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DEBATE-COMMENTARY

HSR Health Services Research

Applying the age-friendly-health system 4M paradigm to reframe climate-related disaster preparedness for nursing home populations

1 | INTRODUCTION

Climate change has increased the frequency and severity of weather-related disasters such as hurricanes, exposure to heat and cold temperatures, flooding events, and wildfires. Between 1980 and 2020, the United States incurred 285 separate billion-dollar weather-related disasters.[1] In 2020, there were 22 billion-dollar events, including seven hurricanes, three tornadoes, eight severe weather events, two hail storms, a historic drought, and a wildfire.[1] Prior studies have repeatedly demonstrated that exposure to natural disasters has significant effects on the 1.4 million nursing home (NH) residents around the US.[2] Recognizing that the effects of most disasters are local but require the assistance of federal and state agencies, it is imperative that stakeholders assess for vulnerabilities and strengthen their preparedness to respond to all-hazards disasters.[2,3]

In 2017, the Institute of Healthcare Improvement (IHI) and the John A. Hartford Foundation introduced a framework for evaluating age-friendly healthcare systems based on four evidence-based core elements.[4] We believe that this 4M's paradigm (What Matters, Medication, Mentation, and Mobility) provides a foundation upon which to consider a more nuanced approach to NH disaster preparedness. Specifically, this requires the application of the 4M model to all phases of disasters (i.e., prevention, mitigation, preparedness response, and recovery). Research has found that the consistent use of evidence-based strategies and assessment approaches across care settings, as envisioned by the 4Ms framework, improves the quality of outcomes.[5] We propose that such an approach has the potential to improve disaster preparedness in NHs. This commentary describes the 4M's paradigm and how it might guide emergency planning and decision making in NHs facing complex disasters. We also propose the addition of a fifth M that is relevant to disaster planning: **Marshaling** Staff and Resources.

2 | THE INCREASING THREAT OF CLIMATE-RELATED DISASTERS FOR OLDER ADULTS

The increased frequency of cold and hot temperature extremes has served to accelerate the rate and severity of weather-related disasters.[6] The number of affected has increased five-fold in the past 50 years, well beyond the proportional rate of population growth (Figure 1).[7] NH residents represent a clustered group of individuals at the highest risk for adverse health effects following a disaster.[8] In the U.S., almost half of the adults living in NHs reside in one of the 18 hurricane-prone Atlantic and Gulf coastal states.[9] NH residents are at risk of physical and psychological harm from disasters for a variety of reasons. First, most NH residents have significant functional limitations. They require assistance with their activities of daily living (ADL), have significant vision/hearing impairments, or live with other conditions, such as Alzheimer's disease or related dementias, that may compromise their ability to respond appropriately and quickly during emergencies.[10–12] These impairments limit health reserve, potentially magnifying the impact of disasters and forced relocation.[13–15] A second major concern that increases the risk for NH residents is increased acuity. As the length of stay has decreased in acute care hospitals, NHs have increasingly become responsible for caring for medically complex post-acute patients. Finally, older adults (50%–90%) report experiencing at least one traumatic event during their lifetime.[16,17] A resident's trauma history influences both risk and resilience during disasters and it is important to note that NHs represent a clustered group of older adults.[18] These factors complicate transitions of care under optimal circumstances, let alone in the chaos and infrastructure breakdown that usually accompanies a disaster.

3 | EXISTING DISASTER FRAMEWORK

For decades the National Response Framework (NRF) has guided the response to disasters and emergencies in the U.S., operating through a system designed to coordinate the multiple entities needed to maintain critical functions. The NRF relies on each entity to develop procedures to protect those who rely on its care and services and to work in coordination with other critical organizations and service providers.[19] Gaps related to the safety of NH residents became evident during the hurricanes of 2004 and 2005, including Hurricane Katrina. In 2006 the U.S. Office of the Inspector General documented numerous cases of poor NH preparedness, even though 94% of NHs nationwide met the federal preparedness standards at the time.[20] Concerted efforts followed to include NHs as health care facilities within the National Incident Management System, as part of the NRF, and to

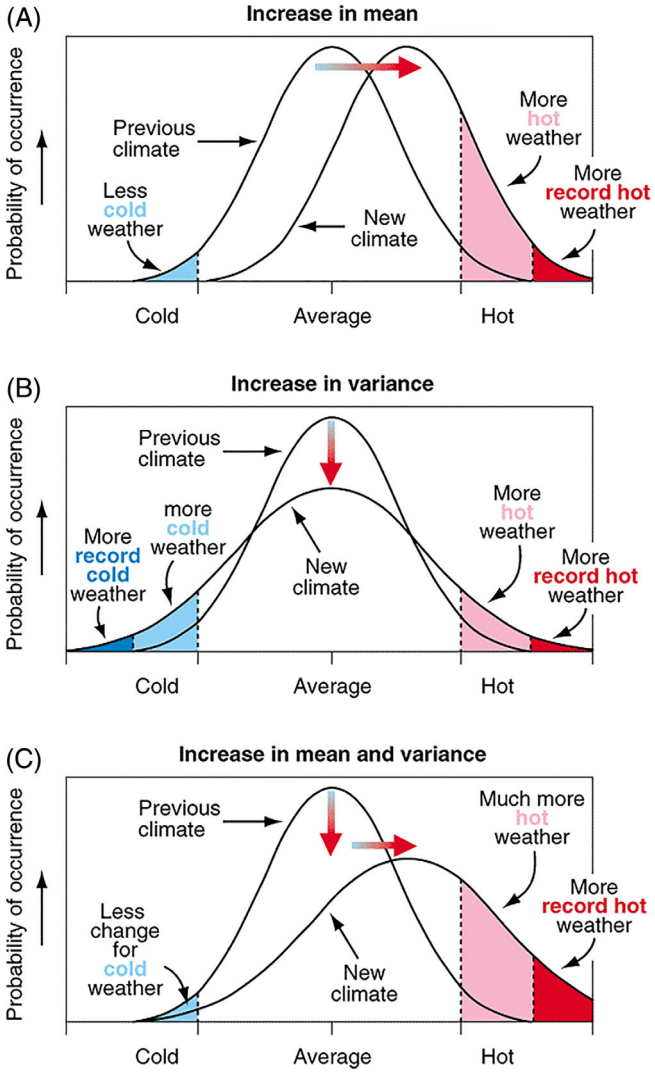

FIGURE 1 Change in temperature and variance. *Source*: Meehl, 2001 (Reference 13) [Color figure can be viewed at wileyonlinelibrary.com]

bolster regulatory requirements for NHs to develop plans to maintain residents' health and safety in a disaster.[21] In the past two decades, emergency management has become recognized as a critical element of NH operations. However, recent studies and reports continue to raise questions about NH preparedness and integration within the infrastructure envisioned by the NRF, and to suggest regulatory compliance is not enough to protect NH residents in disasters.[22–27] To improve overall NH disaster preparedness, a framework that combines key concepts of resident care and coordination with critical resources outside the NH is required.

4 | THE AGE-FRIENDLY 4M FRAMEWORK

Developed initially for acute settings, the 4M framework recognizes varied organizational capacities and more fully addresses institutional practices and processes based on six steps: (1) Understand your current state; (2) Describe care consistent with the 4Ms; (3) Design or adapt your workflow; (4) Provide care; (5) Study your performance, and (6) Improve and sustain care.[4] Figure 2 describes the 4M categories and how the six steps are intended to create an age-friendly environment that optimizes the care for those with chronic medical illness. To our knowledge, the 4M's paradigm has not been utilized in disaster preparedness. Table 1 provides a schematic of how the 4M framework might be applied to the prevention, response, and recovery stages of a disaster. Each category is addressed below:

4.1 | What matters

For What Matters, care providers need to align care with an individual's goals and preferences. From a disaster preparedness perspective, it is imperative to document each resident's care preference goals in advance. Ideally, this should occur upon admission and be updated at the quarterly resident care planning meetings with families' input.[28] In addition to having documented care preferences in the form of advance directives, resident care plans should include personalized disaster care plans that includes consideration of the resident's culture and incorporates information about what matters to the resident in the event of a disaster, with resident and family input for those residents who lack decision making capacity. NHs that strive to support their residents in the context of their own life experiences and values recognize that cultural competence is a first step toward addressing and reducing health disparities.[29] Cultural competence is a dynamic and continuous developmental process and not an end point where an NH or staff member can claim to achieves competency in another culture.[30,31]

Providing person-centered care is central to the 4M model.[28] In addition to following regulatory requirements to maintain resident health and safety in disasters, the NH should ensure residents have all possible comforts (e.g., hot food, comfortable bedding, preferred items, and activities) and minimal disruptions to their daily routines, acknowledging that some disruption may be necessary for safety. During a disaster, residents should also be afforded the support of family, friends, and preferred staff members who know what matters to them.[32] In order for the staff to identify and implement what matters to each resident, effective communication is crucial. We recommend that the residents' interests, values, and goals be digitally and physically documented in the event of an evacuation or power outage. Documentation is crucial for both quality of life and responsive medical care. From an organizational level, NHs should aggregate resident-level data in their central disaster plan and this information should be updated regularly. Such data would enable NHs to review resident needs before a disaster and organize staff to address needs in a prioritized fashion.

4.2 | Medication

Issues pertaining to medications and older adults residing in NHs are well-documented and compounded in the face of disasters. Considerations are both clinical as well as practical. For example, it is essential

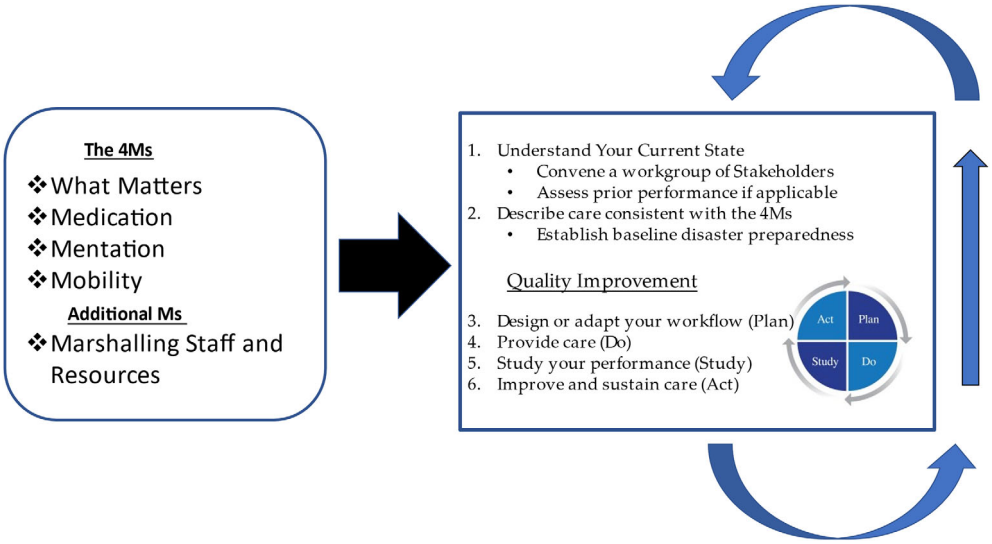

FIGURE 2 Six steps to developing an age friendly health care environment. *Source*: Modified from Institute of Healthcare Improvement [Color figure can be viewed at wileyonlinelibrary.com]

to assure the timely administration of many medications in order to maintain therapeutic dosage for a wide array of serious health conditions (e.g., congestive heart failure, diabetes, chronic obstructive pulmonary disease) in which missed or altered uptake schedules can easily disrupt bodily functioning and impact the quality of life.[33] Previous research following Hurricanes Katrina and Rita noted that one-third of all visits to emergency rooms in the days following the hurricane occurred due to chronic medical illness.[34] Among assisted living residents, there was a 12% increase in emergency room visits for individuals with congestive heart failure in the days following Hurricane Irma.[35] Many of these increased admissions are a result of inadequate access to necessary medications and therapeutics.[34]

Older adults residing in NHs consume nearly nine prescribed medications daily[36] and the prospect of access to and assurance of medication delivery is layered upon an already widespread list of medication issues including polypharmacy,[37] adverse drug reactions, and altered biochemical clearance of medications.[38] Disasters that involve heat-related exposure are particularly problematic as they cause dehydration, which will alter the pharmacokinetics of many well-tolerated medications. Beyond medications, access to time-sensitive treatments such as dialysis or wound care must also be considered. Lastly, access to as-needed medications such as antibiotics, anxiolytics, pain medications, and first aid materials needs to be considered as they might be required in the days following a disaster.

4.3 | Mentation

Mentation is focused on preventing, identifying, treating, and managing dementia, depression, and delirium across care settings. Those who provide care to NH residents acknowledge that managing these conditions is vital during normal day-to-day operations as well as during all stages of a disaster.[39] Research suggests that residents with impaired cognition, chronic and acute medical conditions, and mobility and sensory issues have higher morbidity and mortality rates because of their compromised ability when evacuating or sheltering-in-place.[40,41] Given that approximately 48% percent of NH residents are living with Alzheimer's Dementia and Related Dementias, it is important to consider residents' physical safety when developing disaster plans. Changing residents' schedules or environments can evoke agitation, anxiety, and other changes in behavioral and mood symptoms. Without adequate planning, transfer trauma from evacuation can erode cognitive and physical functioning.[4,34,35]

Beyond identifying those with dementia, determining those with preserved cognitive abilities may be particularly helpful in a disaster situation. Recognizing residents' specific abilities (rather than focusing on disability) is critical to supporting person-centered care. Some residents will be willing and able to support other residents by promoting the use of adaptive coping strategies, reducing stress, and providing emotional support when NH staff are focused on other essential preparedness activities. Viewing residents as active members of a disaster preparedness response or recovery plan rather than victims of the disaster can serve to strengthen our existing system of care and support staff during a demanding time.[42] At present, pre-disaster mental health programs that build resilience and support mentation concerns are not universally offered or financially supported. Further, mental health resilience programs are not a core component of disaster preparedness activities for the general public or NH staff and residents. Currently, crisis counseling programs are activated reactively after a catastrophic event to address adverse mental health outcomes. Appropriate planning might include opportunities to address these issues proactively to improve resilience.

4.4 | Mobility

Providing care to improve or maintain the mobility of NH residents is one of the central elements of an age-friendly NH.[28] In a disaster, knowing and meeting residents' mobility needs is of utmost concern because responding often requires residents to be physically moved.

TABLE 1 Important elements to consider at different stages of a disaster

	What matters	Medication	Mentation	Mobility	Marshaling resources
Prevention	• Conduct regular review of Advance Directives • Ensure that documentation related to a proxy or Durable Power of Attorney is up to date.	• Stock a 5 to 14-day supply of medications for all residents. • Secure expanded or extra emergency drug kits and maintain them in strategic points throughout the facility • Maintain a profile of each resident that includes the names of their medication(s), dosage, and frequency • Develop a process to collect and transport at least a three-day supply of medications in case of evacuation	• Train staff and residents in psychological first aid and behavioral interventions for people with dementia. • Identify residents who are at greater risk for adverse outcomes during a disaster. • Prepare residents and staff to ensure physical and mental safety.	• Develop plan and train/drill staff on evacuation or other resident transitions • Obtain needed equipment and means to move/evacuate equipment • Ensure transportation strategies • Assess fall risk	• Identify minimum staffing levels consistent with state and federal regulations • Determine how resident acuity and characteristics affect sufficient staff levels • Identify residents who might require additional resources to transport during a planned/unplanned evacuation • Measure the staffing response necessary to transport and care for the resident census • Name a disaster response champion who will lead the staff during an emergency • Interface with community and state emergency management groups
Response	• Identify those with most needs (e.g., oxygen, end-of life, palliative and hospice needs, dementia and their caregivers who need to be notified) to prioritize during a disaster.	• Assess extra emergency drug kits, ensuring security safeguards for kits with controlled substances.	• Support residents use of adaptive coping strategies to reduce their stress • Provide emotional care and behavioral interventions to other residents.	• Organize staff to assist residents during transition and the event • Monitor all residents to prevent falls	• Deploy staff on an hourly basis to assess for heat- or cold-related illness • Identify residents and staff who are unwell and may require immediate medical attention from the licensed staff members (e.g., DON, RN) • Document all staff-to-resident interactions in paper format • Maintain communication with emergency response personnel • Meet twice daily to determine whether an evacuation is necessary
Recovery	• Review and document any changes that occurred related to medical decision making and advance directives/advance care planning.	• Assess for disaster-related new medication and treatment needs • Ensure maintenance of residents' regular medication schedules.	• Assess for transfer and other disaster-related traumas and make necessary referrals for evaluation and treatment.	• Assess and mitigate mobility changes post-disaster • Review training/equipment needs for future disaster planning	• Conduct a review among staff to determine strengths and weaknesses during the disaster • Identify gaps in planning and response; Treat staff

TABLE 1 (Continued)

What matters	Medication	Mentation	Mobility	Marshaling resources
		• Conduct an after-disaster review to see what strategies need to be in place for future events.		and residents for stress-related illness in addition to bodily injuries caused by the disaster; • Determine whether staff and residents will require transportation to acute medical facilities; • Measure the staffing levels and reach out to contract organizations if necessary to maintain sufficient staffing levels in the facility

Previous research has revealed that even under optimal circumstances, NH residents who transition health care environments are at heightened risk of mortality and morbidity from falls. Hoffman and colleagues identified falls as the third leading cause of readmission following hospitalization among a Medicare cohort.[43] NH residents are three times more likely to fall than age-matched community-dwellers.[44]

Research specific to disasters has identified functional impairment and mobility as key factors contributing to increased morbidity and mortality following a hurricane.[41] Additional research has highlighted mobility as critical in the decision of whether to evacuate or shelter-in-place.[45–47] In qualitative research, NH administrators have discussed the extreme stress of evacuation on residents with mobility limitations, describing hours-long bus trips ending with residents being crowded into hallways or common rooms where they were left in their wheelchairs or on mats on the floor[24,48,49] Both sheltering-in-place and evacuation carry risks and mobility is especially critical in disasters requiring a rapid response (e.g., sudden flooding, earthquakes, wildfires) internally (e.g., upstairs) or externally.[46] On a systems level, disaster planning for mobility should include maintaining an adequate supply of functioning mobility aids (e.g., wheelchairs, walkers) to meet residents' needs in the NH and receiving facilities. Overall, the success of an NH disaster plan hinges on how well it assesses all residents' mobility risks and secures the spaces, supplies, equipment, and staff members necessary to provide for their safety and comfort as they are transferred.

4.5 | Proposing a 5th "M": Marshaling of Staff and Resources

While the age-friendly 4M model provides a person-centric approach to care within healthcare systems, we posit additional considerations unique to the NH setting and specifically in the area of disaster preparedness. With a greater emphasis on the organizational context of care, we propose the addition of "**M**arshalling of Staff and Resources" as an additional M to the model. Among foremost considerations is the necessity of the NHs to conduct normal operations while facing disaster-related uncertainties. For example, decisions such as whether to evacuate or shelter-in-place require NH administrators to simultaneously consider the primacy of resident safety and care as well as their own requisite staffing and resource availability. Marshaling staff and resources means having the necessary staff, equipment, and supplies available to provide undisrupted care to residents despite emergent conditions. This readiness involves developing internal plans and procedures and also collaborating with outside entities, such as local public health officials, emergency managers, and first responders who can communicate the scope of a threat to the community at large as well as help an NH meet unexpected needs amid an emergency. Research has highlighted the needs and vulnerabilities of NH and other long-term care residents in disasters.[22,50–52] After Hurricane Katrina, the John A. Hartford Foundation funded efforts to better connect NH operators, emergency managers, and other public health and safety officials.[53] However, recent work has found that gaps in communication and collaboration continue to exist among these entities,[24] all of whom have important interconnecting roles in protecting older adults in disasters. There is evidence that emergency management agencies and long-term care operators collaborated more effectively during the COVID-19 pandemic than during prior hurricane disasters.[54] However, much more work is needed to persuade and enable NHs to marshal the resources required to protect the safety and health of residents affected by disasters.

Among the core needs of an NH during a disaster situation is the maintenance of nursing and support staff. Direct-care nurse staffing levels are strongly associated with the quality of care within NHs. Nurse staffing can be broken down into licensed (i.e., registered nurses [RNs]; licensed practical/vocational nurses [LPNs]) and

unlicensed (i.e., certified nursing assistants [CNAs]) staff. Of the two licensed nurse staff, RNs have the greatest training requirements and are the most costly to employ. A higher skill mix (i.e., a greater ratio of RNs to LPNs and CNAs) is associated with lower avoidable hospitalization rates,[55] fewer emergency department visits,[56] fewer regulatory health deficiencies.[57] Generally, greater staffing levels and lower staff turnover is associated with better quality,[58,59] and several factors influence the availability and retention of direct-care staff in NHs, such as payer mix,[60–62] socioeconomic status and rurality of the location,[63,64] and minimum staffing requirements[65,66] in addition to contextual work-environment factors.

During disasters, obtaining adequate staffing to evacuate hundreds of medically-frail residents may be difficult.[66,67] Prior work from Hurricane Irma in September 2017 suggests that NHs increase all types of direct-care nurse staffing in preparation for major hurricanes, but that evacuating a facility requires an even greater staffing response.[68] Unfortunately, lower-quality NHs increased their staffing levels the least and opted to retain fewer RNs compared to higher-quality NHs during Hurricane Irma.[69] Because direct-care staff implements the 4Ms (i.e., resident goal planning and fulfilling preferences/wishes, providing medications and identifying adverse drug-related events, recognizing and managing cognitive and mental health disorders, assisting with transfer and mobility), it is crucial for NHs to maintain adequate staffing levels to meet the needs of residents during disasters.

In addition to staffing, the management of resources is vital. Resources such as gasoline for electric generators, non-perishable food items, clean drinking water, a supply of medications and injectables, and clean linens must be properly stored and distributed.[52,70] Management of resources must include a comprehensive evacuation plan given the complex task of evacuating NHs.[48,51,71–74] This plan should be malleable, as it is influenced by external factors such as the nature of the disaster, the location, and the risk of exposure to the facility. Internal factors also affect an evacuation plan and include destination characteristics (e.g., proximity, availability of beds), transportation (e.g., contract transportation or within-house, consideration of transporting flammable gases such as oxygen), availability of supplies and staff, resident acuity (e.g., management of cognitive, mental, and chronic health issues), and the physical structure of the NH.[75]

A focus on staffing may be especially important to prevent the worsening of health inequities among NH residents during disasters. Residents who identify as Black or Hispanic/Latinix are disproportionately affected because they tend to reside in lower-quality facilities, which are more likely to have lower staffing rates during disasters.[63] Lower-quality facilities are also found in socioeconomically disadvantaged locations, where other disaster response resources may be limited.[64,76] Efforts to address low staffing and poor resource coordination, potentially through reimbursement of disaster-related expenses, may especially benefit minority and socioeconomically disadvantaged residents through improved continuity of care to prevent later hospitalization and mortality.[63]

5 | CONCLUSION

NHs care for residents of increased acuity. Combined with cognitive and functional impairments, this acuity makes NH residents susceptible to the detrimental effects of climate change-related disasters. As these disasters increase in frequency and severity, a more proactive approach to preparedness is required. A modified Age-Friendly 4M Framework provides an important person-centered and organizational framework for stakeholders to develop improved disaster preparedness.

CONFLICT OF INTEREST

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