



How are Asian-Americans different from other races in disaster preparedness in the context of caregiving responsibilities and preparation information access?

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Received: 2 February 2021 / Accepted: 29 December 2021 / Published online: 19 February 2022
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Abstract

This study focused on Asian-Americans who have rarely been studied in previous disaster research and examined their disaster preparedness when they provided caregiving. Using a sample of 4316 individuals from the 2017 Federal Emergency Management Agency National Household Survey, linear regressions were performed to investigate racial differences in disaster preparedness of individuals with two types of caregiving responsibilities (i.e., 1) caring for children, and (2) caring for older adults or those with disabilities), as well as how access to preparedness-related information moderated such differences. The results showed that on average individuals who had children in their households reported better disaster preparedness, so did those who provided care for older or disabled family members or friends. But further examination with two-way interaction showed that this finding did not apply to Asians, among whom the caregivers of children were particularly disadvantaged with lower levels of preparedness relative to non-caregivers. Actually, Asian caregivers of children were the most disadvantaged group when compared to either caregivers or non-caregivers of other races, namely White, African-American, and Native American. In addition, the vulnerability of Asian caregivers of children was magnified when there is a lack of information about how to get better prepared for disasters. The findings highlighted the uniqueness of the Asian population in disaster preparedness, their vulnerability to caregiving responsibilities, and the importance of information access. The findings could guide interventions and programs to serve and engage Asian communities in disaster planning and promote their disaster preparedness and resilience.

Keywords Disaster preparedness · Asian · Caregiving · Children · Older adults · Community-based theory

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1 Introduction

Since 1953, there have been approximately 3728 federally declared disasters in the US caused by natural hazards or man-made events, with increasing numbers of events, costs, and casualties in the past 20 years (Federal Emergency Management Agency 2020b; NOAA National Centers for Environmental Information 2020). Children, older adults, and persons with disabilities are usually considered as particularly vulnerable in those disasters (Centers for Disease Control and Prevention 2015). Because of their special needs, caregivers of those individuals are faced with unique challenges in disaster-related processes.

Generally speaking, it has been reported that individuals who care for children, older adults, or persons with a disability tend to have relatively higher levels of disaster preparedness (Bronfman et al. 2019; Levac et al. 2012; O’Sullivan et al. 2012). However, caregivers’ disaster preparedness could vary a lot due to their pre-existing social vulnerabilities, among which racial minority is an understudied key factor (Lippmann 2011; Thomas et al. 2013). Especially, as of 2019, there were 18.6 million residents who reported to be Asian alone (i.e., individuals who reported Asian and did not report any other race) in the US (U.S. Census Bureau 2020b), and this single-race group is projected to reach 24.4 million in 2030 and 36.8 million in 2060 as a result of their high immigration rate (Vespa et al. 2020). Among different racial minorities, studies on Asian-Americans are rare (Li et al. 2008); and the lack of studies on this population would be a major barrier to better serving and engaging this fastest-growing population.

This study focused on Asian-Americans and investigated how the disaster preparedness of Asian caregivers differed from that of other major races in the US. In addition, given the disadvantages of minority communities concerning the capacity to receive disaster-related information (Howard et al. 2018), we further examined how access to the information about how to get better prepared affected the above differences. The present study is mainly guided by the social vulnerability perspective, which highlights the vulnerability of minority groups to disasters because of their potential disadvantages in disaster preparedness associated with language barriers and socioeconomic status. (Thomas et al. 2013; Wisner et al. 2004). In addition, this study is enriched by the community-based theory that further directs attention to minority groups’ vulnerabilities in accessing information due to institutional isolation, i.e., members of minority groups are isolated from public preparedness agencies and rely more on the disaster mechanisms within their own communities (Lippmann 2011).

2 Literature review

2.1 Disaster preparedness of caregivers

It is estimated that in 2020 approximately 63.1 million people lived with children under age 18 (U.S. Census Bureau 2020a) and 41.8 million adults provided care for their older family members with illness or disability (National Alliance for Caregiving and AARP 2020). Children are at greater risks in disaster contexts due to their unique physical needs, levels of psychological and behavioral development, and dependence on others for protection and care (Committee on Pediatric Emergency Medicine 2015; Zahran et al. 2008). Meanwhile, disasters also pose more challenges for older adults because of their mobility problems, chronic health conditions, declined cognitive and sensory conditions with aging,

and specific needs for care and support (Al-Rousan et al. 2014; Centers for Disease Control and Prevention 2020b). Those with disabilities are also exposed to higher risks as a result of physical, cognitive, or sensory impairment, which reduces their ability to hear and understand disaster warnings and limits response activities (Centers for Disease Control and Prevention 2015). In addition to the caregiving responsibilities, caregivers of children, older adults, or those with disabilities bear a significant responsibility for disaster preparedness on behalf of those care recipients to prevent or mitigate the negative impacts of disasters on them (Centers for Disease Control and Prevention 2020a; Wakui et al. 2017).

Caregiving responsibilities have been identified to promote disaster preparedness among the general population (Bronfman et al. 2019; Levac et al. 2012; Tekeli-Yeşil et al. 2010). For example, a study conducted in Los Angeles County reported that people with household dependents under age 18 were more likely to prepare supplies and have emergency plans in response to the possibility of terrorism than those without children at home (Eisenman et al. 2006). Besides, Chaney et al. (2013) suggested that caregivers of children in Alabama were more likely to practice the prepared plans (e.g., participating in a tornado drill) than households without children. Christensen (2012) examined the preparedness for hurricanes among caregivers of older adults with cognitive impairment in Florida, revealing that most family caregivers were well prepared, such as preparing disaster kits and hurricane shutters and making basic evacuation plans. Family caregivers of older stroke survivors with functional disabilities in Canada were also found to have adequate supplies and be able to sustain themselves and provide caregiving support for three days in a community crisis or disaster (O’Sullivan et al. 2012).

The primary reason for possible better preparedness among caregivers is the anticipation of great needs and help among care recipients during disasters because of their special needs (Becker et al. 2012; Eisenman et al. 2007; Pfefferbaum and North 2008). In addition, specific resources, such as school-based requirements, community-based support, and advocacy and promotion from federal agencies, are available to caregivers to encourage them to make preparatory plans that consider the needs of children and older adults (Centers for Disease Control and Prevention 2018; Heptulla et al. 2016; Zamboni and Martin 2020). Despite the generally high levels of disaster preparedness among people with caregiving responsibilities, their preparedness can vary as a result of factors reflecting their social vulnerabilities, such as living in rural areas, special health care needs of care recipients, lack of money (Goodhue et al. 2016; Hamann et al. 2016), as well as racial minority identities (Rivera 2020).

2.2 Racial differences

The social vulnerability perspective posits that certain characteristics (e.g., age, gender, income, disability, race/ethnicity) of individuals or groups could have a fundamental impact on how they prepare for, respond to, and recover from disasters (Bolin and Kurtz 2018; Thomas et al. 2013; Wisner et al. 2004). Racial minority status has been identified as an important factor that is associated with people’s higher levels of vulnerability to disasters due to language barriers, immigrant backgrounds, and community isolation (Howard et al. 2018; Mathew and Kelly 2008). However, racial issues have been understudied in research on disaster preparedness (Lippmann 2011); and the existing studies have primarily focused on African-Americans and their differences from Whites, omitting other racial minorities with smaller populations, especially Asians (Li et al. 2008). This study aimed to address the gaps in the literature by examining racial differences

in disaster preparedness with a focus on the differences between the Asian and other races, especially in the contexts of caregiving and access to information about how to get prepared.

The first Asian immigrants began arriving in the 1850s and in 2019 there were around 18.6 million Asian alone residents in the US, accounting for approximately 5.7% of the population (U.S. Census Bureau 2020b). This racial group is expected to grow fast due to its high immigration rate, reaching 36.8 million by 2060, nearly a tenth of the total population (Vespa et al. 2020). Asian-Americans are diverse with 19 groups with origins from the far East, Southeast Asia, or the Indian subcontinent; they have been the fastest-growing major racial group in the US (Budiman et al. 2019).

One of the most striking characteristics that distinguish the Asian from other racial groups is their immigrant backgrounds. Based on the 2019 American Community Survey, nearly 65.7% of the Asian-Americans were foreign-born immigrants, which far outnumbered the immigrant populations among White (8.6%), Black or African-American (10.4%), American Indian or Alaska Native (6.3%), and Native Hawaiian or Pacific Islander (26.4%) (U.S. Census Bureau 2020b). As a result, Asians could face unique challenges in preparing for disasters, such as language barriers, cultural traditions, social isolation, and poor assimilation into the local community (Mathew and Kelly 2008; Nepal et al. 2012; Teo et al. 2019); even though on average, Asian-Americans have relatively higher levels of education, employment rates, and median household income than other four major races (U.S. Census Bureau 2020b), which are typically associated with better preparedness (Eisenman et al. 2009; Smith and Notaro 2009).

In addition to the social vulnerability perspective, which acknowledges disadvantages of minority groups (Thomas et al. 2013), the community-based theory provides a more in-depth view on minority groups' unique challenges concerning disaster preparedness by positing that minority groups tend to be isolated from external public disaster management and rely on internal disaster mechanisms and networks within the community (Lippmann 2011). Even though the majority of disaster management responsibilities have been shifted to public administrations from families and communities in the US, the traditional disaster mechanism that focuses on community-based social networks still plays an important role, especially among immigrant or minority groups (Kirschenbaum 2002). Members in minority communities that share similar languages, cultures, values, and norms, may tend to trust and rely on their smaller and informal social interactions built on family-clan, friendship, and job-related networks, to develop their own preparatory plans for disasters (Kirschenbaum and Vigoda 2002). Meanwhile, since these minority populations are less likely to seek formal help outside their communities, their specific needs and characteristics may not be well understood by government agencies, which could put them in an isolated condition and at higher risks than mainstream groups in disaster contexts (Lippmann 2011).

Especially, Asian-Americans tend to form linguistically and culturally isolated communities from mainstream American culture and public disaster management. For example, Asian-Americans in New York City had formed identifiable communities, spoke more than 12 major Asian languages and dialects, and had a variety of immigration identities; Their language and cultural barriers could isolate them from public disaster agencies and present challenges in disaster communication and access to accurate information (Ready Campaign 2013). Similarly, Mathew and Kelly (2008) reported that Asian communities in Southern California preferred to rely on their native language information within communities and were isolated from public disaster management due to the lack of linguistically and culturally appropriate services and resources (e.g., translations, materials, training, and community outreach).

2.3 Disaster preparedness, caregiving responsibilities, and race

Although caregiving responsibilities could promote disaster preparedness in the general population, those responsibilities could present unique challenges to Asian caregivers. Compared to White and African-American caregivers, Asian-Americans are more likely to report emotional and physical burdens as a result of caregiving responsibilities (National Alliance for Caregiving and AARP 2020), which are usually related to their immigration backgrounds, community isolation, and cultural values. For instance, Asian caregivers tend to use less formal support than their White counterparts due to language barriers, culturally related stigma and shame, or a lack of culturally competent services (Pinquart and Sörensen 2005; Sun et al. 2012). In addition, their informal support networks (e.g., family and friend) are often smaller than that of other races (Dilworth-Anderson et al. 2002), which would make Asian caregivers overwhelmingly feel that they have no choice but to take on the caregiving roles (National Alliance for Caregiving and AARP 2020). Specifically, Asian caregivers of children often struggle with inter-generational differences within the family that older generations are more influenced by Asian cultures while children are more affected by Western cultures (Weng 2017). For example, traditional Asian parenting styles emphasize restrictions and authoritarianism (Kwok and Wong 2000), which could conflict with mainstream cultures in the US and thus lead to higher levels of stress among Asian caregivers of children (DeLambo et al. 2011). Concerning caregivers for older adults, Asians are more often to take care of care recipients with advanced age (e.g., parent/parent-in-law) than caregivers of other races (National Alliance for Caregiving and AARP 2020). Many of those older Asian care recipients moved to the US to join their adult children, so most of them have limited English proficiency, are highly dependent on adult children, and live with their caregivers (Weng 2017), which can further increase the caregiving burden of Asian caregivers. Overall, although Asian cultures and traditions emphasize a strong sense of family obligation, Asian-American caregivers could experience more caregiving burdens and are more vulnerable than caregivers of other races (Lai 2007).

People from culturally and linguistically diverse backgrounds, as well as families with caregiving responsibilities, have been found to heavily rely on disaster and emergency-related services in preparing for disasters (Howard et al. 2018). However, Asian caregivers may have limited access to guidance and support from public disaster agencies that are necessary for developing complex preparatory plans involving the needs of their care recipients, as a result of community isolation (Mathew and Kelly 2008). For instance, many disaster preparedness organizations in the US provide information and training only in English or Spanish without translation services in other languages, which cannot meet the needs of most of the Asian population who have limited English proficiency and speak a wide range of Asian languages and dialects (Rivera 2020; U.S. Census Bureau 2020b). In addition, there is a shortage of bilingually and culturally competent staff and volunteers in public agencies to serve Asians, collaborate with trusted community leaders, or conduct effective community outreach activities, which would further make it difficult to inform Asians of the necessary information and services concerning caregiver disaster preparedness (Mathew and Kelly 2008; Nguyen and Salvesen 2014). Furthermore, the caregiving burden would take up most of the time and energy of caregivers, and thus leaves them little time to watch the news or listen to radios which are particularly important or even the only source for Asian caregivers to learn disaster-related information from the outside world (Nepal et al. 2012). Within the

community, Asian community organizations that provide disaster management services for community members have been developing in recent years but are still in the stage of improvement and expansion (Ready Campaign 2013). Thus, they may not be able to effectively reach the increasing Asian communities that are facing unique challenges or to develop preparedness programs that meet Asian caregivers' specific needs.

In addition, the disaster preparedness of Asian caregivers could be lower because of other factors including cultures, traditional beliefs, or customs of their countries of origin (Lippmann 2011). For example, Nepal et al. (2012) found that immigrants from highly government-controlled countries, such as China, tend to depend on governments to make precautionary plans rather than viewing them as personal responsibilities. Parents of young children in the East Asian region (e.g., South Korea and Hong Kong) have also been identified to be poorly prepared for disasters possibly due to the long-held belief that there is no need to prepare in advance in their less disaster-prone regions (Fung and Loke 2010; Jung et al. 2020). Similarly, caregivers of older adults in Japan and Hong Kong were found to be less likely to prepare for disasters, which may result from the lack of attention and support from local disaster management agencies (Lam et al. 2017; Wakui et al. 2017). Moreover, specific risks faced by vulnerable groups, such as children, might not receive sufficient attention from many disaster preparedness programs in urban areas of South and Southeast Asia, including Bangladesh, Nepal, Philippines, and Indonesia, because of limited understandings of the vulnerabilities of those groups in disaster contexts (Brown and Dodman 2014).

2.4 Caregivers' disaster preparedness and information access

As a result of the vulnerability and particularity of children and older adults in disaster contexts, their caregivers have higher demands for information to help them understand the disaster risks and take precautionary actions (Fung and Loke 2010; Hipper et al. 2018; Wakui et al. 2017). Disadvantages in accessing that information could have different impacts among different racial groups. Without adequate information that enables Asian caregivers to understand how to get prepared locally, they might tend to maintain the traditional beliefs or customs of their home countries, paying little attention to household disaster preparedness and specific needs of children and older adults (Brown and Dodman 2014; Jung et al. 2020; Lam et al. 2017). In contrast, other races could have rich local experiences in disaster preparedness and their disaster mechanisms could have been developed from the experiences of several generations (Lippmann 2011), e.g., in the disaster subculture of tornado alley, knowledge about precautions measures is transmitted across generations (Webb 2018). Therefore, we expect that information accessing could be more critical for Asian caregivers in being prepared than for caregivers of other races.

2.5 Hypotheses

Based on the above discussion, we developed four hypotheses.

Hypothesis 1 Individuals with either of the two types of caregiving responsibilities (i.e., 1) caring for children and (2) caring for those with older age and/or disabilities) will report better disaster preparedness than those who are not caregivers.

Hypothesis 2 The Asian will be less well-prepared than other major races, namely, White, African-American, and Native American.

Hypothesis 3 Asian caregivers will be less prepared than non-caregivers.

Hypothesis 4 The vulnerability of Asian caregivers will be magnified when there is a lack of information about how to get better prepared for disasters.

3 Methods

3.1 Data source and study sample

The data from the 2017 National Household Survey (NHS) were used in this study. Conducted by the U.S. Federal Emergency Management Agency (FEMA), NHS aims to track individual disaster preparedness concerning behaviors, attitudes, and motivations (Federal Emergency Management Agency 2020a). A nationally representative sample was randomly selected via landline or mobile telephone in English or Spanish, with hazard-specific oversamples including earthquake, tornado, wildfire, flood, hurricane, winter storm, extreme heat, and urban event. A total of 5042 adult respondents were included in the 2017 NHS (Federal Emergency Management Agency 2020a). The working sample in this study included 4316 out of the 4955 respondents who provided valid answers regarding their disaster preparedness. The variables of race and homeownership contributed to the major missingness of 10.4%.

3.2 Measures

3.2.1 Dependent variable

The dependent variable was individuals' disaster preparedness. Respondents were asked "Thinking about preparing yourself for a disaster, have you developed and discussed an action plan with your family, that includes information about how to leave your community or where to shelter, and have set aside supplies such as, food, water, and other essentials that allow you to be self-sufficient for at least three days?" Answers were measured from 0 = "I have NOT prepared, and I do not intend to prepare in the next year", 1 = "I have NOT prepared, but I intend to prepare in the next year", 2 = "I have NOT prepared, but I intend to prepare in the next six months", 3 = "I have been prepared for the last year", to 4 = "I have been preparing for MORE than a year". A higher score means better disaster preparedness.

3.2.2 Independent variable

Caregiving responsibility for children was measured by asking "whether there are any children under the age of 18 living in your household?" (0 = no, 1 = yes). Caregiving responsibility for older adults or disabled family members was assessed by the question "do you currently help care for an elderly or disabled family member, relative, or friend?" (0 = no, 1 = yes).

3.2.3 Moderators

The race was initially categorized into five single-race groups in the 2017 NHS: White, African-American, Asian, American Indian/Alaska Native, and Native Hawaiian/Pacific Islander. Due to the small sample sizes, we combined American Indian/Alaska Native and Native Hawaiian/Pacific Islander together as Native Americans. Therefore, four racial groups were finally operationalized in this study. Asian was the reference group to highlight the influence of this racial minority (i.e., a social vulnerability factor) on disaster preparedness compared to White and other racial groups.

Information access was assessed by asking “In the past six months, have you read, seen, or heard any information about how to get better prepared for a disaster. By disaster, I mean events that could threaten lives, disrupt public or emergency services like water and power, or damage property?” (0 = no, 1 = yes).

3.2.4 Control variables

Control variables included respondent’s age, gender, educational level, homeownership, disability, previous exposure to a disaster, response efficacy, and self-efficacy. Age was a continuous variable, ranging from 18 to 95. Gender was a binary variable (0 = male, 1 = female). Educational level was an ordinal variable ranging from 0 (i.e., less than high school diploma) to 5 (i.e., postgraduate work or degree). Homeownership was dichotomously measured by 0 = “rent a home” and 1 = “own a home”. Disability was assessed 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). Previous exposure to a disaster was measured by asking “Did you ever experience the impacts of a disaster yourself?” (0 = no, 1 = yes).

We also controlled for efficacy-related variables, which are shown to affect disaster preparedness (Grothmann and Reusswig 2006; Tang and Feng 2018). Response efficacy is the belief that preparedness is useful in protecting people from disasters, which was measured on a 5-point Likert scale by asking “How much would taking steps to prepare, such as creating a household emergency plan, developing an evacuation and shelter plan, signing up for alerts and warning systems, or stocking up on supplies help you get through a disaster in your area?” (from 0 = not at all to 4 = a great deal). Self-efficacy refers to an individual’s perceived ability to conduct precautionary actions, which was assessed by the question “How confident are you that you can take the steps to prepare for a disaster in your area?” on a 5-point Likert scale from 0 = “not at all confident” to 4 = “extremely confident”.

3.3 Data analyses

First, univariate analyses were performed to describe preparedness, caregiving responsibilities, race, access to information, and all control variables. Second, Pearson’s chi-squared tests were used to compare the racial differences in information access, caregiving responsibility for children, and caregiving responsibility for older or disabled adults. Third, multiple linear regressions with five models were conducted. Key variables and control variables were included in Model 1. The two-way interaction between caring for children and race was added in Model 2. The interaction between caring for older or disabled adults and race was added in Model 3. The three-way interactions among caregiving responsibilities,

race, and information access were also separately included in Model 4 for childcare and Model 5 for caring for older adults or those with disabilities. All analyses were conducted using Stata 15 (StataCorp 2017), with the significance level set at 5%.

4 Results

Table 1 summarizes the sample characteristics. The average preparedness of the whole sample was 2.31 ($SD=1.42$) out of the possible 4. The percentage of the participants who had children living in their households was 30.19%; and 16.77% of participants were caregivers of an older or disabled family member, relative, or friend. Whites accounted for the majority of the sample (80.33%), followed by African-Americans (13.83%), Asians (3.04%), and Native Americans (2.80%). The percentage of the participants who had received information about how to get prepared for a disaster in the past six months was 48.98%. The mean age of the whole sample was 52.75 ($SD=17.71$) years. Nearly half of them were female. Around three-fourths of the participants had some college education or higher levels of education.

As shown in Table 2, the proportion of participants who had information access differed by race ($\chi^2=31.13$, $p<0.001$). Forty-four percent of the Asian sample reported that they had received information about how to get prepared in the past six months, which was much lower than White (50.85%) and Native American (51.24%), but more than that of African-Americans (38.86%). There were significant differences in caregiving responsibility for children among the four racial groups ($\chi^2=43.65$, $p<0.001$). Thirty-five percent of Asian respondents had children under the age of 18 in the household, and this percentage was lower than that of African-Americans (39.03%) and Native Americans (44.63%), but higher than that of White (27.98%). Likewise, there were racial differences in caregiving responsibility for older adults ($\chi^2=14.05$, $p<0.01$), and Asian respondents reported the lowest proportion of caring for older or disabled family members, relatives, or friends (12.98%).

Table 3 presents the results of linear regressions with five models. Model 1 examined the association between caregiving responsibilities and disaster preparedness (Hypothesis 1) and the racial differences in preparedness level (Hypothesis 2). The results showed that having caregiving responsibilities for children ($B=0.14$, $p<0.01$) and for older/disabled adults ($B=0.10$, $p<0.05$) were both positively associated with better disaster preparedness. No racial differences were found in this main effect model. Individuals who had recent access to information about how to get prepared were more likely to report better preparedness ($B=0.60$, $p<0.001$). In terms of control variables, older age ($B=0.01$, $p<0.001$), being homeowners ($B=0.11$, $p<0.05$), previous disaster exposure ($B=0.47$, $p<0.001$), higher levels of response efficacy ($B=0.15$, $p<0.001$), or self-efficacy ($B=0.33$, $p<0.001$) were associated with better preparedness.

The interaction between race and caregiving responsibilities for children was added in Model 2 and the interaction between race and caregiving responsibilities for older or disabled adults was added in Model 3 to examine the moderating effect of race (Hypothesis 3). As illustrated in Fig. 1 (based on estimates from Model 2), Asian caregivers of children were the group whose disaster preparedness was most negatively affected by their caregiving responsibilities. The results demonstrated that compared to Asians, Whites ($B=0.53$, $p<0.05$), and Native Americans ($B=0.68$, $p<0.05$) reported higher levels of preparedness

Table 1 Sample characteristics ($N=4316$)

Variables	<i>N</i>	Percentage (%)	Mean (<i>SD</i> ^a)	Range
Disaster preparedness			2.31 (1.42)	0–4
<i>Caring for children</i>				
No	3013	69.81		
Yes	1303	30.19		
<i>Caring for older/disabled adults</i>				
No	3592	83.23		
Yes	724	16.77		
<i>Race</i>				
Asian	131	3.04		
White	3467	80.33		
African-American	597	13.83		
Native American	121	2.80		
<i>Access to information</i>				
No	2202	51.02		
Yes	2114	48.98		
Age			52.75 (17.71)	18–99
<i>Gender</i>				
Male	2236	51.81		
Female	2080	48.19		
<i>Educational level</i>				
Less than high school diploma	176	4.08		
High school degree or diploma	626	14.50		
Technical/vocational school	243	5.63		
Some college	1009	23.38		
College graduate	1270	29.43		
Postgraduate work or degree	992	22.98		
<i>Disability</i>				
No	3503	81.16		
Yes	813	18.84		
<i>Home ownership</i>				
Rent a home	1399	32.41		
Own a home	2917	67.59		
Response efficacy			2.80 (1.17)	0–4
Self-efficacy			2.97 (1.02)	0–4
<i>Previous disaster exposure</i>				
No	2391	55.40		
Yes	1925	44.60		

^a*SD*, standard deviation

when living with children. No significant interaction was found between race and caring for older or disabled adults in Model 3.

Model 4 and Model 5, respectively, included the three-way interaction among caring for children, race, and information access and the three-way interaction among caring for older

Table 2 Information access, caregiving responsibility for children, and caregiving responsibility for older adults by race ($N=4316$)

	Asian	White	African-American	Native American	Chi-square value
<i>Information access</i>					
No	74 (56.49%)	1704 (49.15%)	365 (61.14%)	59 (48.76%)	31.13***
Yes	57 (43.51%)	1763 (50.85%)	232 (38.86%)	62 (51.24%)	
<i>Caring for children</i>					
No	85 (64.89%)	2497 (72.02%)	364 (60.97%)	67 (55.37%)	43.65***
Yes	46 (35.11%)	970 (27.98%)	233 (39.03%)	54 (44.63%)	
<i>Caring for older adults of those with disabilities</i>					
No	114 (87.02%)	2,913 (84.02%)	467 (78.22%)	98 (80.99%)	14.05**
Yes	17 (12.98%)	554 (15.98%)	130 (21.78%)	23 (19.01%)	
Total	131	3467	597	121	

** $p < .01$, *** $p < .001$ for χ^2 test of racial differences in percentages of having information access, caring for children, and caring for older adults or those with disabilities

or disabled adults, race, and information access (Hypothesis 4). Only the former reached statistical significance, which meant that the vulnerability of Asian caregivers of children identified in Hypothesis 3 was stronger when there was no information access, or the vulnerabilities of Asian caregivers of children were magnified when there was no information access. To put it another way, information access was more important for Asian caregivers to overcome their barriers and disadvantages relative to non-caregivers to get prepared.

Figure 2 further shows how information access affected the interaction between caregiving responsibility for children and race. The left panel showed that compared to child caregivers of other major races, Asian caregivers of children reported a lower level of preparedness than caregivers of other races when there was no information access. While information access increased disaster preparedness of children caregivers of all racial groups, it also greatly reduced Asian caregivers' disadvantages relative to other races. The right panel showed that Asian non-caregivers were not very responsive to disaster preparation information. Thus, information access was more important for Asian caregivers than for Asian non-caregivers. When comparing caregivers (left panel) and non-caregivers (right panel), it was shown that Asian caregivers of children were the least prepared groups among all caregivers and non-caregivers. Without receiving the information regarding how to get better prepared for a disaster, Asian caregivers of children had obvious disadvantages in preparedness than Asian non-caregivers, while caregivers of other races even reported an advantage over non-caregivers of the same race. In contrast, with access to preparedness information, the disadvantage of Asian caregivers of children against Asian non-caregivers disappeared.

5 Discussion

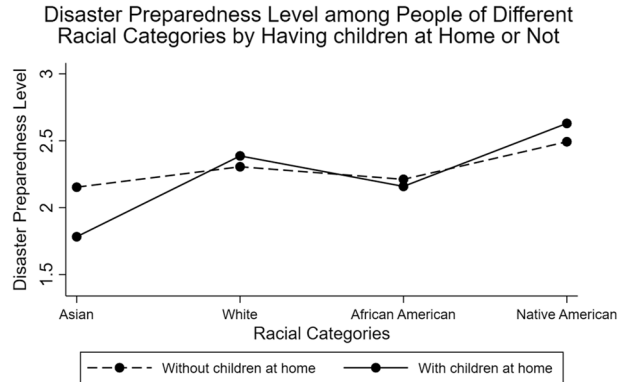
Guided by the social vulnerability perspective and the community-based theory, this study used a nationally representative sample in the US to investigate racial differences concerning disaster preparedness in the contexts of two types of caregiving

Table 3 Linear regression with moderators ($N=4316$)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>
Age	0.01***	0.01***	0.01***	0.01***	0.01***
Female (<i>ref</i> =male) ^a	−0.02	−0.02	−0.02	−0.02	−0.02
Educational level	−0.01	−0.00	−0.00	−0.00	−0.00
Disability (<i>ref</i> =no)	0.09†	0.09†	0.09†	0.09†	0.08
Home ownership (<i>ref</i> =rent a home)	0.11*	0.11*	0.11*	0.11*	0.10*
Response efficacy	0.15***	0.15***	0.15***	0.15***	0.15***
Self-efficacy	0.33***	0.33***	0.33***	0.33***	0.33***
Previous disaster exposure (<i>ref</i> =no)	0.47***	0.47***	0.47***	0.47***	0.47***
Caring for children (<i>ref</i> =no)	0.14**	−0.37	0.14**	−0.88**	0.13**
Caring for older/disabled adults (<i>ref</i> =no)	0.10*	0.10†	−0.16	0.10†	−0.17
<i>Race (ref=Asian)</i>					
White	0.01	−0.18	−0.03	−0.48*	−0.14
African-American	0.02	−0.15	0.02	−0.25	0.10
Native American	0.30†	0.04	0.25	−0.54†	−0.09
Access to information (<i>ref</i> =no)	0.60***	0.60***	0.60***	0.02	0.43†
<i>Caring for children × Asian</i>					
White		0.53*		1.11***	
African-American		0.48†		0.92**	
Native American		0.68*		1.33**	
<i>Caring for older/disabled adults × Asian</i>					
White			0.31		0.42
African-American			0.08		−0.00
Native American			0.35		0.45
<i>Caring for children × access to information</i>				1.17*	
<i>Caring for older/disabled adults × access to information</i>					−0.00
<i>Access to information × Asian</i>					
White				0.67*	0.24
African-American				0.20	−0.23
Native American				1.18**	0.69*
<i>Caring for children × Asian × access to information</i>					
White				−1.32**	
African-American				−1.09*	
Native American				−1.41*	
<i>Caring for older/disabled adults × Asian × access to information</i>					
White					−0.18
African-American					0.28
Native American					−0.21
<i>Model fit</i>					
<i>F</i> statistics	90.14	74.62	74.44	54.23	53.73
Degrees of freedom	14, 4301	17, 4298	17, 4298	24, 4291	24, 4291
<i>p</i> -value	<.001	<.001	<.001	<.001	<.001
Adjusted R-squared	22.43%	22.48%	22.44%	22.84%	22.68%

† $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$ ^aThe reference categories are in parentheses

Fig. 1 Disaster preparedness level by racial groups and child caregiver status



responsibilities, namely caring for children and caring for those with older age or disabilities. We further examined how access to information contextualized such differences.

Hypothesis 1 was supported. Individuals with caregiving responsibilities for children and caregivers of older adults or those with disabilities were both more likely to report higher levels of disaster preparedness, which was consistent with the previous literature (Bronfman et al. 2019; Levac et al. 2012). The special needs and dependence of children, older adults, and people with disabilities could motivate caregivers to develop disaster prevention plans out of a sense of responsibility to protect their care recipients (Becker et al. 2012; Pfefferbaum and North 2008). Moreover, disaster preparedness has been identified to be a useful and effective strategy to protect the safety of vulnerable groups (Christensen and Castañeda 2014), and thus caregivers are provided with diverse resources concerning how to make preparatory plans that could accommodate the needs of children and older adults (Centers for Disease Control and Prevention 2018; Zamboni and Martin 2020), which may further promote caregivers' disaster preparedness among the general population.

Hypothesis 2 was not supported. The main effect model did not show significant differences between Asian and other racial groups, which was inconsistent with some previous studies that demonstrated Asians were less likely to develop household emergency plans compared to Whites (Rivera 2020) or Asians reported lower levels of emergency supplies preparedness relative to Whites and African-Americans (Eisenman et al. 2006). This could be caused by the different measurements of disaster preparedness. Previous research tended to solely investigate individual's action-based preparedness (e.g., emergency plans) or resource-based preparedness (e.g., supplies), while the measure used in the present study required these two types of preparedness as well as family involvement, which addressed a more sophisticated scenario of preparation and were different from other studies that focus on a single dimension of preparedness.

Hypothesis 3 was partially supported because only the interaction between caregiving responsibilities for children and race was significant, not that for caring for older adults or those with disabilities. This finding highlighted the uniqueness of the Asian population in disaster preparedness and their vulnerability related to caregiving responsibilities. As we discussed earlier, compared to other races, Asian-Americans tend to have a higher level of caregiving burden when caring for children because caregivers who are more influenced by Asian cultures and values could face unique challenges in raising children who are more affected by Western cultures (DeLambo et al. 2011; Weng 2017), which may force Asian

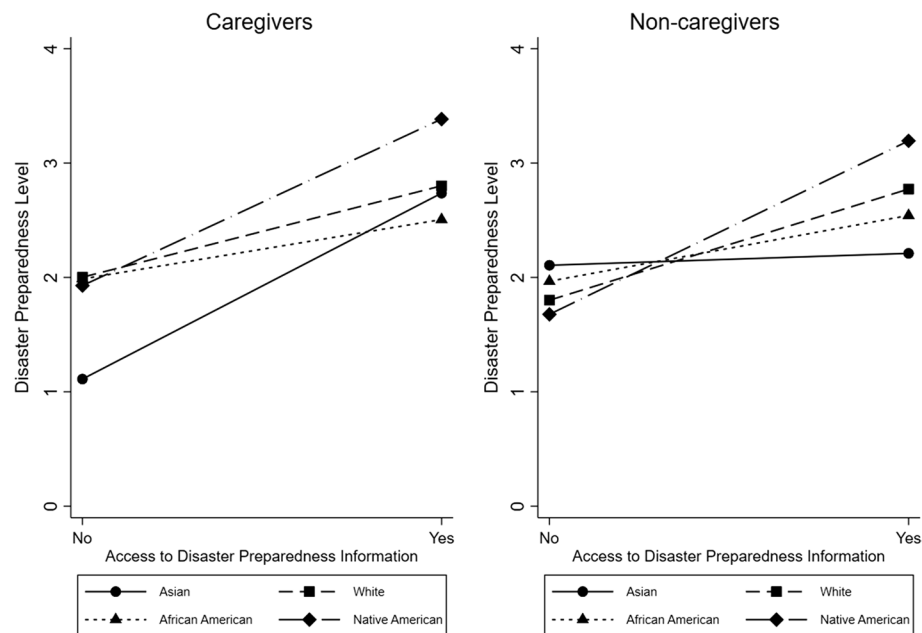


Fig. 2 Disaster preparedness level by racial groups, access to information, and child caregiver status

caregivers to focus more on dealing with caregiving issues rather than disaster preparedness. In addition, Asian caregivers may have language and cultural barriers in reaching for information about child-friendly household disaster preparedness from sources outside the community (Mathew and Kelly 2008); and caregiving would also reduce the time caregivers spend on watching the news or listening to radios which are extremely important sources for Asian parents to learn disaster-related information outside their communities (Nepal et al. 2012). Moreover, Asian communities have limited resources to provide Asian caregivers with needed resources to be prepared for disasters while considering the special needs of children because of immature development of disaster preparedness mechanisms (Ready Campaign 2013). As a result, Fig. 1 shows that when having children at home, Asians had a distinct decrease in disaster preparedness compared to other major races. In addition, despite the general better preparedness among child caregivers, Asian child caregivers were much less prepared than the non-caregivers of the same race. The interaction between race and caring for older adults or those with disabilities was not significant. This could be because the number of Asian caregivers for older or disabled adults was small (i.e., 17) and thus there was insufficient statistical power to detect differences.

Hypothesis 4 was partially supported. Figure 2 (left panel) shows that compared to child caregivers of other major races, Asian caregivers of children reported a lower level of preparedness when there was no information access; or, in other words, the vulnerability of Asian caregivers of children was magnified when there was no information access. This finding highlighted the importance of recent access to disaster preparedness information for Asian caregivers of children and the information divide that distinguishes their preparedness. Asian caregivers of children were especially vulnerable when there was no information access and reported a lower level of preparedness. But when preparedness-related information was received, such as in the situations when Asian caregivers receive

preparedness-related information from diverse sources including community training or education, military service, media outlets, schools, church, and workplace. Asian caregivers can also be well equipped with relevant knowledge and take effective household precautionary actions for disasters, like other major races (Jung et al. 2020; Mathew and Kelly 2008). In the absence of recent information, however, caregivers of children from other major races may draw from social capital that is not available to Asian caregivers, such as rich local experiences as well as knowledge and preparedness culture transmitted across generations, and thus show higher levels of disaster preparedness than Asian child caregivers (Lippmann 2011; Webb 2018). Figure 2 (right panel) shows Asian non-caregivers reported little difference in disaster preparedness whether they received information or not, but non-caregivers of other races presented an increase in preparedness level with information access. The lack of response to information among Asian non-caregivers may indicate non-caregivers' lack of integration with the external society and thus lack of support to get prepared even with information access, which in contrast could be available to Asian caregivers via school-based requirements and community-based support for parents (Heptulla et al. 2016; Mathew and Kelly 2008; Zamboni and Martin 2020). Because of the lack of studies in this area, future studies could further examine the barriers for Asian non-caregivers to get more prepared even with information access.

In terms of control variables, age, previous disaster exposure, homeownership, response efficacy, and self-efficacy were all significant predictors of individuals' disaster preparedness, which was consistent with previous research (Eisenman et al. 2009; Grothmann and Reusswig 2006; Wakui et al. 2017). The factors of age and previous exposure to disasters are usually intertwined. Older adults tend to have more lifetime experiences of disasters and thus have a better understanding of their own vulnerabilities in disaster contexts, possible consequences of disasters, and the importance of being prepared (Tuohy et al. 2014), which can encourage them to prepare. In addition, older adults could have more time to communicate with physicians and others about how to prepare as a result of retirement (Tomio et al. 2012), which may also contribute to their better preparedness. Homeowners care more about their belongings and houses and have more chances to make structural changes to houses than tenants, which can motivate their protective responses (Grothmann and Reusswig 2006). Interestingly, homeowners usually feel confident that their own houses have been well built to survive in disasters (Ripley 2006), which may further explain their better perception of disaster preparedness. The roles of response efficacy and self-efficacy in promoting precautionary actions have also been theoretically and empirically supported in previous studies concerning disasters, such as earthquakes, floods, and wildfires (Bubeck et al. 2013; Martin et al. 2007; Tang and Feng 2018).

There are some limitations in the present study. First, the disaster preparedness examined in this study included both action-based (e.g., evacuation plan) and resource-based (e.g., supplies such as food and water) preparedness, which catch different aspects of disaster preparedness. For example, Zamboni and Martin (2020) found that families with children may have less disposable income and thus be less likely to prepare for resource-based items, but they would be more likely to have communication plans and meeting locations (i.e., action-based preparedness) according to school requirements. A similar situation was also reported by family caregivers of older adults that the average percentage of caregivers who prepared household communication plans or evacuation plans (i.e., action-based preparedness) outnumbered that of caregivers who stored food or prepared emergency kits (i.e., resource-based preparedness) (Kyota et al. 2018). Second, in this study, Asians were regarded as one racial group and we were unable to consider the heterogeneity in preparedness among this group who has diverse origins of East, Southeast, and South Asia due to

data limitation. For instance, Green et al. (2020) revealed that Chinese and Korean were less likely to prepare emergency kit items as a result of the lack of disaster experiences, while Filipino and Vietnamese tended to have disaster kits due to their rich experiences in disaster training and exposure to previous disasters in their home countries. Thus, there is a need to examine Asian communities with different origins to identify their specific barriers and needs in disaster preparedness. Third, the vulnerability of Asian caregivers in disaster preparedness could be associated with factors related to their immigration status, such as language barriers, community isolation, and cultures in countries of origin (such as over-relying on governmental agencies for disaster preparation), but we did not have access to the measure of immigration status and those relevant factors due to secondary data limitations. Fourth, we were not able to distinguish caregivers for older adults and caregivers for people with disabilities. Moreover, studies on racial minorities usually will face challenges of a small sample size. Although we used a national dataset with a large sample size, when we narrowed down our questions to caregiving for older adults and those with disabilities, the number of Asian caregivers was small, which limited the statistical power of analyses. Similarly, we combined American Indian/Alaska Native and Native Hawaiian/Pacific Islander because of their small sample sizes and would thus overlook their differences. But our effort of focusing on Asians who have long been understudied in the previous literature outweighs those limitations. Even though our analyses concerning caregivers of older adults and those with disabilities were underpowered, the hypotheses we proposed could be used to guide future studies when sufficient data are available.

Despite these limitations, this study has several important contributions and implications. First, disaster preparedness among Asians is usually understudied and they are less likely to be compared to other races as a result of difficulties in accessing a sample with enough Asians. Thanks to a large national survey, we were able to compare across different races with a focus on Asians. Second, the findings highlight unique vulnerabilities among Asian communities and caution against the general understanding that caregivers are better prepared. Third, the findings highlight the importance of information access for Asian communities. Based on these findings, tailored intervention strategies can be developed to assist Asians with caregiving responsibilities to get better prepared for disasters. For example, public disaster management agencies should collaborate with Asian community organizations and involve them in disaster planning. They should provide materials and training in different languages by culturally and linguistically competent staff and volunteers for Asians who may have language barriers. These resources should also include specific and detailed tips and guidance for caregivers based on care recipients' special needs in disaster contexts. In addition, disseminating the information regarding how to get better prepared should be one priority of disaster management agencies at different levels in their work with Asian communities, given the importance of information access to Asian caregivers. For instance, agencies can provide time-flexible meetings, training, and educations in a variety of forms for Asians with caregiving responsibilities to learn how to make preparatory plans that address the special needs of vulnerable care recipients.

6 Conclusion

This study contributed to the literature by directing attention to Asian-Americans who were seldom examined in previous disaster research and focused on their disaster preparedness when having different caregiving responsibilities. The results of this study highlight

two major findings. First, despite the general better preparedness among caregivers, Asian caregivers of children are more likely to be disadvantaged than non-caregiver of the same race. Asian caregivers of children were the least prepared among both caregivers of children and non-caregivers across all racial groups. Second, disaster information access is more important to differentiate preparedness among caregivers of children among the Asian than among other races, i.e., the vulnerability of Asian caregivers was magnified when there was no information access. Based on these findings, tailored intervention strategies and programs can be designed to promote disaster preparedness of Asian caregivers, through information-based educations and collaborations between mainstream disaster management agencies and Asian communities.

Acknowledgement We would like to acknowledge the invaluable support from Dr. Daan Liang.

Funding This work is partially supported by the National Science Foundation [CMMI 1839516] and the National Institute of Standards and Technology [70NANB19H061].

Data availability All data used during the study are available in a repository online (Federal Emergency Management Agency (2020a, b) 2017 National household survey. <https://www.fema.gov/about/openfema/data-sets/national-household-survey>).

Declarations

Conflict of interest The authors have no relevant financial or non-financial interests to disclose.

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

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