Tuohy et al., 2015; Tuohy, Stephens, et al., 2014). These individuals have also been known to look after supplies, the sick and injured, orphans, children and other dependents while able-bodied community members were engaged in recovery activities (Ardalan et al., 2010; HelpAge International, 1999; Mayhorn, 2005; Powell et al., 2009; Roberto, Henderson, Kano, & McCann, 2010; Tuohy et al., 2015). They can teach younger generations about traditional survival skills, alternative medicines and provide local environmental knowledge that can guide resource distribution (Ardalan et al., 2010; HelpAge International, 1999; Roberto et al., 2010). Utilizing and protecting the elderly and the medically frail, as well as engaging them in disaster preparation, management and post-disaster recovery, will enhance community resilience overall.

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AUTHORS’ CONTRIBUTIONS
Both authors made substantial contributions to the conception and design of the manuscript. TH researched, interpreted and wrote the initial manuscript. DP supervised the study process and critically reviewed and revised the manuscript.

DISCLOSURE
The authors also have no financial or personal relationships with other people or organizations that could inappropriately influence or bias the work. The authors have no commercial associations that could pose a conflict of interest or financial bias.

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