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Original Research

National Estimates of Nurse Practitioner Disaster Preparedness Training

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A B S T R A C T

We aimed to determine nationally representative differences in annual hazard-specific disaster preparedness training by health care provider shortage area (HPSA), practice rurality, patient population, and racial/ethnic identity. Weighted estimates were generated from National Sample Survey of Registered Nurses (NSSRN) data, of which 15,408 surveys represented 208,866 nurse practitioners (NPs). Almost two-thirds had engaged in any disaster training annual updates. Fewer rural practitioners had trained for chemical (28% vs 32%) and biological (26% vs. 29%) disasters. Psychiatric NPs engaged in the least disaster training. Our findings provide a national training needs assessment for policymakers, professional organizations, employers, and individual NPs.

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Introduction

Large-scale disasters are escalating in scope, scale, frequency, and cost.[1,2] Although disaster preparedness and response are expected competencies of newly trained nurse practitioners (NPs),[3] a gap exists in overall workforce disaster competency attainment.[4,5] NPs are essential providers with a unique reach and presence in communities most likely to experience health-harming impacts of disasters.[6,7] The overarching goal of our team's work is to:

1. Assess and strengthen climate disaster resilience—the capacity of individuals, health systems, and communities to anticipate, withstand, adapt to, and recover from climate-driven hazards while maintaining essential health services;
2. Expand a climate-savvy health workforce—clinicians who possess the knowledge, skills, and attitudes to recognize, manage, and prevent climate-related health impacts and to advocate for mitigation and adaptation; and
3. Generate evidence that guides policymaking.[4]

The objective here was to generate nationally representative estimates of NP disaster preparedness training updates.

Background and Significance

In response to the World Health Organizations' assertion that climate change is the most significant health threat facing humanity,[8] the American Nurses Association (ANA) released a comprehensive position statement in 2023.[9] This statement highlights the pivotal role nurses play in addressing climate change, promoting climate justice, and protecting public health. Acknowledging these pressing concerns, several national professional nursing and policy-focused organizations have released supportive reports, white papers, and position statements, including the Alliance of Nurses for Healthy Environments,[10] the Oncology Nursing Society,[11] the Gerontological Association of Advanced Practice Nurses,[12] the American Holistic Nurses Association,[13] and the National Association of Pediatric Nurse Practitioners.[14] Additionally, as *The Journal for Nurse Practitioners* is the official scholarly journal of the American Association of Nurse Practitioners (AANP), this special edition ("Advanced Practice Nurses' Role in Planetary Health") serves as a vital platform for advancing leadership strategies, fostering evidence-based dialogue, and promoting innovative practice approaches in this space. Collectively, these commitments emphasize the broad health impacts of planetary health and climate change, particularly among vulnerable populations, and highlight the essential roles of leadership, advocacy, and the adoption of sustainable, holistic approaches to health care.

The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report emphasizes the urgent need for immediate and effective global action to reduce greenhouse gas emissions that contribute to global warming, ecologic instability, and cascading effects on human health.[15] Importantly, the IPCC report also outlines *adaptation* as a crucial pathway to reduce the health-related impacts of climate change, with disaster preparedness highlighted as a key public health strategy. Adaptation measures, such as strengthening early warning systems, improving health infrastructure, and expanding community preparedness efforts, are

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fundamental to building climate-resilient health systems and communities.

These strategies, when embedded in nursing and health professional education, ensure that advanced practice nurses and other health care providers are equipped to respond effectively to the growing burden of climate-driven disasters.[16,17] In turn, disaster preparedness can significantly reduce morbidity and mortality from extreme weather events, floods, wildfires, and heatwaves, particularly in rural and underserved communities where climate vulnerability is compounded by limited access to care.

Responding effectively to climate-related disasters requires updated health care training and practice. Although a substantial majority of providers endorse that patient emergency preparedness is important, less than half feel confident in their knowledge and competency to provide emergency preparedness interventions as part of their care in women's health.[5,18] Little is known about national NP workforce population estimates of hazard-specific disaster preparedness training, with most of the literature on disaster preparedness/training focused on nursing students and registered nurses.[19]

However, this information is needed to determine where disaster training is needed for NPs, specifically, in which geographic areas and for which patient populations at risk. For example, a national survey of pediatric NPs found those who received disaster training were 1.5-times more likely to respond to a disaster compared with those without disaster training.[20] Across specialties, NPs report low to moderate knowledge of public health emergency readiness, even after working during the coronavirus disease 2019 pandemic.[19] As the numbers of NPs in the United States (US) increase, especially in rural, low-income, and health care provider shortage areas (HPSAs), understanding disaster training needs across rural and nonrural areas and by patient population becomes increasingly important to ensure equitable disaster preparedness and response among underserved populations.[6]

Purpose

The purpose of this study was to determine nationally representative differences in annual hazard-specific disaster preparedness training by HPSA, rurality of nursing practice, patient population, and nurse racial/ethnic identity.

Methods

Study Design and Data Source

We used an applied epidemiology study design of observational data to generate national estimates by analyzing the National Sample Survey of Registered Nurses (NSSRN).[21] The survey is currently administered by the US Census Bureau, with data collected in cross-sectional waves since 1977. As a public use file, the data set contained no identifiable information and was deemed not human subjects. Thus, institutional review board determination was not required.[22]

Setting and Participants

The US Census Bureau administered the 2022 NSSRN survey to strata of registered nurses and NPs in the 50 US States and the District of Columbia between December 15, 2022, and April 13, 2023. Additional detail on the population and sampling can be found at the federal website.[21] The data set was filtered to only include NPs who were employed full-time in nursing with a bachelor's degree or higher. We excluded those who worked exclusively in nonpatient settings (eg, government agency, university academic, insurance, regulatory, or professional organization).

Variables

Demographic variables were analyzed from survey responses addressing self-reported sex, age-group, racial and ethnic identity group, marital status, veteran status, household income, and highest educational attainment. Rurality of work setting was a calculated variable provided by the US Census Bureau based on the Rural-Urban Commuting Area code the government associated with the address of the respondent's work setting as of December 31, 2021, and stored in the dataset as either *rural* or *not rural* for analysis. Similarly, a derived variable indicated whether the NP worked in a primary care HPSA. The US Census Bureau also generated a derived binary racial/ethnic identity variable as *White* or *other* due to small sample sizes in several categories of racial/ethnic identity.

Our main variable of interest was disaster preparedness training updates. To measure disaster preparedness training updates, we used survey item B14 with the item stem of: "Within the past year, have you received or provided emergency preparedness training in any of the following areas specifically related to patient care or medical response to these emergencies?" Participants were able to mark yes or no responses for each of the following 6 categories: chemical, nuclear or radiologic, infectious disease epidemic, biological, natural disaster, or other public health emergency (PHE). We created a calculated variable for any disaster training if the participant endorsed any of the 6 categories.

Patient population was measured by the response to survey item A8c "Which of the following NP certifications did you have from a NATIONAL CERTIFYING ORGANIZATION?" We included respondents' endorsement of the following response options: Family NP, Adult-Gerontology Primary Care NP, Adult-Gerontology Acute Care NP, Pediatric Primary Care NP, Psychiatric-Mental Health NP, Neonatal NP, and Women's Health Care NP.

Bias

We report the results of all analysis conducted here in the manuscript and the Supplementary Table (available online at http://www.npjournal.org) to reduce the opportunity for publication bias. This manuscript follows the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline for transparent reporting.[23]

Statistical Methods

Using Stata 17.0 (StataCorp) statistical software, we generated population-weighted estimates by successive difference replication as indicated in the documentation from the survey and dataset developers at the Health Research Services Association.[21] Subpopulation analyses were conducted by nurse racial/ethnic identity (White or other), rurality of practice (rural or not rural), HPSA practice (HPSA or not HPSA), and by patient population (endorsed vs not endorsed). Comparisons were observed by the 95% CI of the population estimate. A sensitivity analysis was completed to analyze each test with and without missing data. The results that excluded missing data are reported in the main results here.

Table 1
Nurse Practitioner Demographic Characteristics and Disaster Preparedness Training Updates by Practice Rurality

Variable	Rural (N = 22,030)		Not Rural (N = 163,405)	
	No. (%)	95% CI	No. (%)	95% CI
Sex				
Male	1,672 (12.13)	10.33-14.18	13,370 (14.30)	13.25-15.42
Female	19,359 (87.87)	85.82-89.67	14,0035 (85.70)	84.58-86.75
Age, y				
<29	170 (0.77)	0.44-1.33	1,291 (1.40)	1.18-1.67
30-34	1,802 (12.72)	10.98-14.70	11,320 (13.05)	12.26-13.88
35-39[a]	1,802 (17.26)	15.87-18.74	12,987 (20.19)	19.14-21.28
40-44	1,751 (17.03)	15.20-19.02	16,124 (15.99)	15.20-16.81
45-49	1,262 (14.81)	12.66-17.25	15,783 (15.78)	14.98-16.61
50-54	1,809 (12.75)	10.89-14.87	11,424 (13.11)	12.47-13.77
55-59	1,456 (11.15)	9.67-12.82	15,613 (9.56)	8.85-10.31
60-64	1,521 (6.91)	5.93-8.02	10,749 (6.58)	6.07-7.13
65-69[a]	1,162 (5.28)	4.02-6.89	1,323 (3.26)	2.92-3.64
70-74	146 (0.66)	0.33-1.32	1,507 (0.92)	0.74-1.14
≥75[a]	149 (0.68)	0.34-1.35	283 (0.17)	0.10-0.31
Race/ethnic identity				
Hispanic[a]	495 (2.25)	1.54-3.27	15,050 (9.21)	8.67-9.79
White only, non-Hispanic[a]	19,126 (86.81)	84.73-88.66	101,680 (64.67)	63.60-65.73
Black only, non-Hispanic[a]	897 (4.07)	2.84-5.80	12,768 (13.93)	13.05-14.87
Asian only, non-Hispanic[a]	361 (1.64)	0.92-2.90	13,875 (8.49)	7.97-9.05
American Indian only, non-Hispanic	191 (0.87)	0.51-1.47	610 (0.37)	0.25-0.55
Pacific Islander or multiple races, non-Hispanic	961 (4.36)	3.09-6.13	1,422 (3.32)	2.90-3.80
Marital status				
Married or in domestic partnership[a]	17,853 (81.04)	79.09-82.84	12,1,635 (75.66)	74.60-76.69
Widowed, divorced, separated	1,800 (12.71)	11.03-14.59	10,760 (12.70)	11.95-13.50
Never married[a]	1,378 (6.25)	5.11-7.63	19,011 (11.63)	10.88-12.43
Veteran status				
Never served in the military	10,948 (95.09)	93.96-96.01	151,193 (94.36)	93.67-94.98
Only on active duty for training in the reserves or National Guard	327 (1.48)	0.99-2.21	1,965 (1.20)	0.94-1.54
Now on active duty or on active duty in the past	756 (3.43)	2.61-4.50	1,247 (4.43)	3.89-5.06
Annual household income				
≤$25,000	36 (0.17)	0.07-0.40	186 (0.11)	0.06-0.21
$25,001−$35,000	45 (0.21)	0.05-0.88	51 (0.03)	0.01-0.08
$35,001−$50,000	81 (0.37)	0.17-0.80	418 (0.26)	0.16-0.41
$50,001−$75,000	421 (1.91)	1.47-2.45	1,540 (2.17)	1.81-2.59
$75,001−$100,000	1,179 (9.89)	8.50-11.48	14,767 (9.04)	8.33-9.79
$100,001−$150,000[a]	1,582 (38.95)	36.49-41.48	15,799 (34.15)	32.92-35.39
$150,001−$200,000	1,256 (28.40)	26.54-30.33	12,415 (25.96)	24.94-27.00
>$200,000[a]	1,429 (20.10)	18.29-22.05	16,229 (28.29)	27.16-29.46
Educational attainment				
Bachelors	1,500 (6.81)	5.63-8.21	11,390 (6.97)	6.45-7.53
Masters/post-masters certificate[a]	17,796 (80.78)	78.81-82.61	121,197 (77.84)	76.78-78.87
Doctorate[a]	1,735 (12.42)	10.82-14.21	14,818 (15.19)	14.29-16.13
Disaster preparedness				
Chemical[a]	1,180 (28.05)	26.00-30.00	11,759 (31.68)	30.48-32.89
Biological[a]	1,623 (25.53)	23.58-27.58	17,741 (29.22)	27.99-30.48
Nuclear/radiologic	1,776 (17.14)	15.36-19.08	12,233 (19.73)	18.78-20.70
Epidemic	12,154 (55.17)	52.55-57.76	11,983 (56.29)	55.00-57.57
Natural disaster	1,555 (34.29)	32.03-36.63	16,733 (34.72)	33.44-36.02
Other	1,796 (35.39)	33.13-37.72	19,012 (36.11)	35.06-37.18
Any disaster	12,970 (58.87)	56.39-61.31	19,354 (60.80)	59.69-61.90

[a] Population proportion estimate differences observed by 95% CI.

Participants

Responses from 15,408 surveys, representing a weighted estimate of 208,866 NPs across the nation were analyzed. Overall, 60% of NPs had any form of disaster preparedness training in the previous year.

Descriptive Data

NP demographic characteristics by practice rurality are listed in Table 1, where population proportion estimate differences were detected with 95% CIs that did not overlap. Rural NPs were slightly older and much less racially diverse compared with nonrural counterparts. A higher proportion of rural NPs were married or in a domestic partnership compared with nonrural NPs (81% vs 76%). A larger proportion of nonrural NPs belonged to wealthier households, with 28% reporting an annual household income of ≥$200,000 compared to 20% of rural NPs. No differences were observed in sex or veteran status by NP rurality.

Main Results by Rurality and HPSA

Fewer rural NPs had trained for chemical (28% vs 32%) and biological (26% vs 29%) disasters (Table 1). No differences in disaster preparedness training updates were observed for NPs working in HPSAs compared with non-HPSAs (see Supplementary Table, available online at www.npjournal.org).

Table 2
Nurse Practitioner Disaster Preparedness Training Updates by Patient Population

Disaster	Family NP	
	No. (%)	95% CI
Chemical	38,584 (31.2)	30.01-32.41
Biological	35,766 (28.92)	27.64-30.23
Nuclear/radiologic	24,102 (19.49)	18.38-20.64
Epidemic	70,620 (57.10)	55.70-58.48
Natural disaster	43,321 (35.03)	33.55-36.53
Other	44,908 (36.31)	35.09-37.55
Any disaster	**76,104 (61.53)**	**60.15-62.90**
	Adult Gerontology—Primary Care NP	
Chemical	8,130 (33.45)	30.78-36.23
Biological	7,378 (30.36)	27.95-32.88
Nuclear/radiologic	4,997 (20.56)	18.35-22.96
Epidemic	13,987 (57.55)	54.26-60.77
Natural disaster	8,274 (34.04)	31.53-36.65
Other	8,384 (34.50)	31.75-37.34
Any disaster	14,919 (61.39)	58.19-64.49
	Adult Gerontology—Acute Care NP	
Chemical	6,228 (35.21)	31.69-38.90
Biological	5,815 (32.88)	29.35-36.61
Nuclear/radiologic	**4,446 (25.14)**	**21.85-28.74**
Epidemic	10,592 (59.89)	56.07-63.60
Natural Disaster	6,539 (36.98)	33.16-40.97
Other	6,890 (38.96)	35.25-42.80
Any Disaster	11,280 (63.78)	59.89-67.51
	Pediatric Primary Care NP	
Chemical	3,314 (30.69)	26.59-35.11
Biological	2,899 (26.84)	22.52-31.66
Nuclear/radiologic	2,085 (19.30)	15.80-23.37
Epidemic	5,704 (52.81)	47.25-58.30
Natural disaster	3,412 (31.59)	27.39-36.12
Other	3,773 (34.93)	30.00-40.20
Any disaster	6,227 (57.65)	52.12-62.99
	Psychiatric/Mental Health NP	
Chemical	**3,827 (24.57)**	**21.20-28.28**
Biological	**3,514 (22.56)**	**19.49-25.96**
Nuclear/radiologic	**2,223 (14.27)**	**11.96-16.95**
Epidemic	**6,606 (42.41)**	**38.43-46.49**
Natural disaster	4,784 (30.71)	26.57-35.19
Other	5,111 (32.81)	29.34-36.47
Any disaster	**7,586 (48.70)**	**45.19-52.22**
	Women's Health NP	
Chemical	2,143 (33.34)	27.57-39.65
Biological	2,053 (31.94)	26.59-37.82
Nuclear/radiologic	1,333 (20.74)	15.66-26.93
Epidemic	3,459 (53.81)	47.87-59.65
Natural disaster	2,164 (33.66)	29.03-38.63
Other	2,440 (37.96)	32.79-43.43
Any disaster	3,646 (56.73)	50.58-62.68

Data reported for nurse practitioners (NPs) who endorsed having the training. Data for the comparators who did not endorse in each category are not presented in the table as noted in manuscript text. **Row is bolded** where population proportion estimate differences between endorsed/not endorsed participant responses were observed by 95% CI. Group differences by NP certification for adult/gerontology unspecified and other (neonatal, emergency) are not reported to due lack of specificity in the survey concepts.

Results by Patient Population Served

NP disaster preparedness update training by patient population certification is summarized in Table 2. Overall, a lower proportion of psychiatric/mental health NPs had engaged in these updates compared with their peers. By hazard, a greater proportion of adult gerontology—acute care NPs reported engaging in training in the last year on nuclear/radiologic (25% vs 19%) disasters compared with their peers. On the other hand, a smaller proportion of the national psychiatric-mental health NP (PMHNP) workforce had engaged in chemical (25% vs 32%), biological (23% vs 29%), nuclear/radiologic (14% vs. 20%), infectious disease epidemic (42% vs 57%), or the derived indicator for any disaster training (49% vs 61%) compared with peers who did not hold this certification. Although there were no hazard-specific differences for family NPs, a larger proportion had participated in any disaster training updates (62% vs 58%) compared with peers who did not hold a family NP certification. No differences were observed by adult gerontology—primary care, pediatric primary care, or women's health certification for NPs. Nonspecific NP certification response options of other and adult/gerontology unspecified were not included in this report due to a lack of specificity of the survey concept.

Results by NP Racial/Ethnic Identity

NP engagement in disaster preparedness training during the year before the survey by reported nurse racial/ethnic identity are presented in Table 3. No differences were observed, except a lower proportion of NPs who reported their race/ethnicity as White, non-Hispanic engaged in nuclear/radiologic disaster preparedness training (18% vs 22%) and other public health emergency (34% vs 39%).

Sensitivity Analysis

A sensitivity analysis was conducted to generate the estimates with missing data as an indicator variable. This analysis produced no difference in the interpretation of findings and is not included in the report presented here.

Discussion

This is the first study to generate nationally representative estimates of NP disaster preparedness training updates by disaster type, rurality, certification specialty, and NP racial/ethnic identity, filling a critical gap in the disaster preparedness and health care workforce literature. NPs are becoming more prevalent in the US, specifically in low-income, rural, and HPSAs[6] where communities are most likely to experience the health-harming impacts of disasters, yet we found only 60% of NPs reported receiving any form of disaster preparedness training in the previous year. Overall, there is a paucity of literature regarding disaster training and preparedness for NPs in the US, with most of the literature being limited to a single health system, geographic area, and/or single certification specialty.[19,20] Disaster training fosters a sense of preparedness and is needed to ensure NPs respond to disasters. A 2020 Texas study found that only one-third of NPs felt prepared for disaster management.[24]

Education and training leads to an increased readiness to take action. A national study found receiving disaster training was associated with NPs reporting feeling 1.5-times more likely to respond to a disaster compared with those without disaster training,[20] indicating an important opportunity to provide and ensure receipt of appropriate training to foster a prepared workforce, especially in underreached areas.

Although no differences were found for NPs working in HPSAs, we noted disparities by rural vs nonrural geographic areas, with fewer rural NPs having trained for chemical and biological disasters compared with those in nonrural areas. Previous research has not investigated whether rural disparities for disaster training among NPs exist, yet rural nurses have previously reported training disparities overall compared with nurses working in more urban areas.[25] This may partially be attributed to unique workforce and funding challenges in rural areas.[26]

Table 3
Nurse Practitioner Disaster Preparedness Training Updates by Reported Racial Identity (weighted n = 208,866)

Disaster	White (N = 139,010)		Other (N = 69,856)	
	No. (%)	95% CI	No. (%)	95% CI
Chemical	42,076 (30.27)	29.10-31.47	23,235 (33.26)	30.89-35.72
Biological	38,244 (27.51)	26.33-28.72	21,646 (30.99)	28.57-33.51
Nuclear/radiologic[a]	**25,315 (18.21)**	**17.31-19.14**	**15,232 (21.80)**	**19.71-24.05**
Epidemic	77,385 (55.67)	54.42-56.91	39,004 (55.84)	53.49-58.16
Natural Disaster	46,214 (33.24)	31.97-34.55	25,564 (36.60)	34.31-38.94
Other[a]	**47,609 (34.25)**	**33.16-35.35**	**27,029 (38.69)**	**36.56-40.87**
Any Disaster	82,623 (59.44)	58.33-60.53	42,936 (61.46)	59.29-63.60

Row is bolded where population proportion estimate differences between endorsed/not endorsed participant responses were observed by 95% CI.
[a] Population proportion estimate differences observed by 95% CI.

By patient population served (measured by certification in Table 2), we found psychiatric/mental health NPs reported lower proportions of engaging in any disaster preparedness training updates compared with their peers who did not hold this certification (49% vs 61%); with the largest disparity being 15 percentage points for infectious disease epidemic training (42% vs 57%). Although there have been calls for enhancing mental health practitioners' role in psychological first aid, there is little evidence on efficacy or effectiveness of disaster training to upskill in preparation for higher acuity and whole-patient health needs in disaster contexts.[27,28] In other specialties, such as women's health, previous assessments corroborate our findings that approximately two-thirds of NPs are willing to engage in disaster preparedness training.[18] Additional assessments are recommended for PMHNPs.

Implication for NP Education and Training

The American Association of Colleges of Nursing (AACN) *The Essentials: Core Competencies for Professional Nursing Education*[29] (hereafter AACN *Essentials*) provides a foundational framework for NP education and training, including competencies related to disaster preparedness. Domain 3 (Population Health), Domain 5 (Quality and Safety), Domain 6 (Interprofessional Partnerships), and Domain 7 (Systems-Based Practice), Domain 8 (Informatics and Healthcare Technologies), and Domain 9 (Professionalism) are key domains to guide the development of disaster-related competencies across all specialties. For example, Domain 3 emphasizes improving health outcomes and reducing disparities and has core goals central in climate resilience, particularly as vulnerable populations are disproportionately affected by climate-related disasters. Domain 5 focuses on minimizing harm, highlighting the importance of preparing NPs to anticipate, respond to, and manage risks during public health emergencies. Domains 6 and 7 underscore the importance of cross-disciplinary teamwork and coordination, which are essential during disaster responses where collaboration with public health, emergency management, and other clinical teams ensures effective care delivery. Domain 8 supports the integration of digital tools, such as early warning systems, electronic health records, and telehealth platforms, that facilitate continuity of care and real-time decision-making during crises. Finally, Domain 9 reinforces the professional obligation of NPs to be prepared, advocate for vulnerable populations, and respond decisively to public health threats linked to climate change. Collectively, these domains support the integration of disaster preparedness into all NP educational pathways.

Although the AACN *Essentials* provide the foundation for formal education, disaster readiness must also be embraced as a lifelong professional responsibility. Internationally, the International Council of Nurses (ICN) "Core Competencies in Disaster Nursing Version 2.0"[30] offers a complementary framework that reinforces these priorities, especially in areas of population-level care, interprofessional collaboration, and systems-based response. Aligning ICN disaster competencies with the AACN *Essentials* can help guide curricular development that prepares NPs for leadership in disaster preparedness and response on both.

These AACN-aligned competencies also mirror the climate adaptation strategies emphasized in the IPCC Report.[15] Embedding disaster preparedness into NP education is not only consistent with national competency standards but also directly supports global goals to build climate-resilient health systems. Notably, IPCC adaptation priorities essential for reducing the health-related impacts of climate change (ie, strengthening early warning systems, improving health infrastructure, and expanding community-level preparedness) align directly with the AACN *Essentials.* NP educational programs that intentionally align educational outcomes with these global adaptation priorities will help build an agile, responsive future NP workforce and, hopefully, one that serves as a key driver of health system resilience.

To align with these competencies, targeted education on disaster preparedness must be prioritized for all NPs, and in particular, PMHNPs, who are uniquely positioned to address the psychological toll of climate-related disasters. Events such as floods, wildfires, and pandemics often intensify symptoms of anxiety, depression, posttraumatic stress disorder (PTSD), and substance use disorder, especially among individuals with preexisting mental health conditions.[31] However, many PMHNPs lack adequate education or ongoing training to respond effectively in such high-stakes situations. Notably, our findings indicate that PMHNPs were the least likely to receive hazard-specific preparedness training (ie, chemical, biological, nuclear/radiological, infectious disease epidemic, or natural disasters).

Despite this gap, PMHNPs are extensively trained to manage the psychological and behavioral health consequences of high-stress events or disasters more generally, building on their foundational preparation as registered nurses. This nursing background provides a broad base in physical health care and allows PMHNPs to adapt and expand their skills rapidly in crisis contexts. Such breadth distinguishes them from mental health professionals such as psychologists or clinical social workers, whose training typically lacks comparable physical care competencies. This dual foundation enables PMHNPs to address a wider range of health needs during disasters, making their psychosocial expertise a critical complement to the clinical capabilities of other NP specialties and interprofessional providers necessary for effective disaster preparedness and recovery.

Psychological First Aid (PFA) is an evidence-informed, nonintrusive intervention developed by the National Center for PTSD and the National Child Traumatic Stress Network[32,33] and is recognized by the American Red Cross as a foundational competency for mental health responders.[34] PFA helps reduce acute trauma-related distress and supports long-term recovery by promoting core principles of safety, calmness, connectedness, self-

efficacy, and hope. Its flexibility across diverse disaster contexts makes PFA especially valuable for PMHNPs, who are often called upon to provide early and long-term psychological support. To address the preparedness gap identified in the literature, integrating PFA, trauma-informed care into both graduate and continuing education is a vital strategy to address the preparedness gap observed in the literature.[27,28]

All NP students, regardless of population or specialty, would benefit from hazard-specific training that addresses threats such as infectious disease outbreaks, chemical, and radiologic exposures, and natural disasters. Graduate programs should collaborate with organizations such as the American Red Cross and the Substance Abuse and Mental Health Services Administration[35] to deliver simulation-based, evidence-informed training. These immersive experiences not only enhance real-world readiness but also foster cross-disciplinary collaborations through interprofessional disaster drills. Continuing education requirements should include emergency preparedness content at least every 1 to 2 years to ensure the NP workforce remains responsive to evolving public health threats.

Certification in PFA should be encouraged across NP roles to build psychological response capacity at scale. Among advanced practice certification boards, the Pediatric Nursing Certification Board includes environmental exposure and disaster preparedness content in its certification examinations more explicitly.[36] Broader inclusion of environmental exposure and disaster preparedness competencies across all NP certification examinations would likely incentivize NP programs to embed this content into core curricula, enhancing readiness for both licensure and frontline response.

Future Research

Our findings indicate the need for additional research on NP disaster training updates focused on education, discovery, implementation, and leadership. Educational effectiveness research is needed to ascertain optimal content, delivery method(s), intensity, duration, and update frequency to maintain disaster preparedness competency. Educational effectiveness research is also needed to tailor access and content toward eliminating the disparities observed in our findings. Discovery research is needed to generate new disaster nursing innovations and test efficacy in simulation education intervention, precision hazard threat prediction, and other advances in disaster nursing intervention competency at the advanced practice level.

Although our findings provide a needs assessment for nationally scaled NP disaster training, little is known about the implementation of completed training into NP practice or patient outcome impacts. We recommend rigorous implementation science designs in future research to ascertain the causal links between updated training, practice adoption, and organizational or patient outcomes.

Last, the disparities observed in our findings indicate the need for multilevel nursing leadership intervention research to ensure alignment in NP disaster competency and training updates with overarching rural health practice in the US, patient population certification, and equality in training access by nurse racial/ethnic identity. We note a specific need to address a national plan and clarify expectations for disaster-context upskilling and hazard-specific preparedness among PMHNPs.

Policy Implications

Our findings have local, state, and national policy implications. An essential competency advanced practice nurses obtain in graduate school focuses on system-level leadership that advances population health through disaster preparedness and public health emergency response.[29] These competencies include organizational policy development and refinement. NPs in organizational leadership positions may wish to use our national needs assessment findings to justify updates to their organization's overall and hazard-specific policies for NP annual disaster preparedness training to ensure workforce preparation for the hazards that threaten their organizations with a focus on behavioral and mental health workforce and rural practices. They may also wish to replicate our analysis in an organization-specific needs assessment.

At this manuscript was written, federal funding that supports state and regional programs is undergoing a period of transformation. The main source of federal funding for health system preparedness flows from the Center for Disease Control and Prevention Hospital Preparedness Program (HPP) and Public Health Emergency Preparedness (PHEP) program budgets, which support regional health care coalition coordination. Nurses in academic, practice, and professional association leadership positions are well poised to fill the anticipated gaps these cost-containment measures leave and generate nurse-led, interdisciplinary collaboration, training, and exercises.[16,17] In collaboration with policy and government relations experts, nurses with public health competencies are well positioned to inform policy development and priorities on meaningful public funding of disaster preparedness with NP disaster training updates.

Nationally, disasters disproportionately impact medically underserved populations where NPs have established their lead in addressing the unmet need for health care.[5] Federal policy and appropriation support for rural NP education, workforce retention, and disaster preparedness competencies are warranted. Alternatively, the international conflict and crisis responsibilities of our nation's military nurses positions them with a unique depth of disaster preparedness and response capacity. Policies and infrastructure capacity to open military-civilian partnerships among rural NPs for military-grade disaster preparedness training provides an innovative policy target.[37]

The responsibility for federal interagency disaster preparedness coordination rests with the Public Health Emergency Medical Countermeasure Enterprise (PHEMCE).[38] NPs are ideally positioned to contribute to the PHEMCE strategic objective to "enhance collaboration between federal and non-federal partners to improve engagement for effective [medical countermeasure] decision-making and use," noting these countermeasures include pharmaceutical, medical device, personal protective equipment, decontamination, and clinical decision-making support. Rural NP leadership and input is essential to ensure federal government policymakers are informed and calibrated with this nursing lens.[39] We recommend further optimizing rural NP professional organization and stakeholder representation in high-level decision-making and committees informing PHEMCE and other relevant government disaster-related consulting initiatives. Last, a national plan for just-in-time upskilling of the entire nursing workforce is essential to future preparedness.[40] Our findings here not only indicate a need for enhanced reach of current disaster preparedness training updates but also contribute to the need for specific specialty organizations to be prepared to expand their skills to care for patients with higher levels of acuity and potentially outside of the specialty area under conditions of a national public health emergency.

Limitations

The data collected for the 2022 NSSRN occurred in the context of the coronavirus disease 2019 pandemic, which captures recent

training experiences and not the entirety of the respondents' educational backgrounds or the potential variability in training over time and among different NP cohorts. Accordingly, these national estimates should be interpreted with caution for generalizability beyond the context of this global public health emergency. As with any self-report survey finding, social desirability bias and recall bias may influence the findings. We used a binary comparison for nurse racial/ethnic identity, which may not capture the full nuance and intersectionality of this variable. Reporting disaster training in the last year may not represent the actual level of the NP's disaster competency and preparedness. As with any analysis of a cross-sectional wave, no causation can be determined by this analysis.

Conclusion

This study quantified nationally representative differences in annual hazard-specific disaster preparedness training by HPSA, practice rurality, patient population, and race/ethic identity from the 2022 NSSRN data. Of the 208,866 NPs, nearly two-thirds had engaged in any disaster training annual updates. We observed no differences by HPSA. Fewer rural practitioners had trained for chemical (28% vs 32%) and biological (26% vs 29%) disasters compared with their peers. PMHNPs engaged in the least disaster training. Our findings provide a national training needs assessment for policymakers, professional organizations, employers, and individual NPs to improve disaster preparedness training. Nurse-led models of disaster preparedness interdisciplinary training are needed to transform the national system to one that is responsive for patients most at risk for disproportionate health impacts from disaster.

CRediT authorship contribution statement

Valerie Sabol: Writing – review & editing, Writing – original draft, Funding acquisition, Conceptualization. **Taryn Amberson:** Writing – review & editing, Writing – original draft. **Jessica Castner:** Writing – review & editing, Writing – original draft, Funding acquisition, Data curation, Conceptualization.

Declaration of Competing Interests

Jessica Castner is the president and principal of Castner Incorporated, a woman-owned small business research institute, and co-owner of a family farmland limited liability corporation (LLC). Valerie Sabol and Taryn Amberson have nothing to declare.

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Data and Resource Availability

The deidentified and publicly available data used in this analysis can be found at the corresponding US Government website. Software analytic code as research data is available upon reasonable request.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

During the preparation of this work the authors used Microsoft Co-Pilot to troubleshoot aspects of the missing data analyses from author-drafted analytic code. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article. There was no other use of AI.

Supplementary Data

A Supplementary Table associated with this article can be found in the online version at https://doi.org/10.1016/j.nurpra.2025.105568.

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