



Barriers to preparing for disasters: Age differences and caregiving responsibilities

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ABSTRACT

This study examined age differences in barriers to preparing for disasters and how caregiving responsibilities are associated with these barriers among different age groups. Using a sample of 1142 individuals from the 2017 Federal Emergency Management Agency National Household Survey, binary and multinomial logistic regressions were conducted to investigate the likelihood of encountering any or one of the two types of barriers, namely, barriers related to coping appraisal (i.e., capacity) and those related to threat appraisal (i.e., risk perception). Age was the key predictor and was categorized into five groups: 18–34, 35–49, 50–64, 65–74, and 75+. The results showed that the 18–34, 35–49, and 75+ age groups were more likely to have coping appraisal barriers than those aged between 65 and 74. In addition, being a caregiver increased the likelihood of having coping appraisal barriers. Interestingly, relative to the 65–74 age group, being a caregiver in the 18–34, 35–49, and 50–64 age groups would be more likely to have coping appraisal barriers. Our findings highlighted age patterns and heterogeneity among older adults. This study also directed attention to how disaster preparation behaviors were shaped by life course experiences.

1. Introduction

Disasters pose great threats to communities by causing casualties and a variety of social, psychological, financial, or environmental losses [1]. In the last decade alone, those disasters have affected approximately 1.7 billion people across the world [2]. Therefore, disaster preparedness that involves a variety of planning and training activities is of vital importance [3–5].

However, individuals, in general, are unprepared or underprepared, due to various barriers. In the 2017 American Housing Survey, nearly half of the respondents reported a lack of preparation with respect to the emergency kit, around 60% of them did not prepare an emergency meeting location, more than 70% had no communication plan, and approximately 80% lacked power generator [6]. Howe [7] estimated that only about 41% of the population in the U.S. stocked disaster supplies in their homes, with Arizona and Iowa having the lowest proportion (34%); and those who lived in disaster-prone regions were no more prepared than ones who didn't.

With a fast-aging population and an increasing demand for caregiving [8,9], an important but understudied question is how individuals' age and caregiving responsibilities affect disaster preparedness.

Following the protection motivation theory (PMT) that examines factors contributing to protective action and the life course perspective that recognizes differences in behaviors at different stages of the life course, this study investigated the age pattern of barriers to preparing for disasters, the impact of caregiving responsibilities on those barriers, and how this effect of caregiving was contextualized by age.

1.1. Theoretical framework: protection motivation theory

The protection motivation theory explains the factors affecting individuals' disaster preparedness. It was initially conceptualized to explain how fear-arousing communications could change health-related attitudes and behaviors [10]. It has also been applied to injury prevention, environment concerns, and natural disasters [11–13]. An updated version of PMT put forward by Rogers and Prentice-Dunn [14] provides a framework to study individuals' protective decision-making in response to disasters.

According to the model, two cognitive processes, namely the threat appraisal process and coping appraisal process, are hypothesized to fundamentally affect protective motivations and eventually elicit protective action [11,13,14]. Threat appraisal (also known as risk

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perception) describes how individuals assess the threat they perceive with a certain risk in terms of probability (expectation of risk exposure) and severity (estimation of risk consequences). Coping appraisal evaluates one's capability to deal with the threat in three dimensions [12]. The first one is response efficacy, referring to the belief that measures are effective in protecting people from threats [13]. The second is self-efficacy, which is the perceived ability of individuals to conduct protective action [12]. The third is the response cost of performing risk reduction or avoidance responses [11].

It was shown that those appraisal processes are underlying individuals' disaster preparedness. For example, Tang and Feng [15] reported that people who had lower scores of response efficacy and self-efficacy (i.e., coping appraisal) received lower scores on actual disaster preparedness actions after the 2016 Kaohsiung Meinong earthquake in Taiwan. Grothmann and Reusswig [13] found that the effectiveness and cost of private preparedness (i.e., coping appraisal) were significant predictors to precautionary action among residents at risk of flood in Germany, including informing others about self-protection, purchasing flood protection devices, and taking structural measures. In addition, a study of farming households in landslide-prone areas in China revealed that individuals who had lower scores on the perception of landslide probability and the threat of a landslide (i.e., threat appraisal), were less likely to adopt disaster preparedness behaviors [16]. Grothmann and Reusswig [13] also showed that the risks and potential consequences of flooding (i.e., threat appraisal) were predictors for preparedness.

Based on the PMT, we classified barriers to disaster preparedness into two main categories, i.e., barriers related to threat appraisal and those related to coping appraisal. Threat appraisal barriers included factors of perceived probability and perceived consequences while coping appraisal barriers included factors of response efficacy, self-efficacy, and response cost. We examined age patterns of those barriers as well as the role of caregiving in this context.

1.2. Age patterns of barriers to preparing for disasters

Age has been examined as an important factor in disaster studies. Studies examining the relationship between age and preparedness produced inconsistent results. Some studies have shown that older adults (65+) might have more barriers to disaster preparedness than their younger counterparts. For example, Heller, Alexander, Gatz, Knight, and Rose reported that older adults engaged in less preparation after experiencing the 1994 Northridge earthquake in California because they were less likely to perceive the severity of consequences and were more likely to believe that they could survive without injury or household damage (i.e., threat appraisal) [17]. Dostal [18] indicated that older adults, especially those with chronic illness or disabilities, were less likely to prepare for evacuation, due to their mobility problems and special needs of shelters, which could be regarded as coping appraisal and in particular self-efficacy associated barriers. Similarly, a study of older adults in San Francisco revealed that older adults who received home care had low self-efficacy (i.e., coping appraisal) in disaster preparedness because of their impairments, disabilities, and resource limitations [19].

In contrast, other studies indicated that older adults could be more prepared with fewer barriers. For example, older adults aged over 65 were reported to be more likely to have a communication plan, supplies of food and water, and other emergency supplies such as battery-powered radios, first aid kits, flashlights, and extra batteries than the younger generation [20,21]. It was suggested that the better preparedness among older adults was attributable to their previous life experiences with impactful disasters and thus a better understanding of risks and consequences of disasters (i.e., higher threat appraisal: perceived risk and consequences) and how to prepare (i.e., higher coping efficacy: self-efficacy) [22,23]. Those inconsistent findings of underlying barriers to disaster preparedness could reflect the heterogeneity among older

adults, in addition to different disasters examined, measures used, and samples included.

Previous research has identified the heterogeneity among older adults, suggesting that those aged 65–74 and those aged 75 or above could be considered to be distinct age groups [24–26]. In research on disaster preparedness, studies have also shown important differences among those aged 65–74 and those of more advanced age (i.e., 75+). For example, Tomio, Sato, and Mizumura [27] found that relative to the adults under the age of 65, those who were aged 65 and above were overall better prepared for medical-related and general events, but a detailed examination revealed that the finding did not apply to the subgroup aged 75+ in certain activities, including having emergency communication plans and evacuation plans. Cox and Kim [28] found that compared to individuals in the late middle-age group (51–64), those who were aged 75 or more had significantly lower levels of disaster preparedness; while there was no significant difference between the late middle-age and those aged 65–74.

Those findings largely suggest that those aged 75 or above are a particularly vulnerable subpopulation and experience more barriers towards disaster preparedness. Variations in health conditions and financial situations are proposed to explain the differences between those aged 65–74 and those aged 75 or above. Older adults with more advanced age are more likely to have declined health and poverty; the limited resources also present barriers for them to prepare for disasters [28], [29].

1.3. Caregiving and barriers to disaster preparedness

Unpaid caregiving is a critical resource to meet the increasing care demands as a result of longer life expectancy and a better survival rate of chronic conditions and disabilities [30]. Approximately 53.0 million caregivers are providing unpaid caregiving in the United States [31]. They are relatives, partners, friends, or neighbors, who provide the lion's share of long-term care for adults or children with chronic conditions or disabilities [9,32].

Those caregivers themselves could face additional barriers to preparing for disasters. Lam et al. [33] reported that respondents with older household members(s) were less likely to have an evacuation kit. Moreover, a study in Japan found that approximately 75% of caregivers were unprepared for disasters and failed to have a concrete evacuation plan for care recipients [34].

The low level of disaster preparedness of caregivers may result from several barriers, especially coping appraisal barriers presented by the caregiving situation. The first is related to caregivers' increased physical, psychological, social, and financial challenges [32,35–37]. Caregivers are likely to neglect their own health and have risky behaviors, including substance abuse, smoking, sleeping problems, poor diets, inadequate rest, and physical inactivity, which could prevent disaster preparing behaviors [37–39]. Second, the declined physical and cognitive functioning of care recipients increases the barriers to caregivers' disaster preparedness. With care recipients' limited mobility and considerable medical needs, issues such as the special needs for assistance in evacuation with medical equipment and daily living activities would complicate the disaster preparedness process [18,40,41]. Third, some care recipients with progressive dementia are unable to assist in the preparation process anymore when caregivers need support [41]. Moreover, the emotional stress from both upcoming disasters and caregiving may cause caregivers to be frustrated or powerless (i.e., coping appraisal barriers) [42]. Additionally, the lack of access to clear instructions and guidance to help caregivers make specific and complicated preparation is also a critical reason for lower levels of disaster preparedness [34]. Furthermore, caregivers who spent lots of time on care responsibilities may not have access or enough time to attend formal training, drills, or development of community emergency plans [34]. In this way, caregiving responsibilities tend to limit caregivers' capacity to prepare for disasters especially due to coping appraisal

barriers.

1.4. Caregiving at the different life stage

With a few exceptions, studies have rarely examined how caregiving responsibilities affect barriers to disaster preparedness among different age groups. Nevertheless, empirical evidence suggested that older family caregivers had more experience in disasters and relevant preparation strategies and were more likely to attain better overall preparedness and have an evacuation plan [22,34]. However, they themselves worried about their limited capacity when an emergency occurs [34].

Their differences in disaster preparedness and barriers faced could be associated with their life experiences and different priorities in life associated with their different stages in the life course [43]. Older caregivers could be more experienced than younger caregivers both in caregiving and preparing for disasters. Additionally, caregiving has different practical and emotional implications for caregivers at different stages. While caregiving could be a normal life event and fully expected at an older age, younger caregivers step into that role without sufficient mental preparation [34]. Especially, as suggested by the socioemotional selectivity theory (SST), older adults put a higher priority on intimate relationships and emotional satisfaction and a lower priority on information seeking and satisfaction from non-emotional related sources [44, 45]. Consequently, older family caregivers are more likely to focus on the positive aspect of caregiving, better regulate and monitor internal emotions and distress, and experience lower risks of anxiety than younger caregivers [46,47]. That said, since older adults, especially older adults of more advanced age, have more health and mobility problems, older caregivers could face more challenges and barriers to preparing for disasters [18,48]. Because of that, we generally expect that caregiving has a different impact on barriers to disaster preparedness among different age groups, and between the young-old and 75+ mainly because of their health conditions and resources.

1.5. Hypotheses

Based on the discussions above, three hypotheses were developed as follows:

Hypothesis 1. Individuals of different age groups are different in their likelihood of having barriers to disaster preparedness; particularly, older adults with advanced age would be more likely to encounter barriers.

Hypothesis 2. Caregivers have a higher likelihood of encountering barriers to disaster preparedness.

Hypothesis 3. Caregiving responsibilities have a different impact on barriers to disaster preparedness among different age groups.

We generally expect that the above hypotheses are more applicable to coping appraisal barriers than threat appraisal barriers because most differences we discussed were concerned with the capacity to prepare for disasters. Although no formal hypothesis was proposed to differentiate these two categories, we regarded them as separate categories and conducted analyses accordingly.

2. Methods

2.1. Data source and study sample

The data used in this study was from the 2017 National Household Survey (NHS), a national survey administered by the U.S. Federal Emergency Management Agency (FEMA). The survey was administered both in English and Spanish and both via landline and mobile telephone. It was administered to approximately 5000 adult respondents each year based on a random sampling strategy that included a nationally representative sample and hazard-specific oversamples, such as earthquake, flood, wildfire, hurricane, winter storm, extreme heat, tornado, and

urban event [49]. NHS aims to track the progress of personal disaster preparedness by examining the public's preparedness behaviors, attitudes, and motivations. In total, 5042 adult respondents were included in the 2017 NHS [49]. Out of the 1321 respondents who reported valid answers regarding barriers to disaster, we used listwise deletion and deleted 179 respondents who had missing values in analytical variables; eventually, the working sample for analyses included 1142 respondents, which represented missingness of 13.55%, i.e., (1142–1321)/1321.

2.2. Measures

2.2.1. Dependent variable

Respondents were firstly asked "how confident are you that you can take the steps to prepare for a disaster in your area?" and the answers ranged from 1 = not at all confident, 2 = slightly confident, 3 = somewhat confident, 4 = moderately confident, to 5 = extremely confident. Those who chose "not at all confident", "slightly confident", or "somewhat confident" were further probed into their barriers in preparedness with an open-ended question: "is there a reason you think you would not be able to take the steps to prepare?"

The answers included no barrier and each respondent's verbal description of barriers to disaster preparedness. 1321 respondents provided valid answers to this question. Although respondents could report up to five barriers, a small portion (8.18%) of respondents provided more than one entry of barriers. After coding those additional barriers, only 4.64% of the working sample reported both coping and threat appraisal barriers. Since the percentage for multiple types of barriers was low, we included only the first entry of the barriers of each respondent as their primary barrier. Based on the PMT, we categorized those reported primary barriers into coping appraisal barriers and threat appraisal barriers. Coping appraisal included perceived self-efficacy, perceived response efficacy, and perceived costs; and threat appraisal consisted of perceived probability and perceived severity.

Specifically, we categorized the following wording of the reported barriers to disaster preparedness as coping appraisal barriers: "Age", "Anything can happen at any time", "Can't afford it/cost", "Disabled/handicapped", "Don't know how to prepare/what to do", "Evacuation", "Government not prepared", "Hard to prepare for", "Have a preparedness plan", "Haven't thought about it", "Health", "I don't drive/no car/no transportation", "Live alone", "No shelter/not near one", "Not having supplies/food and water", "Panic/Scared/Chaos", "Poor planning/no plan", "Procrastination", "Storage space/live in apartment", "Taking care of family members", "Worry about other people/neighbors", and "Would need help". These barriers were regarded as coping appraisal barriers because they were related to the lack of self-capacity to take action, the perception that preparedness was useless, or the inability to afford the cost.

We categorized the following wording of reported barriers as threat appraisal barriers because they were associated with risk perception or risk consequence: "Depends on disaster/time to prepare", "Don't care/not worried about a disaster", "Don't live in a natural disaster area", "I could/but haven't", "Lazy/lack of motivation", "Not enough time/busy", and "Nothing ever happens". Eventually, individuals' barriers to disaster preparedness were coded as 0 = no barrier (reference), 1 = coping appraisal barriers, and 2 = threat appraisal barriers.

2.2.2. Independent variables

Age was coded as 0 = 65–74 (young-old, reference), 1 = 18–34 (young age), 2 = 35–49 (early middle-age), 3 = 50–64 (late middle-age), to 4 = 75+ (old-old).

Caregiving was measured by asking "do you currently help care for an elderly or disabled family member, relative, or friend?" (0 = no, 1 = yes). An interaction between age group and caregiving was also created.

2.2.3. Control variables

Control variables included gender, educational level, race, ethnicity,

homeownership, and disability. Gender was measured by 0 = male and 1 = female. Educational level was initially measured on a 6-point scale with 0 = less than high school diploma, 1 = high school degree or diploma, 2 = technical/vocational school, 3 = some college, 4 = college graduate, and 5 = postgraduate work or degree. For the analyses, we combined “less than high school diploma” and “high school degree or diploma” into “high school or below”; and combined “technical/vocational school” and “some college” into “vocational school/some college”. “High school or below” was used as the reference group, and three dummy variables were created (i.e., vocational school/some college, college graduate, and postgraduate work or degree). Race was coded as a dummy variable (0 = other races, 1 = White). Ethnicity was assessed by asking “are you of Hispanic, Latino, or Spanish origin - such as Mexican, Puerto Rican, Cuban, or other Spanish origin?” (0 = no, 1 = yes). Homeownership was assessed by 0 = rent a home and 1 = own a home. Disability condition was a dichotomous variable measured by asking “Do you have a disability or a health condition that might affect your capacity to respond to an emergency situation?” (0 = no, 1 = yes).

2.3. Data analysis

Binary logistic regressions were used to examine factors associated with reporting barriers vs. no barriers. In the first model, age groups with five categories (young age, early middle-age, late middle-age, young-old, old-old), caregiving, and control variables were added to investigate the differences between young-old and other age groups in barriers to disaster preparedness. The interactions between age groups and caregiving were added to the second model. Similarly, multinomial logistic regressions were conducted with two models to examine factors associated with reporting different types of barriers vs. no barriers. All analyses were performed using Stata 15.

Table 1
Sample characteristics (N = 1142).

Variables	N	Percentage
Gender		
Male	513	44.92%
Female	629	55.08%
Educational level		
High school/less than high school	273	23.91%
Vocational school/some college	350	30.65%
College graduate	292	25.57%
Postgraduate work or degree	227	19.88%
Race		
White	857	75.04%
Others	285	24.96%
Hispanic		
No	998	87.39%
Yes	144	12.61%
Homeownership		
Rent a home	445	38.97%
Own a home	697	61.03%
Disability condition		
No	864	75.66%
Yes	278	24.34%
Family caregiving		
No	954	83.54%
Yes	188	16.46%
Age		
18-34	259	22.68%
35-49	211	18.48%
50-64	318	27.85%
65-74	203	17.78%
75+	151	13.22%
Barriers to disaster preparedness		
No barrier	614	53.77%
Coping appraisal barriers	391	34.24%
Threat appraisal barriers	137	12.00%

3. Results

Descriptives of the analytical variables were presented in Table 1. Females (55.08%) slightly outnumbered males (44.92%). Nearly half of respondents had college degrees or above. A majority of them were White (75.04%) and were not of Hispanic, Latino, or Spanish origin (87.39%). More than 60% of respondents owned a home, and approximately one-fourth of them had disabilities. 16.46% of the respondents were caregivers of older or disabled family members, relatives, or friends. In terms of age distribution, 22.68% were 18–34, 18.48% were 35–49, 27.85% were 50–64, 17.78% were 65–74, and 13.22% were aged 75 or older. More than 50% of respondents did not report any barriers to disaster preparedness, 34.24% reported coping appraisal barriers, and 12.00% had threat appraisal barriers.

Table 2 demonstrated the results of binary logistic regressions on barriers to disaster preparedness. Model 1 aimed to examine the age differences in the likelihood of having preparedness barriers or not (Hypothesis 1) and the association between caregiving and having barriers to preparing (Hypothesis 2). The overall model was significant, $\chi^2(13) = 97.36, p < .001$. Compared to the young-old (65–74), those aged 18–34 (Odds Ratio (OR) = 2.13, $p < .01$), 35–49 (OR = 1.76, $p < .05$), and 75 years or older (OR = 1.60, $p < .05$), had higher odds of having barriers over no barriers. Family caregivers were more likely to report preparedness barriers (OR = 1.63, $p < .01$). In terms of control variables, respondents who were female (OR = 1.39, $p < .01$), and had

Table 2
Binary logistic regression on barriers to disaster preparedness (N = 1142).

Variables	Model 1		Model 2	
	OR	95%CI	OR	95%CI
Female	1.39**	1.09, 1.78	1.40**	1.09, 1.79
Educational level (reference: high school/below high school)				
Vocational school/some college	1.59**	1.13, 2.23	1.60**	1.13, 2.26
College graduate	1.49*	1.04, 2.15	1.51*	1.05, 2.18
Postgraduate work or degree	1.61*	1.09, 2.36	1.64*	1.11, 2.41
White	1.09	0.81, 1.46	1.13	0.84, 1.52
Hispanic	0.72	0.49, 1.07	0.70	0.47, 1.04
Homeownership	0.81	0.61, 1.07	0.81	0.61, 1.07
Disability condition	3.22***	2.35, 4.40	3.27***	2.38, 4.48
Caregiving	1.63**	1.16, 2.28	0.61	0.28, 1.31
Age (reference: 65–74)				
18-34	2.13**	1.38, 3.30	1.65*	1.04, 2.61
35-49	1.76*	1.15, 2.70	1.55	0.97, 2.45
50-64	1.44	0.99, 2.11	1.14	0.75, 1.74
75+	1.60*	1.01, 2.51	1.28	0.79, 2.07
Interaction between caregiving and age				
18-34			7.13**	2.08, 24.50
35-49			2.03	0.69, 5.97
50-64			3.33*	1.30, 8.50
75+			5.00	0.83, 30.16
Model fit				
LR Chi-square	97.36		110.14	
Degree of freedom	13		17	
Pseudo R-square	6.17%		6.99%	
p-value	<.001		<.001	

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

disabilities ($OR = 3.22, p < .001$), were at higher risks of having barriers. Compared to those with high school or below degree, respondents who had vocational school/some college degree ($OR = 1.59, p < .01$), college graduate degree ($OR = 1.49, p < .05$), and postgraduate work or degree ($OR = 1.61, p < .05$), were more likely to have preparedness barriers.

The interaction terms between age and caregiving were added into Model 2 to investigate the moderating role of caregiving (*Hypothesis 3*). Results showed that the interaction terms between 18 and 34 and caregiving ($OR = 7.13, p < .01$), and between 50 and 64 and caregiving ($OR = 3.33, p < .05$), were significant. It meant that compared to young-old caregivers, caregiving was associated with higher risks of having barriers among those in young age and late middle-age.

Table 3 presented the results of multinomial logistic regression models on barriers to disaster preparedness. In model 1 (*Hypothesis 1* & *Hypothesis 2*), the overall model was significant, $\chi^2(26) = 164.07, p < .001$. The first set of estimates compared respondents who had coping appraisal barriers with those who had no barriers. Compared to individuals between 65 and 74, those between 18 and 34 ($OR = 2.26, p < .01$), 35 and 49 ($OR = 1.75, p < .05$), and aged 75+ ($OR = 1.95, p < .01$) had higher odds of having coping appraisal barriers over no barriers. Relative to non-caregivers, caregivers had higher odds of reporting coping appraisal barriers over no barriers ($OR = 1.65, p < .01$). As for control variables, female respondents had higher odds of having coping appraisal barriers ($OR = 1.84, p < .001$). Homeowners had lower odds of having coping appraisal barriers compared to those who rented a home ($OR = 0.72, p < .05$). Respondents with disabilities had higher odds of having coping appraisal barriers ($OR = 4.13, p < .001$). Compared to respondents with high school or below degree, those who had vocational school/some college were at higher risks of having coping appraisal barriers ($OR = 1.52, p < .05$). The second set of estimates in model 1 compared respondents who had threat appraisal barriers with those who had no barriers. Educational level was the only significant predictor, showing that compared to those with high school or below high school degree, individuals who had vocational school/some college ($OR = 1.89, p < .05$), college degree ($OR = 1.84, p < .05$), and postgraduate work or degree ($OR = 2.11, p < .05$) had higher odds of reporting threat

appraisal barriers over no barriers.

In model 2, interactions between age groups and caregiving were added to examine the moderating effect of caregiving (*Hypothesis 3*). The first set of coefficients compared respondents who had coping appraisal barriers to those who had no barriers. The interactions between the age group 18–34 and caregiving ($OR = 9.08, p < .01$), between the age group 35–49 and caregiving ($OR = 3.67, p < .05$), and between the age group 50–64 and caregiving ($OR = 3.95, p < .05$) were all significant, indicating caregiving was associated with greater coping appraisal barriers among those age groups than among those aged 65–74. The second set of estimates compared respondents who had threat appraisal barriers to those who had no barriers and no significant interaction terms were found.

4. Discussion

Using a national dataset, this study examined age patterns (young age, early middle-age, late middle-age, young-old, and old-old) of barriers to disaster preparedness, the impact of caregiving on those barriers, and the differing impact of caregiving among different age groups. Guided by the PMT, we categorized respondents' descriptions of barriers into coping appraisal barriers and threat appraisal barriers and thereafter examined factors contributing to those barriers.

Hypothesis 1 was partially supported. The results revealed that compared to individuals aged 65–74, those aged 18–34, 35–49, and 75+ had higher odds of having coping appraisal barriers than having no barriers. Compared to those younger adults, those aged 65–74 (i.e., young-old) could have more previous experiences of disasters which enabled them to understand the risk of disasters, have more resilience and strengths, and also know what to do when preparing for disasters [50]. Moreover, as a result of retirement, young-old adults tend to have more time than individuals at a young age and early middle-age to communicate with physicians and others about disaster preparation [27]. Consistent with previous findings, the disaster preparedness behaviors among the young-old are similar to the late middle-age group [28]. In contrast, older adults aged 75 or above had more coping

Table 3
Multinomial logistic regression on barriers to disaster preparedness ($N = 1142$).

Variables	Model 1				Model 2			
	Coping appraisal barrier vs. no barrier		Threat appraisal barrier vs. no barrier		Coping appraisal barrier vs. no barrier		Threat appraisal barrier vs. no barrier	
	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI
Female	1.84***	1.39, 2.42	0.71	0.48, 1.04	1.84***	1.39, 2.43	0.72	0.49, 1.05
Educational level (reference: high school/below high school)								
Vocational school/some college	1.52*	1.05, 2.21	1.89*	1.06, 3.38	1.55*	1.06, 2.25	1.88*	1.05, 3.37
College graduate	1.40	0.94, 2.10	1.84*	1.01, 3.34	1.43	0.95, 2.14	1.84*	1.01, 3.35
Postgraduate work or degree	1.48	0.97, 2.26	2.11*	1.13, 3.94	1.51	0.99, 2.32	2.14*	1.14, 4.01
White	1.01	0.73, 1.39	1.35	0.84, 2.17	1.05	0.76, 1.46	1.37	0.85, 2.23
Hispanic	0.79	0.51, 1.21	0.57	0.29, 1.12	0.76	0.49, 1.18	0.57	0.29, 1.11
Homeownership	0.72*	0.53, 0.97	1.15	0.74, 1.81	0.72*	0.53, 0.98	1.12	0.72, 1.77
Disability	4.13***	2.95, 5.78	1.41	0.84, 2.39	4.23***	3.01, 5.94	1.39	0.82, 2.36
Caregiving	1.65**	1.14, 2.39	1.61	0.97, 2.67	0.48	0.20, 1.17	1.09	0.36, 3.31
Age (reference: 65–74)								
18–34	2.26**	1.39, 3.68	1.92	0.98, 3.79	1.68*	1.01, 2.80	1.66	0.80, 3.43
35–49	1.75*	1.08, 2.84	1.77	0.93, 3.37	1.38	0.81, 2.32	1.95	0.98, 3.89
50–64	1.36	0.89, 2.08	1.60	0.90, 2.84	1.05	0.65, 1.69	1.36	0.71, 2.62
75+	1.95**	1.20, 3.19	0.70	0.29, 1.68	1.51	0.90, 2.54	0.61	0.24, 1.57
Interaction between caregiving and age								
18–34					9.08**	2.38, 34.67	3.78	0.66, 21.71
35–49					3.67*	1.12, 12.06	0.22	0.02, 2.32
50–64					3.95*	1.35, 11.55	2.12	0.56, 8.00
75+					5.74	0.88, 37.51	4.20	0.26, 68.04
Model fit								
LR Chi-square	164.07				184.06			
Degree of freedom	26				34			
Pseudo R-square	7.52%				8.44%			
p-value	<.001				<.001			

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

appraisal barriers to disaster preparedness, compared with those among the young-old group. This is consistent with previous findings that older adults with more advanced age had worse health and fewer financial resources and thus less self-efficacy in disaster preparedness [27,28].

Interestingly this study showed that age differences mainly existed in coping appraisal and no differences in threat appraisal were detected, possibly a result of a combination of counterbalancing impact of experiences, higher risk perceptions, and practical limitations [17–19,22]. For example, older adults' richer life experiences would be associated with higher risk perceptions, but the lack of motivation as death comes closer could cancel each other in the overall threat appraisal barriers. As suggested by the socioemotional selectivity theory, when death is closer, people change their priorities to more emotional-related matters and reduce the importance of practical matters [51].

Hypothesis 2 was supported for coping appraisal barriers, but not for threat appraisal barriers, suggesting caregiving could mainly impact caregivers' disaster preparedness by limiting their capacities to prepare, but not their perceptions of risks. **Hypothesis 3** was also partially supported. Compared to those aged 65–74, caregiving had a bigger impact on having barriers among the young age (18–34), early middle-age (35–49), and late middle-age (50–64) groups. Caregiving-related emotional stress, care recipients' health and functioning limitations, and caregivers' lack of access to or enough time for training, have been found to reduce the ability of caregivers in preparing for disasters [34, 41,42]. It is possible that older caregivers could better relieve caregiving-related distress and negative emotions because of their more experiences in and positive perception of caregiving [46,47]. Besides, older caregivers could be more experienced and competent than younger caregivers to prepare for disasters; and caregivers in both young and middle age might be more likely to pay more attention to caregiving itself while unable to undertake disaster preparation [34]. The findings support that the life stage could shape different behaviors in disaster preparedness [43].

In terms of control variables, being female, renting a home, and being disabled were found to have a higher likelihood of having coping appraisal barriers; and higher education was the only significant predictor of having more threat appraisal barriers. These findings were generally consistent with previous studies. For example, females were found to be more worried about preparing for disasters and had more limited capacity in the face of emergencies [34]. Grothmann and Reusswig [13] reported that homeowners were more likely to make preparations for flood, such as informing themselves about purchasing flood protection devices and taking mitigation measures, because owners may lose much more than tenants in floods and owners can take independent measures easily in their house while tenants are usually not allowed to make structural changes to the houses. Disabilities may affect individuals' physical functioning and add to the difficulty in preparation for evacuation [18], which could affect individuals' self-efficacy when preparing for disasters. Compared to those with high school or below degree, individuals with a higher educational level were less likely to be generally prepared than their counterparts, which could be because they were more self-sufficient and more confident about their judgment on perceived probability and consequences of disasters [27]. This study further shows that more threat appraisal barriers may be the underlying reason why people of higher education levels could be less prepared. Besides, since barriers are self-reported and higher barriers may not be directly translated to less preparedness and people with higher education levels could have different perceptions for preparedness and barriers. We also conducted supplemental analyses for how age groups contextualized the impact of the above factors on having barriers and found that compared to women aged 65–74, women in age groups of 18–34, 50–64, and 75+ had higher odds of having threat appraisal barriers over no barriers. Those findings could be further explored in future studies.

There are several limitations of this study. First, there was a screening question about respondents' confidence in disaster

preparedness before assessing respondents' barriers in preparation, which excluded those who chose “moderately confident” or “extremely confident”. However, they could still face some barriers related to coping or threat appraisal. Therefore, this screening question might have excluded some respondents who had barriers to disaster preparedness. Second, some of the answers about barriers in preparing for disasters were too broad or vague. The authors followed the concepts of PMT and classified those barriers into coping appraisal barriers and threat appraisal barriers subjectively and thus some of the classifications could be inaccurate. But the efforts of digging deep into people's own perception of barriers to disaster preparedness with their own words with a large sample could outweigh the limitations coming with that. Third, this study examined respondent's chronological age without considering the perceived age, i.e., how old people perceive themselves as being. The discrepancy between the actual and perceived age might affect the accuracy of age categories and the interpretations of age-related findings. For example, it was reported that individuals in young adulthood tend to feel older whereas older adults often feel younger than their chronological ages [52]. It would be interesting for future studies to integrate measures of perceived age. In addition, the continuous decline in response rates of telephone surveys in recent years could introduce biases, especially those related to underestimating the barriers faced by caregivers since most vulnerable caregivers could be less likely to participate in the survey.

5. Implications

The results of this study highlighted heterogeneity among older adults. The young-old (65–74) could be similar to the late middle-aged (50–64) in their disaster preparedness behaviors and could even be more advantaged than the younger groups (i.e., 18–34, 35–49). Nevertheless, those who were 75 or older were different from the young-old and had significantly more barriers in preparedness, an indicator of vulnerability because of the advanced age. Examining older adults' differences from the younger adults without considering the substantial differences among older adults of different ages could present an overoptimistic scenario and divert attention from older adults' unique vulnerability [34]. Therefore, public disaster education and support for preparedness can be designed and conducted based on the vulnerability and resilience of individuals in different age groups.

This study directed attention to special challenges faced by young and middle-aged adults when they provide care for families, friends, and relatives. They may be less experienced in providing care and struggle to find a balance between caregiving and other demanding tasks such as jobs and children. This study suggested that training and support programs should consider these characteristics and include specific tips, such as the special needs of care recipients in disaster contexts and the specific resources and support for caregivers to get prepared. For example, agencies can provide caregivers with time-flexible educations and training in varied forms (e.g., online meetings) so that they can learn about preparedness amid heavy caregiving responsibilities. Moreover, older adults can be actively involved in public disaster education because of their ability to share rich life experiences and skills regarding disasters or caregiving with community members, which would contribute to community inclusion and social preparedness [53].

This study also suggests that social disparities in disaster preparedness are more likely to exist in coping appraisal barriers than threat appraisal barriers. Thus, although it is important to educate the probabilities and consequences of disasters to increase threat appraisal (i.e., risk perception) and reduce its relevant barriers, it is even more important to enhance individuals' capacity and thus reduce their coping appraisal barriers to preparing for disasters to achieve the goal of reducing disparities. This is because disparities in disaster preparedness would eventually contribute to disparities in responding and recovering from disasters [54,55]. For example, to reduce coping appraisal barriers and boost individuals' capacities, preparedness-related knowledge and

information could be shared via meetings, workshops, training, and community outreach activities. The information-sharing could highlight the effectiveness of different types of preparedness activities and available resources and assistance from public disaster management and community organizations. The assistance should also be provided to develop tailored preparedness plans that consider individuals' and families' special needs.

The findings of this study, especially those concerning age differences, caregiving-related challenges, and coping appraisal barriers in preparedness, could also advise policy-making. For instance, the findings of this study suggest that a tax break for purchasing disaster preparation supplies could be an effective way in reducing disparities in disaster preparedness. This is because it helps to reduce costs to disaster preparedness and thus reduces coping appraisal barriers. An example is the annual Texas Emergency Supplies Sales Tax Holiday, which was approved by the Texas Legislature in 2015; it provides tax breaks and encourages the purchase of certain emergency preparation items [56]. Disaster preparedness campaigns and educational programs that coordinate with those policies could magnify their effectiveness. In addition, the vulnerabilities of caregivers in disaster preparedness should be acknowledged and accommodated at the policy level. For example, an emergency preparedness leave for caregivers could be provided for them to gain knowledge and supplies as well as develop plans for disasters.

Overall, preparedness for disaster is a global imperative, especially when COVID-19 has resulted in unprecedented disruption in human society and increased demands for the family to take care of its members. This study presents immediate implications for policymakers and interventions to design programs to consider needs with a life course perspective and acknowledge heterogeneity and differences among older adults.

6. Conclusion

The present study was guided by the life course perspective and suggested that young adults, early middle-aged adults, and older adults with advanced age were at higher risks of having barriers to disaster preparedness than the young-old; being a caregiver increased the likelihood of encountering coping appraisal barriers, especially for young and middle-aged adults. Given the age patterns and heterogeneity among older adults, more studies and intervention programs should be conducted to improve capacity in disaster preparedness targeting individuals in different age groups.

Data availability

Datasets related to this article can be found at <https://www.fema.gov/about/openfema/data-sets/national-household-survey>.

Author note

The authors declare that there is no conflict of interest.

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No ethical approval is needed because we used secondary data which has no identifying information.

FEMA and the Federal Government cannot vouch for the data or analyses derived from these data after the data have been retrieved from the Agency's website.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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