

ORIGINAL RESEARCH

Vulnerability of Urban Homebound Older Adults in Disasters: A Survey of Evacuation Preparedness

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ABSTRACT

Objective: Recent disasters within the United States, such as Hurricanes Katrina and Sandy, have highlighted the vulnerability of older adults, and recent litigation has upheld the responsibility of government in assisting the public during mandatory evacuations. Older adults designated as homebound due to their disabilities are at greatest risk of poor outcomes in disasters. This study aimed at assessing the willingness and ability of homebound older adults to evacuate, as well as categorizing their medical needs in the event they are relocated to an emergency shelter.

Methods: Fifty-six homebound older adults and medical decision surrogates from 1 homebound primary care practice in Philadelphia were assessed with a novel structured interview.

Results: Respondents reported limitations in both their ability and their willingness to evacuate their neighborhoods. Medical needs of homebound older adults were on par with those of nursing home residents.

Conclusions: Many homebound older adults are unable or unwilling to evacuate in a mandatory evacuation situation, highlighting a need for public assistance. Their complex medical needs will require significant preparation by special needs shelters. (*Disaster Med Public Health Preparedness*. 2015;9:301-306)

Key Words: disaster planning, emergency preparedness, vulnerable populations

The population of homebound adults is a rapidly growing segment in the United States and presents new and difficult public health challenges. Since 2010, the baby boomer generation has been entering the 65-and-over age bracket and, in 2030, many will enter the “older old” category of 85 and over. According to US Census projections, the population of those older than 85 years old will increase from 5.7 million in 2010 to 19.0 million in 2050.¹ Additionally, it is increasingly common for the elderly to live with multiple chronic diseases and increasing levels of physical and cognitive disability.² Considering the rising number of older adults with disabilities, evidence points to a need for improved capacity in delivering supportive services to enable seniors to age in their own homes, preventing unnecessary and expensive stays in nursing homes and hospitals.³⁻⁵

Although many current efforts have focused on ensuring comprehensive yet efficient medical care and support systems for homebound adults, assisting adults with disabilities to stay in their own homes is facilitating another public health problem since adults with disabilities may not be able to evacuate their homes in case of emergency.⁶ Our disaster preparedness systems have already proven to be unprepared in

servicing frail older adults, especially regarding mandatory evacuations in response to large-scale disasters. However, according to the Disaster Relief Act Amendments of 1974, government has the legal duty to assist the public in mandatory evacuations and must provide assistance across all levels of disability, as per the Americans with Disabilities Act (ADA).^{7,8} New York City was recently sued for its lack of disaster preparation regarding Hurricanes Sandy and Irene and has responded by coordinating a citywide registry of homebound and vulnerable individuals, coupled with an outreach and recovery plan for those individuals.

The vulnerability of older adults to disasters has been shown to be due to increased physical and mental disabilities via a variety of mechanisms, including increased difficulty in physically evacuating their homes, increased susceptibility to stress whether at home or in a forced evacuation, loss of access to necessary medical prescriptions and treatments, and loss of access to supportive individuals and services.^{9,10} As disabled adults are more dependent on a network of care, the sudden disruption of this network due to a disaster can be catastrophic.

The fallout from recent disasters within the United States highlighted the vulnerability of older adults

in disasters. For example, in weather-related disasters in the United States, 50% of deaths caused by Hurricane Sandy were among those 65 years or older, and 49% of deaths caused by Hurricane Katrina were among those 75 years or older.¹¹ Man-made disasters within the United States—such as 9/11 and the Northeastern Blackout of 2003—revealed the significant lack of resources in meeting the needs of older adults after a sudden catastrophe. Many lacked the ability or support necessary to leave their homes or were unable to receive the services on which they depended.^{12,13} Internationally, similar patterns of vulnerability have been found.¹⁴⁻¹⁷

More recent evidence has examined the difficult problem of nursing homes during disasters, since sheltering-in-place proved to be a fatal decision in Hurricanes Katrina and Sandy, yet evacuating residents also has significant mortality costs.¹⁸⁻²⁴ Less well understood is the problem of homebound older adults living in the community during disasters, partly due to the lack of any formal database of such individuals. Importantly, it has been shown that the homebound population is generally poorly prepared for disasters as well as their supportive home health and personal care agencies.²⁵⁻²⁹ Although increasing levels of frailty may necessitate increasing levels of preparedness, evidence supports that increasing levels of disability are associated with being less prepared for disaster as well as choosing to shelter in place despite orders to evacuate.^{30,31} Furthermore, assuming individuals are able to evacuate to a shelter, disaster shelters have been quite unprepared for the level of care such individuals require.³²⁻³⁵

This study attempts to fill gaps in the current research by assessing the willingness and ability of homebound older adults to comply with a mandatory evacuation order as well as categorizing their medical needs in the event that they are to be cared for in an emergency shelter. This is the first research attempt to specifically examine the homebound older adult population in evacuation planning. As previous research has suggested that trust in government and pets at home affect decisions to evacuate in other populations, these topics were incorporated into the interview.^{36,37}

METHODS

Two structured interviews were designed to assess the willingness and ability of homebound older adults to comply with a theoretical mandatory evacuation order. Considering the high prevalence of cognitive impairment among homebound older adults, it is important to interview both homebound older adults directly as well as their surrogate decision-makers. These interviews utilized previous research and then underwent a multiple revision process with the help of public health and geriatric health practitioners followed by field-testing. The study was approved by the University of Pennsylvania's institutional review board and found to be in compliance with regulations for the protection of human subjects.

Each structured interview began with a brief definition of *mandatory evacuation* followed by the open-ended question, "What words come to mind when you think of a mandatory evacuation?" This question was posited to elicit unbiased salient concepts and concerns from the interviewees. A demographics and health status section then asked questions regarding ethnicity, ZIP code, age, sex, insurance, cognitive status, functional status, medical therapies, living arrangement, sleeping arrangement, and mobility. A series of close-ended and short-answer questions then followed to examine willingness and ability to comply with a mandatory evacuation order. These questions included topics of pet ownership, history of evacuation, and trust in government since these characteristics have been found to affect willingness in previous research. The interview designed for surrogate decision-makers also included questions regarding their relationship to the homebound older adult. Both interviews concluded with the open-ended question, "What concerns do you have if there were a mandatory evacuation?" to elicit the most significant concerns after being exposed to issues of evacuation during the interview.

All interviews were conducted by healthcare practitioners from the Ralston Homecare Practice of the University of Pennsylvania, including 4 geriatricians and 2 nurse practitioners. All healthcare practitioners were trained in the use of the structured interview prior to starting the study. All interviews conducted with homebound older adults were completed in the home after usual patient care, whereas all interviews conducted with surrogate decision-makers were completed over the phone because many surrogates are not present during primary care home visits. Responses to open-ended questions were coded into categories by 2 independent coders. Data from homebound older adults and surrogates were combined and analyzed together, as the decision to leave the home is usually, by necessity, a joint decision between those homebound and their surrogates with varying agency in each relationship.

RESULTS

A total of 56 interviews were completed from February through April 2014, including 36 interviews of homebound older adults and 20 interviews of surrogate decision-makers representing 25% of the practice's total census of 228 patients. All interview data pertain to homebound older adults in Philadelphia, the majority of whom (82%) live in West Philadelphia. Demographics of homebound older adults are presented in Table 1. Responses to the opening question ("What words come to mind when you think of mandatory evacuation?") as well as the concluding question ("What concerns do you have if there were a mandatory evacuation?") were coded into themes and are presented in Table 2. Answers to questions pertaining to willingness to comply with a mandatory evacuation order as well as associated issues (such as pet ownership, trust in government, and

TABLE 1

Demographics		
	Average	(Range)
Age	85	(64-105)
Sex	%	(n)
Female	74%	(42)
Male	26%	(15)
Insurance	%	(n)
Medicare	64%	(37)
Medicare Advantage	35%	(20)
Ethnicity	%	(n)
African American	81%	(46)
Caucasian	18%	(10)
Asian	2%	(1)
Other	0%	(0)
Cognition	%	(n)
Intact	46%	(26)
Mild cognitive impairment	11%	(6)
Dementia	44%	(25)

TABLE 2

Opening & Concluding Questions		
What words come to mind when you think of a mandatory evacuation?^a	%	(n)
Leave	44%	(25)
Urgency	23%	(13)
Fear/chaos	16%	(9)
Assistance needed	12%	(7)
Concern for living situation	11%	(6)
Nothing	9%	(5)
Safety	9%	(5)
Disaster types	7%	(4)
Don't understand	4%	(2)
Necessary	4%	(2)
What concerns do you have if there were a mandatory evacuation?^a	%	(n)
How to physically exit the home	32%	(18)
None	18%	(10)
Where to go	12%	(7)
Concern for supplies	9%	(5)
Have to leave	5%	(3)
Concern for families and friends	5%	(3)
Concern for being alone	5%	(3)
Concern for health	5%	(3)
Concern for ability to return home	5%	(3)
Concern for assistance	5%	(3)
Question evacuation order	4%	(2)
Fear of shelter	4%	(2)
Concern for availability of care	4%	(2)

^aListed if reported by ≥ 2 respondents.

history of evacuation) are presented in Table 3. Answers to questions regarding the ability to physically leave the neighborhood, as well as the medical and functional assistance needs of participants, are presented in Table 4.

TABLE 3

Willingness		
If there were a mandatory evacuation, would you be willing to evacuate?	%	(n)
Definitely/probably	91%	(51)
Maybe/not at all	9%	(5)
If you were told to evacuate to an emergency shelter, would you be willing to go there?	%	(n)
Yes	81%	(46)
No	19%	(11)
Are there pets in the home?	%	(n)
Yes	32%	(18)
No	68%	(39)
If you couldn't take your pets with you, would you be willing to evacuate? (of those with pets)	%	(n)
Yes	78%	(14)
No	22%	(4)
Have you ever evacuated your home in an emergency?	%	(n)
Yes	7%	(4)
No	93%	(53)
How much of the time do you think you can trust Philadelphia government to do what is right?	%	(n)
Always	14%	(8)
Most of the time	37%	(21)
Some of the time	40%	(23)
Never	5%	(3)

DISCUSSION

The opening question of the interview—"What words come to mind when you think of mandatory evacuation?"—revealed that the concept of mandatory evacuation was not a salient topic for most respondents. Only 12% of participants had more than two responses to the question; the two most common responses, coded as *urgency* and *leave*, were simply redefinitions of the given terms *mandatory* and *evacuation*. Such low salience suggests that participants had little considered the issue of evacuation. The third most common response was the concept of fear and chaos, suggesting that respondents feel that they and their emergency response systems are ill prepared for such situations.

Many participants outside of the structured interview noted that they previously had simply not thought about the possible difficulties of evacuation and thanked interviewers for bringing this issue to their attention, considering how difficult evacuation would be to accomplish. Few respondents reported any personal history of evacuation, which is likely due to the fact that Philadelphia has not had any mandatory evacuations in recent memory. Despite recent nearby disasters such as Hurricane Sandy, this lack of personal history likely greatly contributed to the general lack of salience of evacuation planning among respondents.

Willingness

Although the majority of respondents reported probable or definite willingness to participate in a mandatory evacuation,

TABLE 4

Mobility, Medical, and Functional Needs		
Are you able to leave your neighborhood using your personal support network? (without using public assistance)	%	(n)
Yes	60%	(34)
No	40%	(23)
Do you have somewhere to stay outside of your neighborhood if you decided to evacuate? (assuming transportation is not an issue)	%	(n)
Yes	75%	(43)
No	25%	(14)
Senior sleeps on:	%	(n)
Ground floor	37%	(21)
Upper floor	63%	(36)
Access to: (for those on upper floor)	%	(n)
Stairlift	16%	(6)
Elevator	24%	(9)
What equipment does the patient need to physically exit the home to the street curb?	%	(n)
None	11%	(6)
Cane	7%	(4)
Walker	28%	(16)
Wheelchair or scooter	33%	(19)
Stretcher	21%	(12)
Other	5%	(3)
Living arrangement	%	(n)
Lives alone	21%	(12)
Lives with family	70%	(40)
Lives with other	9%	(5)
ADL assistance needed	%	(n)
Bathing	88%	(50)
Dressing	68%	(39)
Toileting	60%	(34)
Transferring	63%	(36)
Continence	46%	(26)
Feeding	33%	(19)
Medical therapies used	%	(n)
Oxygen	11%	(6)
Nebulizer	11%	(6)
BiPAP/CPAP	5%	(3)
Ventilator	2%	(1)
Suctioning	2%	(1)
Insulin	9%	(5)
Warfarin	16%	(9)
Foley catheter	4%	(2)
Wound dressings	11%	(6)
Electric bed or mattress	28%	(16)
Feeding tube/pump	2%	(1)
Number of daily medicines	Mean (Range)	
	7.8	(0-24)

9% of respondents reported they would be unlikely to be willing to evacuate, putting them at high risk of death in such a scenario. Furthermore, 19% of respondents would not be willing to evacuate to an emergency shelter (if that were the instruction), placing more lives at risk. Nonadherence to mandatory evacuation orders contributed to the many drowning deaths in Hurricanes Katrina and Sandy. Regarding the effect of pets on evacuation, most respondents did not

report having pets in the home, and those with pets reported that they would evacuate without their pets if necessary. However, 7% of the total population interviewed were those with pets who would not leave without them. If these individuals disregarded a mandatory evacuation order due to their pets, they would also be at high risk of death, highlighting the importance of availability and public knowledge of pet-ready shelters in evacuations.

Mobility

Although a lack of willingness may contribute significantly to mortality during evacuations, the simple lack of ability of older homebound adults to evacuate their homes is the largest obstacle to successful evacuation for this population. Forty percent of respondents reported that they could not leave their own neighborhood without public assistance, and most of these respondents reported that they simply could not evacuate their own home due to issues of physical mobility. When respondents were asked what equipment would be needed to get from inside their home to the street curb, 21% reported they would need a stretcher, and another 33% would need a wheelchair to get out of their home to the street curb.

This difficulty in leaving the home depends on the type of housing in which they live. Although chairfast individuals may be very mobile when living in housing compliant with the ADA, much of the housing stock of Philadelphia consists of row homes with all bathrooms and bedrooms on the second floor, accessible only by staircase. These houses confine many disabled residents to living upstairs without the ability to get downstairs. In our survey, 65% of homebound adults lived above ground level, but only 41% of those living upstairs had access to an elevator or stairlift. One daughter said that in case of a fire, she would roll up her bedbound mother in a rug and drag her down the steps since this would be the only way to exit quickly without outside assistance.

In addition, many homes have steps between the front door and the street curb, making it difficult for those using wheelchairs to get to the street. One respondent explained how she would help her chairfast mother exit the home by first helping her mother transfer from the bed to a wheelchair in her upstairs bedroom so she could wheel her to the stairlift. She would help her mother transfer to the stairlift chair, which would transport her downstairs, and then she would help her transfer from the stairlift chair to a wheelchair on the ground floor. She would then be able to wheel her out the front door. However, there were still three steps outside (between the front door and the street curb) which she could not navigate on her own, prompting her to ask her neighbor for assistance the last time she left the home. Just one or two steps can be an enormous barrier for someone with a disability. This has led to the concepts of barrier-free and universal design in creating spaces that are inherently accessible to all levels of disability.

Many respondents had difficulty deciding what equipment was needed to evacuate because there may be a difference between the safest method of exiting the home versus what might be possible in an emergency situation. Regardless, the inability to leave the home was a significant difficulty for many respondents and a major barrier in complying with a mandatory evacuation order. The second greatest obstacle was the lack of an appropriate alternative shelter if they were to leave their homes. Twenty-five percent of respondents did not have anywhere to stay, even if they had the means of getting there, highlighting the need for emergency shelters.

Special Needs Shelters

The medical and functional assistance needs of homebound older adults includes significant assistance in basic activities of daily living, need for durable medical equipment, and requirements in complex medication management. If homebound older adults were to evacuate to emergency shelters, this population would require care similar to that of a nursing home population. One homebound older adult even required mechanical ventilation, which most nursing homes are not prepared to manage. Although evacuees may bring their immediate personal support networks with them to the shelter, many homebound older adults and their caretakers depend on the assistance of visiting nurses, therapists, and physicians. Significant medical resources may be needed in an evacuation shelter to replace the complex networks of care previously provided in the home. If special needs shelters are unprepared to provide chronic healthcare needs, these disabled citizens will be forced to turn to the hospital networks that are likely to be strained during disaster situations.

The final question of the interview established that respondents had two major concerns after discussing evacuation issues: (1) how to physically exit the home and (2) where to go in the event of an evacuation. Although mandatory evacuation had not been a salient issue at the beginning of the interview, only 13% of respondents had no concerns at the end of the interview, indicating both that substantial assistance for homebound older adults is required to comply with a mandatory evacuation order and that this population is unlikely to make preparations in the near future.

Limitations and Next Steps

Limitations of this study include the fact that respondents may not be representative of the general urban, older, homebound population of Philadelphia as a whole. Multiple selection biases may have affected results, one being how surrogates were contacted. Because surrogates were contacted by phone, the ability and interest of surrogates in answering their phones and completing the survey may lead to a non-representative sample. Also, responses from surrogates and homebound older adults were analyzed as a combined dataset without equal representation. Furthermore, the power dynamic in the relationship between homebound older adults

and their surrogates regarding home evacuation was not explored. Respondents may also have higher levels of disability compared to the total older homebound population since all respondents were drawn from a medical practice. In addition, the West Philadelphia neighborhood is over-represented in the survey, yet evacuation ability may vary across the city depending upon the housing stock, socio-economic status, and variety of disability within the population. A more comprehensive assessment would be helpful in disaster planning for homebound adults of the City of Philadelphia to better categorize ability in home evacuation. Furthermore, as each city will vary regarding its housing stock and population of older homebound adults, each city would need to examine its own population to best match evacuation resources to its particular population and environment.

Despite these limitations, these data suggest a significant lack of ability of disabled older adults to comply with a mandatory evacuation order. Further research could help paint a more representative picture of homebound older adults in Philadelphia and yield estimates on the total number of those unlikely to be able to comply with a mandatory evacuation order. Although these data do not address any solutions to the problem, recent litigation upheld the responsibility of government to assist the disabled in mandatory evacuations. Other cities have already begun to enact policy and make preparations in accordance with the precautionary principal of public health regarding disasters. If the City of Philadelphia were to directly assist individuals with disabilities in evacuation, it could consider the creation of a centralized registry of those with disabilities, such as the one recently enacted in New York City. In addition, because lack of ADA compliant housing appears to be a significant burden for those with disabilities, policies encouraging universal design in Philadelphia housing and assistance in moving homebound adults into universal housing may relieve some of this burden. As policies are made, continued research will need to evaluate the most effective approaches.

CONCLUSIONS

This study demonstrates that many homebound older adults are unprepared to evacuate their homes and neighborhoods due to their physical disabilities and lack of resources, and they would be in mortal danger in the event of a mandatory evacuation situation. Recent disasters such as Hurricanes Katrina and Sandy demonstrated the vulnerability of older adults in disasters. Despite recent litigation in New York, which upheld the responsibility of government in assisting the disabled in mandatory evacuation situations, many cities do not have plans in place. In addition, this study highlighted the sheltering needs of homebound older adults. Chronic healthcare needs of homebound older adults were on par with those of nursing home residents, highlighting the complex resources required to sustain this study population safely in special needs shelters, as well as avoid unnecessary strain on

our hospital systems. Because the size of this population is growing across the United States, emergency preparedness systems must act quickly to address this developing public health need.

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