

Predictors of Emergency Preparedness Among Parents in Hawaii: A Cross-Sectional Survey

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Original Research

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Abstract

Objective: To determine factors predicting emergency preparedness (EP) behaviors among Hawaii parents.

Methods: A cross-sectional online survey of parents of children (age 0–12 y) living in Honolulu, Hawaii, in March 2023 examined associations with (1) having an EP kit (supplies for use during emergencies) and (2) having a family emergency plan (what to do, where to go, how to communicate during emergencies) with demographics/household characteristics and theoretical constructs of the Health Belief Model. A multivariable regression model obtained odds ratios and 95% confidence intervals.

Results: Participants ($N = 278$) were mainly female (84%), college-educated (68%), and were similar in diverse racial/ethnic composition (White; 13.3%) to the overall Honolulu County. Logistic regression determined participants with lower perceived susceptibility to disasters, greater time barriers, and those who needed help to prepare for emergencies were less likely to have an EP kit. Among participants without an EP kit, a website able to create personalized instructions for household EP would be useful. Participants who needed help to prepare for emergencies were less likely to have a family emergency plan.

Conclusions: Future interventions should focus on evidence-based strategies that improve self-efficacy associated with developing EP kits and family emergency plans.

Emergency preparedness (EP) is a major public health priority as the range of hazards threatening communities are mounting. Health emergencies, including those caused by extreme weather events and infectious disease outbreaks, are predicted to rise in frequency and intensity due to climate change.¹ Preparing households for emergencies is a key aspect of reducing vulnerability and exposure to the negative impact that these sudden calamitous events have on families, and is included among the public health priorities of the United States (US) Department of Health and Human Services, Healthy People 2030.² Households in the US have consistently been found to be unprepared for emergencies.^{3–5} Barriers precluding households from carrying out EP recommendations are varied, such as a lack of awareness on how to prepare for emergencies, financial constraints, busy schedules, and language or cultural barriers.^{6,7} The US Federal Emergency Management Agency (FEMA) reported that nationwide, the proportion of households that had taken EP actions increased in 2020 during the coronavirus disease 2019 (COVID-19) pandemic, but has subsequently declined in 2021 and again 2022.⁸

Children are at greater risk during emergencies due to factors that contribute to their physical vulnerability, including dependency on adults to provide for them, an inability to communicate symptoms, and need for specialized medicine or equipment that may be difficult to obtain during emergencies.⁹ Children are also disproportionately affected by social disruptions during health emergencies, including displacement and interrupted schooling. The Centers for Disease Control and Prevention (CDC) provides recommendations on how parents (i.e., primary caregivers) can improve EP behaviors to contribute to safeguarding children from the impact of health emergencies. One recommendation is to assemble an EP kit that includes essential supplies to sustain basic household needs, such as non-perishable food, water, medicines and medical supplies, and personal hygiene items. Another recommendation is to maintain a family emergency plan that identifies potential hazards, locates meeting points and evacuation routes, and establishes communication methods to contact and coordinate with each other during emergencies.⁹ Families in the US as well as those in Hawaii have been found to be ill-prepared for emergencies.^{5,10}

Therefore, the purpose of this study was to determine factors predicting EP behaviors (preparedness with an emergency kit as well as an emergency plan) among Hawaii parents with young children (aged 0–12 y). The aims were to (1) uncover knowledge, attitudes, and behaviors related to household EP (kit and plan), and (2) determine factors associated with EP (kit and plan) among families with young children. The study was informed by the Health Belief Model (HBM), a widely used model designed to inform short-term and long-term behavior change

strategies.¹¹ The HBM consists of 6 main constructs believed to influence decision-making regarding preventative health behaviors: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues to action. Findings provide a foundation for intervention development to build preparedness among families in Hawaii and other locales.

Methods

Study Design and Participants

A cross-sectional online survey of parents living on the island of Oahu, Hawaii, was conducted in March 2023. Participants were recruited by means of the YMCA of Honolulu, which was selected as a study partner due its island-wide programs and facilities that serve diverse communities (rural and urban; varied socioeconomic/racial/ethnic compositions), and its broad range of children programs (preschool through adolescent). Inclusion criteria were: (1) adults aged 18 y or over; (2) able to read English; (3) access to a computer or other Web-enabled device; and (4) parent/caregiver of a child aged 0-12 y old. This age range of children was selected because they are dependent upon their parents for basic needs, and thus would be highly impacted by their parents' EP behaviors during health emergencies. The YMCA of Honolulu promoted participation by sending the study flyer to email listservs for programs serving children in the targeted age-range. The email provided basic study information and a link to a secure online survey platform, Qualtrics®. Eligible participants provided electronic consent before starting the survey. A \$20 gift card was offered as compensation for participation. The study was approved by the University of Hawaii Institutional Review Board.

Measures

Dependent variables

To gain insight into the EP status of the participating families, 2 outcome variables were considered: (1) having an EP kit and (2) having a family emergency plan. To assess the EP kit outcome, the following 2 questions were used: "Do you have a family emergency preparedness kit (supplies to be used in case of any type of disaster)?" and if the answer was "No," we asked, "Do you intend to make a family emergency preparedness kit in the next 30 d." The EP kit was categorized as "Yes" (if the answer was Yes to the first question), "Intend" (if the answer was Yes to the second question), and "No" (if the answer was No to both questions). To assess the family emergency plan outcome, following 2 questions were used: "Do you have a family emergency plan?" and similarly if the answer was "No," we asked, "Do you intend to develop a family emergency plan within the next 30 d?" Similar to the EP kit, the family emergency plan was categorized as "Yes" (if the answer was Yes to the first question), "Intend" (if the answer was Yes to the second question), and "No" (if the answer was "No" to both questions).

Independent variables

Independent variables included questions that were based on the HBM, and the 6 main constructs of the model were assessed. Reliable measures were adapted from previously published studies to assess variables of interest.¹²⁻¹⁵ All items were assessed on a 5-point Likert scale (strongly agree to strongly disagree). The questions were as follows: (1) perceived susceptibility, "Preparing my family for emergencies or disasters is important;" (2) perceived severity, "An emergency or disaster would be a significant problem for my family," "I am afraid of dying from a natural disaster," and

"I am afraid of dying from a disease outbreak;" (3) perceived benefit, "Preparing my family for disasters or other emergencies may decrease our risk of death, injury, or illness" and "Preparing makes me feel less worried about possible emergencies;" and (4) Perceived barriers were assessed using 4 questions, including whether there is no use in preparing for disasters if it is God's will (my destiny) to be in a disaster, whether it is too expensive for me to prepare for emergencies, whether they lack time to prepare, whether it is too stressful to prepare. Finally, (5) self-efficacy was assessed by asking whether they do not know how to prepare for emergencies and whether they need help learning how to prepare for an emergency, and (6) cues to action were assessed by asking participants about the usefulness of getting EP information from 6 sources, including their child's school, a doctor or nurse, community organizations (eg, YMCA, church), city or state government agencies, websites or apps that could create a personalized family emergency plan, and text message notifications from Honolulu County or the State of Hawaii.

Sociodemographics measured included gender (female, male, or something else), race/ethnicity (all predominant race/ethnicities in Hawaii were listed), family composition, education, food security, and household income. Race/ethnicity was categorized based on response distribution and included White, Native Hawaiian and Pacific Islander (NHPI), Japanese, Filipino, Other Asian (eg, Chinese, Korean), and Other (eg, Hispanic, African American, American Indian, or Alaska Native). Education was assessed as some high school, high school graduate, some college, and college graduate or higher. Based on response distribution, we regrouped the categories to some college or less and college graduate or higher. Similarly, household income was assessed as less than \$35,000; \$35,000 to \$49,999; \$50,000 to \$74,999; \$75,000 to \$99,999; \$100,000 to \$149,999; \$150,000 or more, and prefer not to answer. Categories were regrouped as <\$75,000, \$75,000-\$150,000, >\$150,000, and prefer not to answer.

Food security was evaluated using a question: "In the last 12 mo, did you ever eat less than you felt you should because there wasn't enough money to buy food?" Participants were considered to have food security if they answered "No." This question was derived from the PhenX Toolkit on food insecurity.¹⁶ Family composition was assessed by asking participants about the number of people living in their home including themselves and categorizing them into 6 age group questions: infant (0-2), toddler (3-4), school age (5-12), teen (13-18), adults (19-64), and old adults (65 y or older). The total number of family members was computed by summing these questions.

Statistical Analysis

Descriptive analyses were conducted using frequencies and percentages for categorical variables and means and standard deviations (SDs) for continuous variables. Chi-square tests and 2-sample t-tests were used to compare subject characteristics between parents who completed the survey and those who did not. Additionally, chi-squared tests and 1-way analysis of variance were used to examine the bivariate association between potential factors and binary outcomes (EP kit and family emergency plan). Variables with a *P*-value less than 0.05 in bivariate analyses were included in a multinomial logistic regression model to identify factors associated with EP kit and family emergency plan. The "No" group was assigned as the reference. Adjusted odds ratios (AORs) and 95% confidence intervals (CIs) were reported to

evaluate the strength of the identified factors. To examine the effect of missing data on the analysis, a sensitivity test was conducted. This comprised generating 20 imputed datasets through multiple imputation, fitting multinomial logistic regression models to these datasets, and pooling the results of the analyses for the summary. All analyses were conducted in R version 4.2.1 and statistical significance was set to a P -value of <0.05 .

Results

Study Sample and Missing Data Analysis

Three hundred and twenty parents provided online consent and of those 278 participants completed the survey. There were no significant differences in outcome variables between participants who completed the survey and those who did not. However, there were some differences in a few socio-demographic variables. Participants who did not complete the survey were more likely to have a college graduate or higher, preferred not to respond regarding their income level and food security, and had a smaller number of school-aged children. Analysis was conducted on the final sample, $N = 278$.

Descriptive Analysis

Most participants were females (84.2%) and had a college degree or higher (68.3%). There was a relatively balanced distribution of race/ethnicity across the sample, with the largest group being Japanese (25.2%), followed by Filipino (19.1%), NHPI (16.5%), Other Asian (13.7%), White (13.3%) and Other (12.2%). Additionally, two-thirds (66.5%) reported feeling secure in terms of their food supply (Table 1).

In total, approximately half of the participants ($n = 141$; 50.7%) reported having an EP kit, 49 parents (17.6%) intended to create one within 30 d, and 88 participants (31.7%) neither had nor intended to have an EP kit. Fewer participants reported ($n = 116$; 41.7%) having a family emergency plan. Of these 82 participants (29.5%) intended to develop one within 30 d, and 80 participants (28.8%) neither had nor intended to have one. Additionally, 80 participants (28.8%) reported having both an EP kit and a family emergency plan while 101 participants (36.3%) reported not having either of these.

Bivariate Analysis for Emergency Preparedness Kit

Table 1 presents the characteristics of the study participants as well as the bivariate associations between these characteristics and having an EP kit. The following factors showed a significant bivariate association with having an EP kit: education, food security, number of family members, perceived susceptibility, perceived benefit of worry reduction, all 4 perceived barriers, the 2 self-efficacy measures, and cues from doctor or nurse and website or app. Participants with an EP kit were more likely to have a college education and food security. They also exhibited higher self-efficacy scores and lower mean scores on perceived barriers.

Participants who reported intention to have an EP kit had larger family sizes, and highest scores for acting on cues when compared with the other 2 groups. Participants who did not have nor intended to have an emergency kit had the lowest mean scores on perceived susceptibility and perceived benefit of worry reduction.

Multinomial Logistic Regression Analyses for Emergency Preparedness Kit

Table 2 displays the AORs and 95% CIs for the multinomial logistic regression model of having an EP kit. The analysis revealed significant variables that differentiate between those who had an EP kit and those who did not, including perceived susceptibility, barrier due to time, and 1 self-efficacy measure. Individuals with a higher perceived susceptibility score were more likely to have an EP kit (AOR = 2.71; 95% CI = 1.53–4.79), while those with a higher score on time barrier were less likely to have one (AOR = 0.58; 95% CI = 0.38–0.88). Similarly, those with a lower score on self-efficacy (ie, I don't know how to prepare for emergencies) were less likely to have an EP kit (AOR = 0.54; 95% CI = 0.36–0.81). Only 1 significant variable (the number of family members) differentiated those who intended to create a family emergency plan in the future and those who did not have a plan nor intention to create one. For every 1-unit increase in the number of family members, the odds of intending to create an EP kit increases by a factor of 1.25 (95% CI = 1.01–1.55). The results obtained from multiple imputation were similar (see Appendix 1).

Bivariate Analysis for Family Emergency Plan

Table 3 shows the bivariate associations between various characteristics and having a family emergency plan. Several factors showed significant bivariate associations with having a family emergency plan. These factors include being female, number of school-aged children, having older adult(s) in the household, perceived susceptibility, perceived severities regarding emergency or natural disaster, perceived benefit of worry reduction, perceived barriers in preparation time and stress related to preparing, 2 self-efficacy measures, and receiving a cue from website or app (see Table 3).

Participants who intended to create a family emergency plan had the highest percentages of female respondents or having older adults in their households, as well as the highest number of school-aged children compared with the other 2 groups. Additionally, participants who intended to create a family emergency plan had the highest mean score on perceived susceptibility, perceived severity of natural disaster, perceived benefit of worry reduction, and cue from website or app. Participants who neither had nor intended to create a family emergency plan had the highest mean scores on perceived barriers and lowest mean scores on self-efficacy.

Multinomial Logistic Regression Analyses for Family Emergency Plan

Table 4 presents the results of the multivariable logistic regression model for family emergency plan. Parents with higher self-efficacy were more likely to have a plan (AOR = 0.59; 95% CI = 0.40–0.88). The analysis indicates the only variable that significantly differentiated those who intended to create a family emergency plan and those who did not was the cue to action of receiving an emergency text message (AOR = 2.00; 95% CI = 1.21–3.31). The results obtained from multiple imputation were similar (see Appendix 2).

Discussion

This cross-sectional study sought to identify factors influencing parents' attitudes and behaviors relate to EP in Hawaii. The study found that only slightly more than a quarter of participants (28.8%)

Table 1. Subject characteristics by emergency preparedness kit and emergency plan

Variable	Total N = 278	Emergency preparedness kit			P-Value
		Have N = 141	Intend N = 49	No N = 88	
Gender					0.494
Female	234 (84.2%)	117 (83.0%)	44 (89.8%)	73 (83.0%)	
Male or something else	44 (15.8%)	24 (17.0%)	5 (10.2%)	15 (17.0%)	
Race/ethnicity					0.180
White	37 (13.3%)	20 (14.2%)	3 (6.1%)	14 (15.9%)	
NHPI	46 (16.5%)	17 (12.1%)	13 (26.5%)	16 (18.2%)	
Japanese	70 (25.2%)	42 (29.8%)	14 (28.6%)	14 (15.9%)	
Filipino	53 (19.1%)	29 (20.6%)	8 (16.3%)	16 (18.2%)	
Other Asian	38 (13.7%)	17 (12.1%)	6 (12.2%)	15 (17.0%)	
Other	34 (12.2%)	16 (11.3%)	5 (10.2%)	13 (14.8%)	
Education					0.005
Some college or lower	88 (31.7%)	33 (23.4%)	23 (46.9%)	32 (36.4%)	
College graduate or higher	190 (68.3%)	108 (76.6%)	26 (53.1%)	56 (63.6%)	
Income					0.182
<\$75,000	94 (33.8%)	42 (29.8%)	20 (40.8%)	32 (36.4%)	
\$75,000-\$150,000	97 (34.9%)	46 (32.6%)	15 (30.6%)	36 (40.9%)	
>\$150,000	63 (22.7%)	39 (27.7%)	8 (16.3%)	16 (18.2%)	
Prefer not to answer	24 (8.6%)	14 (9.9%)	6 (12.2%)	4 (4.5%)	
Food security					0.017
Secured	185 (66.5%)	105 (74.5%)	28 (57.1%)	52 (59.1%)	
Other	93 (33.5%)	36 (25.5%)	21 (42.9%)	36 (40.9%)	
Have infant(s)	52 (18.7%)	24 (17.0%)	9 (18.4%)	19 (21.6%)	0.688
Have toddler(s)	44 (15.8%)	22 (15.6%)	6 (12.2%)	16 (18.2%)	0.656
No. of school aged kids (5-12)	1.4 ± 0.7	1.4 ± 0.7	1.5 ± 1.0	1.2 ± 0.6	0.062
No. of adults (19-64)	1.8 ± 1.0	1.8 ± 1.0	2.0 ± 1.0	1.8 ± 1.2	0.353
Have teen(s)	75 (27.0%)	34 (24.1%)	13 (26.5%)	28 (31.8%)	0.441
Have older adult(s)	28 (10.1%)	13 (9.2%)	8 (16.3%)	7 (8.0%)	0.264
No. of family members	4.1 ± 1.7	4.0 ± 1.5	4.6 ± 2.0	3.9 ± 1.7	0.035
Susceptibility: Preparing my family for emergencies or disasters is important	4.6 ± 0.7	4.7 ± 0.5	4.7 ± 0.5	4.2 ± 0.9	< 0.001
Severity: An emergency or disaster would be a significant problem for my family	4.1 ± 1.0	4.0 ± 1.0	4.2 ± 0.8	4.1 ± 1.0	0.131
Severity: I am afraid of dying from a natural disaster	3.3 ± 1.2	3.2 ± 1.2	3.7 ± 1.1	3.3 ± 1.4	0.105
Severity: I am afraid of dying from a disease outbreak	3.4 ± 1.2	3.3 ± 1.2	3.8 ± 1.1	3.4 ± 1.4	0.051
Benefit: Preparing my family for disasters or other emergencies may decrease our risk of death, injury or illness	4.3 ± 0.8	4.3 ± 0.8	4.4 ± 0.7	4.2 ± 0.8	0.314
Benefit: Preparing makes me feel less worried about possible emergencies	4.3 ± 0.8	4.4 ± 0.7	4.4 ± 0.8	4.0 ± 0.9	0.003
Barrier: There is no use in preparing for disasters if it is God's will (my destiny) to be in a disaster	2.0 ± 1.1	1.8 ± 1.0	2.0 ± 1.2	2.4 ± 1.2	< 0.001
Barrier: It is too expensive for me to prepare for emergencies	2.7 ± 1.2	2.3 ± 1.2	3.1 ± 1.2	3.0 ± 1.2	< 0.001
Barrier: I don't have time to prepare for emergencies	2.6 ± 1.1	2.2 ± 1.0	2.8 ± 1.1	3.2 ± 1.1	< 0.001
Barrier: It is too stressful to prepare my family for emergencies	2.5 ± 1.1	2.1 ± 1.0	2.7 ± 1.2	3.0 ± 1.0	< 0.001
Self-efficacy: I don't know how to prepare for emergencies	2.6 ± 1.2	2.0 ± 1.1	2.9 ± 1.3	3.2 ± 1.1	< 0.001
Self-efficacy: I need help learning how to prepare for an emergency	3.0 ± 1.2	2.6 ± 1.1	3.2 ± 1.2	3.4 ± 1.1	< 0.001
Cue: From my child's school	4.2 ± 0.9	4.2 ± 0.9	4.3 ± 0.9	4.2 ± 0.8	0.715
Cue: From my doctor or nurse	3.7 ± 1.1	3.6 ± 1.1	4.2 ± 0.8	3.6 ± 1.0	0.005
Cue: A community organization (e.g., YMCA, church)	4.0 ± 0.9	4.0 ± 0.9	4.1 ± 0.8	4.0 ± 0.8	0.562
Cue: City or state government agency	4.4 ± 0.8	4.4 ± 0.8	4.5 ± 0.7	4.3 ± 0.8	0.562
Cue: Website or app	4.3 ± 0.8	4.2 ± 0.9	4.6 ± 0.6	4.3 ± 0.9	0.019
Cue: Receiving emergency text message notifications from Honolulu County or the State of Hawaii	4.9 ± 0.4	4.9 ± 0.4	4.9 ± 0.5	4.9 ± 0.5	0.888

Abbreviation: NHPI, native Hawaiian and other Pacific Islander.

Note: n (%) or mean ± SD. Other racial/ethnic group includes Hispanics. P-value was computed by chi-squared test for categorical variable and one-way analysis of variance for continuous variable. Bold value represents a p-value < 0.05.

Table 2. Adjusted odds ratios and 95% confidence intervals for multinomial logistic regression model for emergency preparedness kit

Variable	Have vs. No	P-value	Intend vs. No	P-Value
	AOR (95% CI)		AOR (95% CI)	
Education				
Some college or lower	Reference		Reference	
College graduate or higher	1.54 (0.74, 3.20)	0.254	0.65 (0.29, 1.47)	0.302
Food security				
Secured	Reference		Reference	
Other	0.70 (0.34, 1.43)	0.331	0.86 (0.37, 2.01)	0.733
No. of family members	0.94 (0.76, 1.15)	0.545	1.25 (1.01, 1.55)	0.043
Susceptibility: Preparing my family for emergencies or disasters is important	2.71 (1.53, 4.79)	0.001	1.45 (0.75, 2.84)	0.271
Benefit: Preparing makes me feel less worried about possible emergencies	1.15 (0.74, 1.78)	0.540	1.53 (0.89, 2.63)	0.128
Barrier: There is no use in preparing for disasters if it is God's will (my destiny) to be in a disaster	0.96 (0.69, 1.33)	0.788	0.82 (0.57, 1.20)	0.318
Barrier: It is too expensive for me to prepare for emergencies	1.05 (0.75, 1.38)	0.760	1.25 (0.84, 1.86)	0.272
Barrier: I don't have time to prepare for emergencies	0.58 (0.38, 0.88)	0.010	0.76 (0.47, 1.24)	0.274
Barrier: It is too stressful to prepare my family for emergencies	0.96 (0.63, 1.47)	0.866	0.96 (0.59, 1.56)	0.878
Self-efficacy: I don't know how to prepare for emergencies	0.54 (0.36, 0.81)	0.003	0.93 (0.58, 1.48)	0.749
Self-efficacy: I need help learning how to prepare for an emergency	1.04 (0.70, 1.33)	0.856	0.98 (0.62, 1.56)	0.940
Cue: Website or app	0.97 (0.69, 1.37)	0.884	1.50 (0.96, 2.35)	0.074
Cue: Receiving emergency text message notifications from Honolulu County or the State of Hawaii	0.69 (0.44, 1.09)	0.113	1.19 (0.64, 2.23)	0.586

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval.

Note: The reference level for the outcome is "No" category. Bold values represent a *P*-value < 0.05.

reported having both an EP kit and family emergency plan, while 36.3% of participants reported not having either. Half (50.7%) the participants had an EP kit and less than half (41.7%) reported having a family emergency plan. Few studies have examined parent EP behaviors in Hawaii. Strid et al.¹⁰ found 63% of mothers who had a recent live birth in Hawaii in 2016 had enough supplies at home for at least 7 d and 41% had an evacuation plan for their children. Few Hawaii households were prepared for a pandemic at the onset of the COVID-19 pandemic,¹⁷ though some parents adopted new EP behaviors during the pandemic.¹⁸ At the nation level, FEMA's 2022 National Household Survey on Disaster Preparedness found that only 33% of respondents had assembled emergency supplies and less than half (41%) reported making a family emergency plan.⁸ These findings suggest that much work is needed at local and national levels to achieve the Healthy People 2030 goal of improving the proportion of the population prepared for health emergencies. The low levels of family EP found in this study are highly concerning considering Hawaii's unique disaster vulnerability. Climate change is driving sea level rise and more frequent and powerful storms, putting Hawaii's homes and critical infrastructure (healthcare facilities, roads, powerlines) at risk for damage or loss. Additionally, the state is heavily dependent on imported goods and fuel, and unlike other states, its remote location in the Pacific Ocean means there are no neighboring jurisdictions to offer immediate assistance and supplies, leaving it in a precarious situation if a large-scale disaster occurs. These factors in combination render families in Hawaii at extremely high risk for disaster health impact.

Several factors significantly predicted having an EP kit. A belief that preparing for emergencies is important (perceived susceptibility) increased odds (AOR = 2.71); however, not having time (barrier) and not knowing how to prepare (self-efficacy) both decreased the odds (AOR = 0.58; AOR = 0.54, respectively) of having an EP kit. In terms of having a family emergency plan, only

not knowing how to prepare (self-efficacy) significantly decreased the odds (AOR = 0.59) of having a plan. These findings reflect other findings from other studies,¹⁹ indicating a need for more targeted efforts to mitigate common barriers to EP behaviors and promote self-efficacy.

This study also indicates an opportunity to improve EP behaviors rates, as 17.6% of participants intended to create an EP kit and 29.5% intended to develop a family emergency plan within 30 d. Findings indicate that the increasing number of family members living in a household significantly increased the odds (AOR = 1.25) of intention to create an EP kit and receiving an emergency text message notification increased the odds (AOR = 2.0) of intention to develop a family emergency plan. Nationally, half of the respondents of a 2022 FEMA survey on household preparedness intended to take some EP action sometime in the future.⁸ This encouraging fact indicates that future targeted interventions designed to bridge the intention-behavior gap²⁰ may result in improved proportions of families taking EP action.

Previous studies have examined demographic and socioeconomic characteristics as being factors influencing household EP behaviors though results have been mixed.^{21–23} In this study, while bivariate analyses found some demographic and socioeconomic characteristics (gender, race/ethnicity, education, income, food security) were associated with outcome variables, none of these factors were found to be significant in the multinomial logistic regression analyses. Presence of children in a household has also been reported as a predictor of EP.¹² However, differences between households with or without children were not explored in this study as all participants had at least 1 child in the household. The number of family members residing within the household was found to significantly increase the odds of intention to have an EP kit but was not significant for having a family emergency plan.

Table 3. Subject characteristics by family emergency plan

Variable	Total N = 278	Have family emergency plan			P-Value
		Have N = 116	Intend N = 82	No N = 80	
Gender					0.050
Female	234 (84.2%)	97 (83.6%)	75 (91.5%)	62 (77.5%)	
Male or something else	44 (15.8%)	19 (16.4%)	7 (8.5%)	18 (22.5%)	
Race/ethnicity					0.119
White	37 (13.3%)	12 (10.3%)	14 (17.1%)	11 (13.8%)	
NHPI	46 (16.5%)	21 (18.1%)	15 (18.3%)	10 (12.5%)	
Japanese	70 (25.2%)	29 (25.0%)	21 (25.6%)	20 (25.0%)	
Filipino	53 (19.1%)	30 (25.9%)	8 (9.8%)	15 (18.8%)	
Other Asian	38 (13.7%)	9 (7.8%)	13 (15.9%)	16 (20.0%)	
Other	34 (12.2%)	15 (12.9%)	11 (13.4%)	8 (10.0%)	
Education					0.434
Some college or lower	88 (31.7%)	38 (32.8%)	29 (35.4%)	21 (26.2%)	
College graduate or higher	190 (68.3%)	78 (67.2%)	53 (64.6%)	59 (73.8%)	
Income					0.057
<\$75,000	94 (33.8%)	42 (36.2%)	31 (37.8%)	21 (26.2%)	
\$75,000-\$150,000	97 (34.9%)	40 (34.5%)	20 (24.4%)	37 (46.2%)	
>\$150,000	63 (22.7%)	21 (18.1%)	24 (29.3%)	18 (22.5%)	
Prefer not to answer	24 (8.6%)	13 (11.2%)	7 (8.5%)	4 (5.0%)	
Food security					0.661
Secured	185 (66.5%)	79 (68.1%)	56 (68.3%)	50 (62.5%)	
Other	93 (33.5%)	37 (31.9%)	26 (31.7%)	30 (37.5%)	
Have infant(s)	52 (18.7%)	23 (19.8%)	12 (14.6%)	17 (21.2%)	0.514
Have toddler(s)	44 (15.8%)	13 (11.2%)	16 (19.5%)	15 (18.8%)	0.201
No. of School aged kids (5-12)	1.4 ± 0.7	1.4 ± 0.6	1.5 ± 0.9	1.2 ± 0.6	0.035
No. of adults (19-64)	1.8 ± 1.0	1.8 ± 1.0	1.8 ± 1.2	1.8 ± 1.0	0.982
Have teen(s)	75 (27.0%)	36 (31.0%)	19 (23.2%)	20 (25.0%)	0.421
Have older adult(s)	28 (10.1%)	8 (6.9%)	14 (17.1%)	6 (7.5%)	0.043
No. of family members	4.1 ± 1.7	4.0 ± 1.5	4.4 ± 2.0	3.8 ± 1.6	0.135
Susceptibility: Preparing my family for emergencies or disasters is important	4.6 ± 0.7	4.7 ± 0.6	4.7 ± 0.6	4.3 ± 0.8	<0.001
Severity: An emergency or disaster would be a significant problem for my family	4.1 ± 1.0	3.9 ± 1.0	4.2 ± 0.8	4.0 ± 1.0	0.077
Severity: I am afraid of dying from a natural disaster	3.3 ± 1.2	3.3 ± 1.2	3.6 ± 1.2	3.1 ± 1.3	0.020
Severity: I am afraid of dying from a disease outbreak	3.4 ± 1.2	3.3 ± 1.2	3.7 ± 1.1	3.3 ± 1.3	0.072
Benefit: Preparing my family for disasters or other emergencies may decrease our risk of death, injury or illness	4.3 ± 0.8	4.3 ± 0.9	4.5 ± 0.6	4.2 ± 0.8	0.109
Benefit: Preparing makes me feel less worried about possible emergencies	4.3 ± 0.8	4.3 ± 0.7	4.4 ± 0.8	4.1 ± 0.9	0.037
Barrier: There is no use in preparing for disasters if it is God's will (my destiny) to be in a disaster	2.0 ± 1.1	2.0 ± 1.1	2.1 ± 1.2	2.1 ± 1.1	0.591
Barrier: It is too expensive for me to prepare for emergencies	2.7 ± 1.2	2.5 ± 1.2	2.8 ± 1.2	2.7 ± 1.3	0.332
Barrier: I don't have time to prepare for emergencies	2.6 ± 1.1	2.3 ± 1.1	2.6 ± 1.1	3.0 ± 1.0	<0.001
Barrier: It is too stressful to prepare my family for emergencies	2.5 ± 1.1	2.2 ± 1.0	2.5 ± 1.2	2.9 ± 1.0	<0.001
Self-efficacy: I don't know how to prepare for emergencies	2.6 ± 1.2	2.1 ± 1.0	2.7 ± 1.3	3.1 ± 1.1	<0.001
Self-efficacy: I need help learning how to prepare for an emergency	3.0 ± 1.2	2.5 ± 1.2	3.2 ± 1.2	3.4 ± 1.0	<0.001
Cue: From my child's school	4.2 ± 0.9	4.2 ± 0.9	4.2 ± 0.8	4.1 ± 0.9	0.422
Cue: From my doctor or nurse	3.7 ± 1.1	3.7 ± 1.1	3.9 ± 1.0	3.7 ± 1.1	0.334
Cue: A community organization (eg, YMCA, church)	4.0 ± 0.9	4.0 ± 0.9	4.1 ± 0.7	3.9 ± 1.0	0.145
Cue: City or state government agency	4.4 ± 0.8	4.4 ± 0.7	4.5 ± 0.7	4.3 ± 0.9	0.222
Cue: Website or app	4.3 ± 0.8	4.3 ± 0.9	4.6 ± 0.5	4.1 ± 1.0	<0.001
Cue: Receiving emergency text message notifications from Honolulu County or the State of Hawaii	4.9 ± 0.4	4.9 ± 0.4	4.9 ± 0.5	4.9 ± 0.4	0.947

Abbreviation: NHPI, Native Hawaiian and other Pacific Islander.

Note: n (%) or mean ± SD. Other racial/ethnic group includes Hispanics. P-Value was computed by chi-squared test for categorical variable and one-way analysis of variance for continuous variable. Bold values represent a P-value < 0.05.

Table 4. Adjusted odds ratios and 95% confidence intervals for multinomial logistic regression model for family emergency plan

Variable	Have vs. No		Intend vs. No	
	AOR (95% CI)	P-Value	AOR (95% CI)	P-Value
Gender				
Female	Reference		Reference	
Male or something else	0.77 (0.33, 1.77)	0.533	0.42 (0.15, 1.19)	0.102
No. of family members	1.03 (0.64, 1.65)	0.916	1.49 (0.92, 2.41)	0.106
Older adult(s)	0.49 (0.14, 1.71)	0.264	1.29 (0.42, 3.92)	0.655
Susceptibility: Preparing my family for emergencies or disasters is important	1.24 (0.74, 2.10)	0.417	1.16 (0.67, 2.03)	0.597
Severity: I am afraid of dying from a natural disaster	1.20 (0.90, 1.59)	0.206	1.31 (0.97, 1.76)	0.076
Benefit: Preparing makes me feel less worried about possible emergencies	1.02 (0.66, 1.58)	0.917	1.07 (0.66, 1.73)	0.777
Barrier: I don't have time to prepare for emergencies	0.94 (0.63, 1.40)	0.765	0.98 (0.64, 1.48)	0.911
Barrier: It is too stressful to prepare my family for emergencies	0.79 (0.53, 1.18)	0.254	0.78 (0.51, 1.18)	0.236
Self-efficacy: I don't know how to prepare for emergencies	0.59 (0.40, 0.88)	0.009	0.73 (0.48, 1.10)	0.135
Self-efficacy: I need help learning how to prepare for an emergency	0.77 (0.53, 1.13)	0.180	1.09 (0.72, 1.65)	0.677
Cue: Receiving emergency text message notifications from Honolulu County or the State of Hawaii	1.40 (0.92, 2.14)	0.115	2.00 (1.21, 3.31)	0.007

Abbreviations: AOR = adjusted odds ratio; CI = confidence interval.

Note: The reference level for the outcome is "No" category. Bold values represent a *P*-value < 0.05.

The results from this study related to perceived susceptibility are consistent with others examining factors influencing EP behaviors among parents. Risk perception for emergencies has been identified as an important predictor for carrying out EP behaviors.^{23,24} Merely being aware of risk, however, is not sufficient for influencing EP action, with previous studies reporting that levels of EP behaviors remain low even when people acknowledge their risk.¹⁵ For example, Ryan et al.⁴ found that parents with high perceived risk for emergencies but low self-efficacy (lacked confidence in their ability to prepare for emergencies), did not demonstrate higher levels of preparedness behavior. Addressing the gap between risk perception and self-efficacy and EP behaviors is an important area for further research.

Lastly, many studies have reported on the role of self-efficacy as a contributing factor to household EP behaviors.^{13,14,25} In this study participants who did not know how to prepare for emergencies were less likely to have an EP kit as well as a family emergency plan. A lack of knowledge and perceived ability to best to prepare for emergencies has been identified as a significant barrier to household EP.¹⁹ Parents with higher levels of self-efficacy were more likely to translate risk perception into actual behavioral preparedness,⁴ suggesting that having confidence in engaging in EP actions is an essential step toward adopting household EP behaviors.

Implications

To improve adoption of EP behaviors novel interventions are needed to highlight the importance of EP as a family health issue, as well as overcome barriers parents experience related to household EP behaviors. Developing tailored EP materials and interventions that match individualized household needs and are also culturally informed will enhance their usefulness. Publicly available EP information has been criticized for being provided in formats difficult to relate to, too generalized to be helpful, written at a literacy level higher than recommended by health organizations, or unavailable in languages other than English.^{26–28} Contextual EP information that helps to overcome the social, economic, and

cultural barriers families face may be better able to improve family EP, especially among diverse populations such as those found in Hawaii. To minimize barriers, EP interventions aimed at parents should be designed to emphasize EP actions that are simple to carry out and take little time to do, and interventions and materials should be designed in ways that are appropriate, acceptable, or understandable to their intended audiences.

Targeted interventions led by health professionals have also proven to increase EP behaviors among parents with children at high risk for emergencies. For example, Heagele and Nurse-Clarke¹⁹ described how a nurse-facilitated intervention led to increased EP behaviors among new parents. Another study showed how individualized disaster education improved EP among parents of children with special needs.²⁹ Health-care providers and community health workers are often aware of complex socioeconomic and cultural barriers patients face when accessing health services and would be well-equipped to (1) assess adoption or intention to create an EP kit or family emergency plan, and (2) provide resources or links to novel solutions that would individually tailor plans to suit family needs. For example, pediatric health-care providers could provide parents with cues to action, such as posters or flyers in waiting rooms that highlight the importance of EP or conduct assessments of family emergency plans (including how and where to meet/reconnect if there were school-based emergencies) as part of annual child health exams.

Creating technology-based approaches to teach household EP, such as websites or smartphone apps capable of providing personalized guidance is another promising approach. Various apps are available for download that provide the public with information regarding disaster preparedness and response. Engagement with such apps surged during the COVID-19 pandemic.^{30–32} In Hawaii, an app developed by the state's department of health that alerted users of COVID-19 exposure had reached 1 million activations during the pandemic, demonstrating residents' willingness to engage with apps for health emergency-related information.³³ Apps have shown potential to improve household EP, especially when designed specifically with the geographic and social context of the user, and optimized for

credibility, ease-of-use, and efficiency in providing information sharing.³¹ Further inquiry to inform the development of apps that integrate localized and personalized information may help identify effective methods for encouraging family EP behaviors.

Limitations

The study was conducted with a limited sample of parents with children enrolled in programs at the YMCA. While the sample population reflected some aspects of overall population (ie, racial/ethnic diversity), it may differ in other ways. The study focused on parents with children aged 0-12 y, parents with older children may have differing characteristics or EP behaviors. Additionally, while Hawaii is a state with clear EP action needs, perceptions of parents in other states may differ and this may affect generalizability of findings. A survey question assessing food insecurity was not validated for use on its own but is contained in the 6-item PhenX Toolkit Food Insecurity protocol, which is validated for households with children. The study used an Internet-based survey to collect data, an approach that provided convenience and flexibility for participants, but may have inadvertently excluded individuals who do not have Internet access or are not adept with using online tools. Data collection relied solely on self-reported survey responses; actual participant EP behaviors could not be independently verified. Finally, the study only captured responses at a single point in time, which may not reflect the dynamic patterns of EP behaviors over a longer period or during other times of the year, such as hurricane season. Despite these limitations, this study provides evidence to inform interventions designed to empower families with children to improve household EP for health emergencies.

Conclusions

Despite the rise in public health emergencies associated with disasters (eg, wildfire, flooding), disease outbreaks, medical emergencies, and other health emergencies that families may face, such as public violence (eg, school violence and public shootings), the rate of family EP remains low. It is important to ensure families have both supplies (ie, an EP kit inclusive of extra supplies of medications) and plans (ie, family emergency plans for how to meet, communicate, and evacuate as appropriate). Families with young children are at significant risk of adverse health outcomes during health emergencies. In this study, only 28.8% of parents had both an EP kit and family emergency plan. Facilitators of EP included higher perceived susceptibility and barriers of EP included time and not knowing how to prepare. Future interventions should focus on innovative solutions, including partnering with health-care providers and using technology to facilitate overcoming common barriers to family EP.

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