Unveiling Disparities in Pediatric Wildfire Preparedness: A Novel, Mixed-Methods Framework for Family Resilience

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Objective To uncover disparities and systemic barriers in pediatric wildfire preparedness across diverse households in a fire-prone community.

Study design This mixed-methods investigation employed 2 novel instruments, literacy-adapted surveys (n = 75) and semi-structured interviews (n = 9) to caregivers. Both tools were pilot tested prior to data gathering. Researchers recruited English- and Spanish-speaking adult (18 years and older) caregivers seeking care for their child in an urban pediatric emergency department. Analysis utilized multivariable regression, dual-independent interview transcript coding and thematic consensus, and convergent methodology. Three study-generated outcomes assessed household readiness, including wildfire item preparedness (WIP), wildfire action preparedness (WAP), and wildfire overall preparedness (WOP). WOP is summative and combines WIP and WAP.

Results Half the households were not prepared for wildfires. Action preparedness (WAP: 18.6%) was less common than item (WIP: 80.6%). Caregivers with less education, younger age, and Hispanic/Latino ethnicity had significantly lower odds of completing readiness actions (WAP). Financial stressors were a major readiness barrier in both study arms. Four novel findings emerged: (1) home insurers represented an untapped opportunity for preparation; (2) renters experienced systematic barriers in home improvement; (3) diagnosis of a child chronic health condition significantly improved family readiness; and (4) caregivers believed schools lacked wildfire preparedness.

Conclusions This study reveals unique and urgent wildfire preparedness gaps and critical inequities that increasingly threaten children's health, safety, and resilience. These findings necessitate immediate, targeted actions that increase public access to low-cost smoke mitigation supplies, optimize renter safety, and strengthen school and community fire responses. *(J Pediatr 2026;291:114924)*.

Catastrophic wildfires[1,2] are a global public health crisis, disproportionately affecting vulnerable populations.[3-6] Wildfire smoke pollutants cause widespread poor air quality,[7-9] driving both pediatric respiratory morbidity[10-12] and emergency department (ED) visits,[13-15] particularly among infants and young children.

The risk intensifies in wildland-urban interfaces (WUIs),[16] where 1 of 3 of the United States population resides.[16,17] These regions are highly prone to fires due to dry vegetation, severe droughts, and extreme winds.[16,18-20] Low-income families in subsidized housing comprise a significant portion of WUI residents,[17,21] placing children at the epicenter of threats from severe health complications to evacuation trauma to disruption of essential medical and educational services.[17,22-24] Geography, environmental inequities, and structural racism amplify these issues,[3,25-28] which were demonstrated during California's devastating 2020 fire season with 8600 fires consuming 4.3 million acres.[29] The Southern California wildfires in January 2025[30] also highlight persistent failures in pediatric readiness and response.

These concerns are continually increasing the gap in household wildfire preparedness. Although more than half of US households maintain hurricane (72%) and earthquake readiness (55%), only 42% report wildfire preparedness.[31] This deficit particularly threatens children, highlighted by recent shortages of pediatric-specific resources, such as infant formula[32] and essential medications including amoxicillin and over-the-counter antipyretics.[33,34] Prior studies have not examined child-specific wildfire preparedness strategies, including smoke mitigation strategies and home emergency planning. We aimed to analyze wildfire readiness among households with children in fire-prone regions across diverse socioeconomic groups, and to understand individual, community, and systemic factors that can affect preparedness.

ED	Emergency department
WUI	Wildfire-urban interface
WOP	Wildfire overall preparedness
WIP	Wildfire item preparedness
WAP	Wildfire action preparedness

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Methods

Study Design and Sample

This mixed-methods study integrated a quantitative literacy-adapted survey with qualitative semi-structured interviews, using a convergent design.[35-37] A convenience sample was recruited from June 2021 to October 2022 at an urban, high-volume, pediatric ED predominantly serving publicly insured patients from marginalized communities in a wildfire-prone area in Los Angeles County with 2 million children under the age of 17, the majority (65%) Black and/or Hispanic.[38]

Study eligibility criteria included English- and Spanish-speaking adult caregivers seeking non-life threatening and non-psychiatric care for their child in the pediatric ED. Inclusion criteria for interviews required English-speaking adult caregivers with either direct wildfire experience or presenting with respiratory illness in a child. Eligible candidates participated in the survey or the interview, but not both. All study participants completed a demographic questionnaire about their personal and family characteristics such as highest level of education, race, ethnicity, annual household income, and more. The local Institutional Review Board approved this study.

Outcome Variables

The study focus was wildfires readiness. We created 3 quantitative outcomes: wildfire action preparedness (WAP), wildfire item preparedness (WIP), and wildfire overall preparedness (WOP). These outcomes were defined by additive numerical scores of survey questions using Zamboni et al's prior disaster literature.[39] WAP included 8 questions about creating and practicing household emergency and evacuation plans. WIP consisted of 13 questions pertaining to possession of disaster supplies such as extra food, water, medications, air purifiers, and masks. Overall preparedness is a summative outcome combining WAP and WIP scores (21 items). We scored preparedness using binary (yes/no) responses. For Likert scale answers, we counted "agree" and "strongly agree" as "yes" and all other responses as "no." Each question was equally weighted; each "yes" received one point, and each "no" received zero points. A household was considered "prepared" if it scored 50% or more for each outcome.

Novel Study Instruments – Quantitative Surveys and Qualitative Interviews

Survey. We mixed previously validated questions from literature and national questionnaires[10,40-46] and novel items tailored to address our study objectives. Question topics represented overall preparedness themes: caregiver wildfire knowledge, perceptions, preparedness, and factors (ie, sociodemographic, child health) associated with readiness. The independent variables and covariates were selected from studies reporting social determinants of health,[22-24,47] overall health inequities, and disparities during disasters (**Table I**).[4,25,28,39] The initial survey was piloted with 5 caregivers with iterative feedback and revisions to grammar and structure, including feedback from all authors, leading to 56 questions being iterated or removed. The final survey contained 126 questions and was translated into Spanish by certified interpreters.

Interviews. We conducted semi-structured interviews with 2 moderators to explore participants' lived experiences.[48-50] Moderators were trained in evidence-based qualitative methods and rehearsed interviewing strategies with senior investigators. Each interview took 30-45 minutes and was completed while the participant was in the ED. Based on feasibility, we aimed to conduct 10 interviews in total. Two authors independently coded interview transcripts and developed themes via consensus, while a third resolved any disagreements. Interview scripts and methodology were tested on 4 caregivers prior to final use. Redundant interview questions were removed, and caregivers recommended a new theme of school-based wildfire preparedness, which was added to the final script.

During strict COVID-19 protocols, all surveys and interviews were administered using video conferencing on a tablet placed in the patient room and research staff in another office.

Table I. Participant demographics for quantitative surveys (n = 75) and qualitative interviews (n = 9): A mixed-methods study of pediatric wildfire preparedness

Demographics			Survey n = 75	Interview n = 9
Caregiver	**Variable**	**Definition**	**%N**	**%N**
Age	Older	≥ 40 y	25.3%	11.1%
	Mid-aged	30-39 y	48%	66.7%
	Younger	18-29 y	25.3%	22.2%
Gender†	Male		32%	55.6%
Education	Highest	≥ College diploma	33.3%	44.4%
	Some	< College > HS	33.3%	22.2%
	Lower	≤ HS diploma	32%	33%
Employed	Unemployed		32%	55.6%
Race‡	Asian	Non-Hispanic	8%	0%
	Black	Non-Hispanic	9.3%	0%
	White	Non-Hispanic	20%	33.3%
	Other/Multiracial§		46.7%	55.6%
Ethnicity	Hispanic/Latino		73.3%	88.9%
Household	**Variable**	**Definition**	**%N**	**%N**
Combined income¶	High income	≥$75,000	14.7%	44.4%
	Middle income	$50,000-$74-999	25.3%	22.2%
	Low income	<$50,000	37.3%	33.3%
Insurance	Uninsured		60%	*
Number of (children)**	One	1 child only	29.3%	11.1%
	Two	2 children	37.3%	66.7%
	Many	≥ 3 children	32%	22.2%
Home type	Apartment	Multiunit	49.3%	44.4%

HS, high school.
*This question was exclusive to surveys. It was not included in the final demographic questionnaire completed by all participants.
†Gender: Survey missing 5.3% (n = 4).
‡Race: Survey declined to state 16% (n = 12).
§Other (race) – Includes those who chose "other" (n = 29) and "multiracial" (n = 6) answers.
¶Combined income: declined to answer = 22.7% (n = 17).
**Child is a member of the household that is less than 18 y old.

Statistical Analysis

Survey and interview data were gathered concurrently but first analyzed independently. Results were then mixed following convergent design principles.[35-37,50] Descriptive and univariate statistics summarized quantitative data. Continuous data and nominal variables with limited response rates were collapsed into categorical groups by visually inspecting the distribution and creating approximately equal-width categories ("buckets") to facilitate analysis and interpretation. Exploratory simple logistic regression models assessed the relationship between household characteristics and 3 study-generated described outcomes. Qualitative data themes are presented thematically side-by-side with quantitative data.

Results

We integrated quantitative survey data (n = 75), primarily reported as odds ratios, and qualitative interviews (n = 9) to assess wildfire preparedness among families with children. Demographic information is presented in Table I. Most caregivers identified as Hispanic/Latino ethnicity and Other/Multiracial race, followed by White, Black, and Asian. Table II highlights significant disparities in wildfire readiness based on caregiver and household sociodemographic factors. In addition, we identified a powerful and novel catalyst of pediatric readiness, parental concern for their child's health, detailed in Table III. Finally, Table IV provides insights into child-centric wildfire preparedness, with thematic quotes from several families with direct wildfire experiences.

Theme 1: Wildfire Preparedness Disparities

Most households with children (78.7%) felt unprepared for wildfires. Overall, half (56.5%) the families were not wildfire ready (Table II). Families frequently reported household disaster supplies (WIP: 80.6%), but not emergency planning actions (WAP: 18.6%). Action preparedness was lower among caregivers with less education, younger age, Other/Multiracial race, and lower income (Table II). Of note, most caregivers (90%) who selected "Other" race later self-reported their race as "Hispanic/Latino."

Interview data corroborated these findings. Participants discussed extensive lists of resources (high WIP) but noted challenges with the accessibility and transportability of these items in packed go-bags (low WAP). Middle- and low-

Table II. Crude odds ratios for pediatric household wildfire overall, action, and item preparedness: A pilot survey analysis (n = 75)

Demographics		Wildfire preparedness		
		Overall (WOP) (56.5%; n = 69)	Action (WAP) (18.6%; n = 70)	Item (WIP) (80.6%; n = 72)
Caregiver	**Variable**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
Age (y)	Older (≥40)	*1.00 [ref*]*	*1.00 [ref]*	*1.00 [ref]*
	Mid-aged (30-39)	1.12 (0.34-3.65)	0.23 (0.06-0.85)‡‡	1.07 (0.28-4.12)
	Younger (18-29)	0.43 (0.11-1.62)	0.03 (0-0.69)‡‡	1.37 (0.28-6.78)
Gender†	Male	0.97 (0.33-2.87)	0.96 (0.24-3.86)	0.58 (0.17-2)
Education	Highest (≥College)	*1.00 [ref]*	*1.00 [ref]*	*1.00 [ref]*
	Some (<College>HS)	0.65 (0.2-2.16)	0.3 (0.08-1.14)‡‡	0.64 (0.14-2.86)
	Lower (≤HS)	0.45 (0.14-1.61)	0.03 (0-0.6)‡‡	0.47 (0.11-2.12)
Employed	Unemployed	1.51 (0.53-4.25)	0.94 (0.26-3.3)	1.75 (0.46-6.65)
Race‡	Asian	0.23 (0.02-2.45)	1.04 (0.13-8.15)	0.08 (0-2.78)
	Black	1.15 (0.17-7.87)	0.34 (0.04-2.92)	0.07 (0-1.96)
	White	*1.00 (ref)*	*1.00 (ref)*	*1.00 (ref)*
	Other/multiracial§	0.74 (0.21-2.63)	0.22 (0.05-0.9)‡‡	0.12 (0-2.51)
Ethnicity	Hispanic/Latino	1.21 (0.4-3.64)	0.32 (0.09-1.1)	0.93 (0.24-3.67)
Household	**Variable**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
Combined income¶	High (≥$75**)	*1.00 (ref)*	*1.00 (ref)*	*1.00 (ref)*
	Middle (<$75**≥ $50**)	0.03 (0-0.61)‡‡	0.31 (0.06-1.55)	0.08 (0-1.88)
	Low (<$50**])	0.04 (0-0.80)‡‡	0.12 (0.02-0.63)‡‡	0.18 (0.01-3.97)
Insurance	Uninsured	0.28 (0.1-0.78)‡‡	0.02 (0-0.27)‡‡	0.21 (0.05-0.89)‡‡
Number of children††	1 child (ref)	*1.00 (ref)*	*1.00 (ref)*	*1.00 (ref)*
	2 children	7.33 (1.97-27)§§	5.67 (0.86-37.5)	7.41 (1.09-50)§§
	≥ 3 children	4.81 (1.28-18)§§	3.16 (0.43-23.4)	0.92 (0.26-3.34)
Home type	Apartment	0.41 (0.15-1.1)	0.4 (0.11-1.39)	0.58 (0.18-1.95)

OR, odds ratio; *CI*, confidence interval; *HS*, high school.
*[ref] is the reference category.
†Gender missing n = 4 (5.3%).
‡Race: Survey declined to state n = 12 (16%).
§Other (n = 29 [90% Hispanic]) + "multiracial"(n = 6).
¶Combined income declined answer n = 17 (22.7%).
**Represents $1000 (Ex: $75,000 = $75k).
††Child: household member aged less than 18.
‡‡Statistically significant negative odds.
§§Statistically significant positive odd.

Table III. Pediatric household wildfire overall, action, and item preparedness and wildfire-specific supplies based on child health variables: A pilot study survey analysis (n = 75)

Child§ health concern		Wildfire preparedness			Mask		Air purifier	
		Overall (WOP)	Action (WAP)	Item (WIP)	Has mask(s) supply	Would use mask for wildfire	Has air purifier(s) supply	Would use purifier for wildfire
Child	%N	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Has chronic issue (diagnosis)	33.3%	10.1 (2.76-37.01)†	1.71 (0.51-5.69)	6.39 (1.06-38.6)†	7.62 (0.39-149)	1.34 (0.43-4.23)	5.33 (1.85-15.35)†	3.19 (1.05-9.66)†
Has URI issue (seasonal allergies)	45.3%	5.2 (1.84-14.71)†	1.84 (0.55-6.14)	6.13 (1.41-26.73)†	13.01 (0.68-250)	0.59 (0.21-1.71)	5.74 (2.09-15.77)†	2.97 (1.1-8.04)†
Has LRI issue (wheezing/asthma)	34.7%	4.87 (1.58-15.09)†	1.71 (0.51-5.69)	6.39 (1.06-38.6)†	7.62 (0.39-149)	0.78 (0.26, 2.3)	7.14 (2.38-21.4)†	4.81 (1.49-15.54)†
Has prescribed Medications	38.7%	9.31 (2.79-31.02)†	2.83 (0.84-9.55)	7.86 (1.31-47.18)†	9.15 (0.47-178)	0.97 (0.33-2.85)	5.81 (2.06-16.4)†	2.53 (0.91-7.02)
Is sensitive to air quality	30.7%	8.26 (2.26-30.3)†	2.01 (0.6-6.73)	5.55 (0.92-33.64)	6.72 (0.34-132)	0.83 (0.27-2.55)	4.21 (1.46-12.13)†	2.68 (0.88-8.18)
Had URI during a wildfire	20%	11.18 (1.82-68.77)†	4.42 (1.22-16.07)	10.34 (0.53-201)	3.77 (0.18-77.32)	1.22 (0.31-4.72)	6.23 (1.64-23.7)†	2.57 (0.68-9.67)
Had LRI during a wildfire	16%	27.72 (1.4-549)†	2.76 (0.69-10.97)	7.8 (0.39-156)	2.88 (0.14-61.03)	2.88 (0.45-18.44)	4.16 (1.05-16.44)†	2.97 (0.65-13.57)

OR, odds ratio; *CI*, confidence interval; *URI*, upper respiratory illness; *LRI*, lower respiratory illness.
†Statistically significant positive odd.
§Child: household member aged less than 18 y.

income households described lower overall readiness compared with high-income. Insufficient funds to prepare for wildfires were a recurrent topic for all income levels in both study groups. Families with extra emergency funds were 4 times more likely to meet overall preparedness criteria than those without. Higher-income interviewees discussed supply chain issues during wildfires, such as air purifiers being "…sold out everywhere." Lower-income caregivers, in contrast, emphasized burdens of purchasing necessary items, describing air purifiers and filters as "very expensive…$60 each room." Additional stressors reported by interviewees are summarized in Table IV.

Theme 2: Novel Preparedness Predictors

We identified 4 unique factors influencing wildfire readiness: insurance plans, property type, child health concerns, and school readiness. First, a home insurance policy significantly improved preparedness for all 3 study outcomes (Table II). However, many (60%) participants reported not having home insurance. Of those insured, 87.1% were unaware if their policy covered wildfire-related issues. Interviewees expressed concerns with home insurance policies denying wildfire-related claims. One interviewee explained, "if you lose your home in a [wild]fire, you're doomed…because [home] insurance will not cover you anymore…[My boss had] fire insurance for 20 years, and then 1 year [the insurer was] like, 'oh no, you don't qualify, you're in a fire zone.'" Second, home preparedness differed between those who owned versus rented property. Homeowners expressed a greater ability to implement safety modifications compared with renters, such as replacing windows to improve indoor air quality. Homeowners trusted their homeowner's association to maintain the highest neighborhood safety standards. In contrast, renters cited substandard living conditions, including wildfire debris entering through poorly maintained roofs and landlords doing the "bare minimum."

Third, child health concerns were strongly associated with preparedness for wildfires. The presence of a child with a chronic health diagnosis, prescription medication, or a history of upper or lower respiratory illnesses was associated with significantly increased odds of both overall and item preparedness (Table III). Interviewees added that child health events, such as a new diagnosis of asthma in the ED, catalyzed their engagement in wildfire readiness (Table IV).

Fourth, interviews consistently identified caregivers' concerns about their child's school lacking wildfire readiness. Caregivers described a lack of wildfire-specific emergency drills at schools and an absence of masking practices to mitigate child respiratory symptoms. Some advocated for school policies mandating child mask use during ongoing wildfires.

Theme 3: Wildfire Mitigation, Evacuation, and Education

Most households (80%) reported an adequate supply of child masks. However, less than half (44%) reported child mask use during wildfires. Unexpectedly, caregivers of children

Table IV. Caregiver quotes from qualitative interviews describing wildfire preparedness, barriers, and other factors (n = 9): A pilot study of pediatric wildfire readiness

Theme	Subtheme	Quote
Disparities	Cost of living	"The cost of living makes it difficult to prepare for a disaster…there's not enough resources for [wildfires]."
	Cost of water systems	**"…you can keep your grass wet or your roof wet with your hose if you want… so your water bill goes up…it keeps it moist so if embers hit your roof, it's not dry and it just doesn't light up [right away]."**
	Insurance	"We did add the higher insurance to have coverage… from wildfires."
New themes	**Wildfire home insurance concerns**	**"I would probably not live in a neighborhood that's close to any fire zones now because the fires are getting worse every year… [home] insurances will not cover you anymore in California…if you're not experienced [or] for a young family that just bought a home, the insurance companies will tell you it's not even a possibility to insure your home for a [wild]fire."**
	Child diagnosis improves preparedness	"We actually got [air purifiers] during that wildfire. We decided to study a little bit about it…because of her [daughter's]…asthma."
		"…he has some…atopic conditions like eczema, food allergies, and we have even had reactive airway when he was a little baby. But this is the first time where he's been basically diagnosed with asthma…I guess, now, that he has [asthma], I think we probably are going to be a little bit more cognizant, because [wildfires] can potentially exacerbate his condition."
	School not prepared	"Another thing is that if there is a wildfire going on nearby our area, I will not allow them to go to school…just because at school they do not keep the same precautions obviously as we would at home."
	School masks	"…when there is a [wild]fire [and] if they are not going to cancel school, they should require children to arrive with masks."
Wildfire smoke mitigation	**Child mask knowledge**	**"That's our like our third fire that we've experienced…it's never even crossed my mind to use [masks] as a tool to prevent my daughter from getting allergies or affected by the [wildfire] smoke."**
		"I don't feel any way towards [masks]…If there's literature that's supportive [of child mask use during wildfires], then sure [I'll use masks]."
	Mask cause potential harm	"I wouldn't know how safe it is to put on a mask with the wildfire (on her infant child)…because I don't know if it would make it worse…like not being able to top breathe…"
	Respirators	"If [N-95s] are necessary to keep [children] safe, then I'll do it."
	Community interactions	"A few of my neighbors, we do have kids-so we're kind of on the same page on board with the air purifiers…and taping the windows to make sure that there's no smoke or debris coming with the ashes."
Study improves awareness	**Interview motivates caregiver**	**"This research has made me aware of how as a community we are going to deal with the [wild]fire again…I will findout-asacommunity-howare we going to be evacuated and where. I think it's been a wakeup call for me to talk to you to make sure I do research for myself…"**
Wildfire education	Preferred strategies	"…kids come home [from school] and teach [parents] things…they'll grow up knowing [wildfire readiness strategies and]…the chances of them staying in their community is pretty high…so then you're raising generations of kids that are aware…of what to do when you live in [wildfire prone areas]."

with health concerns were more likely to possess and utilize air purifiers, but not masks (Table III). Approximately 60% endorsed never monitoring air quality and did not plan to do so during future wildfires, highlighting a cognitive gap. Only 54.5% endorsed basic home ventilation systems, and only half of this group planned to change filters during wildfires. Interviewees valued neighborhood interactions with increased preparedness. Key evacuation barriers identified included concerns about property, uncertain evacuation destinations, and pet considerations. Limited evacuation routes preoccupied families living in WUIs.

Pet owners consistently reported unpreparedness, including lacking extra pet supplies, transport carriers, and copies of important pet documentation. One participant recounted, "[during the wildfire] there are certain ranches where horses were trapped in barns and got burned and killed…The Station didn't have any way to evacuate their animals. They were asking for big rigs to come out and help them and to put their animals in."

Survey participants favored electronic communication (email/e-newsletter 55.4%, phone applications 25.7%) in both written (44.6%) and video (36.5%) educational formats. Interview data suggested innovative approaches: community-based learning in local parks and school-based education programs to enhance family preparedness through child education.

Discussion

Frequent wildfires will threaten more communities, especially in fire-prone WUI regions.[7,16,51] Our study confirmed disparities and systemic barriers influencing wildfire preparedness among families with children in Southern California. Understanding these challenges is crucial for developing effective and equitable interventions to protect children.

Theme 1: Wildfire Preparedness Disparities

Overall wildfire preparedness was low among households with children. We identified a substantial gap between possessing emergency supplies and engaging in actionable planning, suggesting caregivers assume acquiring physical items as perfect readiness. This gap extends beyond previous disaster preparedness findings that separate actionable planning from gathering supplies.[52-54] Current preparedness messaging may inadequately address the transition from gathering supplies to creating plans. In addition, simply having supplies is very different than having them packed and accessible in go-bags for evacuation.

Our findings confirm disparities in preparedness actions among specific groups.[27,39,53] Other/multiracial households, of which 90% self-identified as Hispanic/Latino, exhibited significantly lower rates of action preparedness compared with White households. This finding warrants special attention because a disproportionate proportion of Hispanic families live in WUIs.[16,17] These disparities may stem from systemic issues such as language barriers in emergency communications for non-English speaking groups[55,56] and insufficient disaster outreach to minority communities.[55,57] Caregivers with less education and lower income levels in our community also had significantly lower WAP but not WIP. This finding aligns with prior studies in other higher income and education communities with higher action preparedness.[39,41,58,59] This observation also highlights that simply possessing disaster supplies may not influence WOP as much as planning and practicing emergency plans. Interestingly, readiness was lower among younger caregivers than older ones, suggesting age-specific disaster preparedness interventions are needed for younger families.

Finally, both quantitative and qualitative data noted financial constraints as a consistent barrier to preparedness efforts. Lower-income families face direct burdens of purchasing preparedness items, and even higher-income families encountered resource scarcity during actual events. Preparedness is heavily influenced by systemic economic factors, community readiness, and availability of resources.[60-63] Socioeconomic and demographic factors exacerbate health inequities and hinder disaster resilience among marginalized communities.[25,28,39,64-66] Therefore, targeted efforts to improve emergency planning among at-risk families, alongside equitable interventions to safeguard pediatric populations in the face of escalating wildfire threats are needed.

Theme 2: Novel Preparedness Predictors

Our analysis revealed 4 key new findings that offer insights for interventions toward wildfire preparedness. Home insurance policy was one of the strongest predictors of household wildfire readiness. The strong association between no insurance plan and lower preparedness raises concerns about household financial instability and broader disengagement from protective measures. Recent market trends show both increasing insurance costs for wildfires and potentially unreliable coverage in fire-prone areas.[67,68] Local, state, and federal initiatives, such as subsidized insurance programs, financial support for equitable access to wildfire resources, and more rigorous rental safety standards, are vital for household disaster resilience, especially among growing WUIs with marginalized groups.[16,17,20] In addition to insurance, property type also emerged as a housing inequity. Although previous disaster recovery studies acknowledge housing tenure's importance, its specific impact on wildfire preparedness remains unexplored.[69-71] Consequently, future interventions must consider tenancy status and actively engage landlords in preparedness efforts.

We found that a child's health status can act as a powerful catalyst for parental preparedness, transforming abstract risks into tangible motivations for action. Pediatric healthcare providers can thus leverage these limited "teachable moments" (eg, a new asthma diagnosis) to initiate disaster preparedness conversations and provide targeted resources to families with medically complex children. This may require strengthening relationships between health care systems and emergency management agencies. Strategic collaborations with schools represent an untapped preparedness opportunity, which highlight anxieties regarding schools' lack of specific safety practices for wildfire smoke and emergency drills. Our data and participants support school-based wildfire readiness programs including respiratory protection protocols and drills as a means to reduce the inequity in preparedness.

Theme 3: Wildfire Mitigation, Evacuation, and Education

Despite a high reported supply of child masks, their actual use during wildfires was low. This could be due to lack of education on proper use, discomfort, or perceived ineffectiveness,[72] underscoring the need for public health campaigns focused on effective mask utilization in children during smoke events. On the other hand, interviewed caregivers endorsed increased comfort and familiarity with respirator masks after observing health care workers using them since 2020, which could be key to promote mask education and usage. Infrequent air quality monitoring and inadequate home ventilation practices suggest a broader lack of awareness regarding indoor air quality risks from wildfire smoke.

Therefore, targeted public health messaging based on population preferred methods such as emails and phone applications in written and video format is crucial to improve awareness and promote effective wildfire mitigation strategies for children, pets, and families. Furthermore, clearly defined and communicated evacuation routes, especially for those in WUIs, are essential.

We found actionable insights for designing effective wildfire preparedness interventions, indicating that multimodal, accessible, and contextually relevant educational interventions are most likely to enhance family preparedness, and preparedness within schools. Tailoring educational content to be readily accessible via preferred platforms and leveraging trusted community hubs, such as local parks and schools, can enhance reach and engagement.

Study limitations, including the cross-sectional design, recruitment from a single ED, and small sample size, may weaken causal inferences and constrain generalizability.[73-76] This reflects a broader challenge in disaster research, where planning and executing prospective studies have proven difficult in the past. Data were collected via self-report, which may introduce recall or social desirability bias.[77-81] Our analysis also lacked geographical hazard risk data. Including these data could contextualize preparedness behaviors within specific risk environments, particularly for wildfires.[47,82] Future studies incorporating geospatial analysis can enhance result generalizability and deepen understanding of location-specific preparedness patterns.[83]

Conclusion

Overall, our findings reveal complex disparities in pediatric wildfire preparedness, influenced by socioeconomic factors and novel elements such as insurance coverage, housing type, and child health concerns. Two immediate intervention opportunities for wildfire smoke mitigation include promotion of mask usage and air quality monitoring. School safety protocols are a unique target for wildfire preparedness for children and families. We found need for multilevel, child-centered wildfire preparedness interventions that address financial constraints, housing inequities, and institutional gaps. These readiness elements are critical for safeguarding pediatric health and promoting community resilience during wildfire disasters. ■

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

During the preparation of this work, the author(s) used ChatGPT to check punctuation, grammar, and spelling, and to brainstorm the manuscript title. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content.

CRediT authorship contribution statement

Natasha Gill: Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Danica B. Liberman:** Writing – review & editing, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **Ed Avol:** Writing – review & editing, Supervision, Methodology, Investigation, Conceptualization. **Anita Schmidt:** Writing – review & editing, Supervision, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Samantha Lozano:** Writing – review & editing, Project administration, Data curation. **Yan Chai:** Writing – review & editing, Formal analysis, Data curation. **Todd P. Chang:** Writing – review & editing, Supervision, Methodology, Investigation, Formal analysis, Conceptualization.

Declaration of Competing Interest

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Aryan Madani, DO: Dr. Madani completed a research elective as a rotating medical student through the Arizona College of Osteopathic Medicine, Midwestern University. He was trained and gathered study data for both the survey and interview study instruments. He transcribed the interviews he conducted.

Roxanna Peza: Ms. Peza participated as a research coordinator who administered and gathered survey data, primarily for Spanish-speaking participants, through the Division of Emergency & Transport Medicine, Children's Hospital Los Angeles, Los Angeles, CA.

Anna Nguyen and Devon Sieving: Ms. Nguyen and Ms. Sieving participated as undergraduate students for class credit for their "MEDS490: Advanced Clinical Research" class through the University of Southern California, Los Angeles, CA. Students reviewed literature, screened and recruited survey participants, and administered surveys. They gave a final presentation about their research experience and received grades based on their performance.

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References

1. Shukla P, Skea J, Calvo Buendia V, Masson-Delmotte V, Portner H-O, Roberts D, et al. Climate change and land: Intergovernmental Panel on Climate Change. 2019. Accessed March 25, 2024. https://www.ipcc.ch/site/assets/uploads/2019/11/SRCCL-Full-Report-Compiled-191128.pdf
2. FAO. The Impact of Disasters on Agriculture and Food Security 2023. Food and Agriculture Organization of the United Nations. 2023. https://doi.org/10.4060/cc7900en
3. Davis JR, Wilson S, Brock-Martin A, Glover S, Svendsen ER. The impact of disasters on populations with health and health care disparities. Disaster Med Public Health Prep 2010;4:30-8. https://doi.org/10.1017/s1935789300002391
4. Jimenez AM, Collins TW, Grineski SE. Intra-ethnic disparities in respiratory health problems among Hispanic residents impacted by a flood. J Asthma 2013;50:463-71. https://doi.org/10.3109/02770903.2013.786087
5. Ablah E, Konda K, Kelley CL. Factors predicting individual emergency preparedness: a multi-state analysis of 2006 BRFSS data. Biosecur Bioterror Biodefense Strategy Pract Sci 2009;7:317-30. https://doi.org/10.1089/bsp.2009.0022
6. Chiu M, Goodman L, Palacios CH, Dingeldein M. Children in disasters. Semin Pediatr Surg 2022;31:151219. https://doi.org/10.1016/j.sempedsurg.2022.151219
7. Abatzoglou JT, Williams AP. Impact of anthropogenic climate change on wildfire across Western US forests. Proc Natl Acad Sci 2016;113:11770-5. https://doi.org/10.1073/pnas.1607171113
8. Liu JC, Mickley LJ, Sulprizio MP, Dominici F, Yue X, Ebisu K, et al. Particulate air pollution from wildfires in the Western US under climate change. Clim Change 2016;138:655-66. https://doi.org/10.1007/s10584-016-1762-6
9. McClure CD, Jaffe DA. US particulate matter air quality improves except in wildfire-prone areas. Proc Natl Acad Sci U S A 2018;115:7901-6. https://doi.org/10.1073/pnas.1804353115

10. Künzli N, Avol E, Wu J, Gauderman WJ, Rappaport E, Millstein J, et al. Health Effects of the 2003 Southern California Wildfires on Children. Am J Respir Crit Care Med 2006;174:1221-8. https://doi.org/10.1164/rccm.200604-519OC
11. Holm SM, Miller MD, Balmes JR. Health effects of wildfire smoke in children and public health tools: a narrative review. J Expo Sci Environ Epidemiol 2021;31:1-20. https://doi.org/10.1038/s41370-020-00267-4
12. Delfino RJ, Brummel S, Wu J, Stern H, Ostro B, Lipsett M, et al. The relationship of respiratory and cardiovascular hospital admissions to the southern California wildfires of 2003. Occup Environ Med 2009;66:189-97. https://doi.org/10.1136/oem.2008.041376
13. Doubleday A, Sheppard L, Austin E, Busch Isaksen T. Wildfire smoke exposure and emergency department visits in Washington State. Environ Res Health 2023;1:025006. https://doi.org/10.1088/2752-5309/acd3a1
14. Chen K, Ma Y, Bell ML, Yang W. Canadian wildfire smoke and asthma syndrome emergency department visits in New York City. JAMA 2023;330:1385. https://doi.org/10.1001/jama.2023.18768
15. Leibel S, Nguyen M, Brick W, Parker J, Ilango S, Aguilera R, et al. Increase in pediatric respiratory visits associated with Santa Ana wind-driven wildfire smoke and PM2.5 levels in San Diego county. Ann Am Thorac Soc 2020;17:313-20. https://doi.org/10.1513/AnnalsATS.201902-150OC
16. Radeloff VC, Helmers DP, Kramer HA, Mockrin MH, Alexandre PM, Bar-Massada A, et al. Rapid growth of the US wildland-urban interface raises wildfire risk. Proc Natl Acad Sci 2018;115:3314-9. https://doi.org/10.1073/pnas.1718850115
17. Greenberg M, Angelo H, Losada E, Wilmers CC. Relational geographies of urban unsustainability: the entanglement of California's housing crisis with WUI growth and climate change. Proc Natl Acad Sci 2024;121:e2310080121. https://doi.org/10.1073/pnas.2310080121
18. Schug F, Bar-Massada A, Carlson AR, Cox H, Hawbaker TJ, Helmers D, et al. The global wildland-urban interface. Nature 2023;621:94-9. https://doi.org/10.1038/s41586-023-06320-0
19. Karels J, Corbin M. Wildland Urban Interface: A Look at Issues and Resolutions. 2022. Accessed November 15, 2023. https://www.usfa.fema.gov/downloads/pdf/publications/wui-issues-resolutions-report.pdf. United States Fire Administration.
20. Anton CE, Lawrence C. Does place attachment predict wildfire mitigation and preparedness? A comparison of wildland-urban interface and rural communities. Environ Manage 2016;57:148-62. https://doi.org/10.1007/s00267-015-0597-7
21. Gabbe CJ, Pierce G, Oxlaj E. Subsidized households and wildfire hazards in California. Environ Manage 2020;66:873-83. https://doi.org/10.1007/s00267-020-01340-2
22. World Health Organization. Closing the gap in a generation: health equity through action on the social determinants of Health. WHO. 2008. Accessed April 23, 2021. https://apps.who.int/iris/handle/10665/43943
23. Braveman P, Gottlieb L. The social determinants of health: it's time to consider the causes of the causes. Public Health Rep Wash DC 1974 2014;129:19-31. https://doi.org/10.1177/00333549141291S206
24. Hahn RA. What is a social determinant of health? Back to basics. J Public Health Res 2021;10:2324. https://doi.org/10.4081/jphr.2021.2324
25. Adepoju OE, Han D, Chae M, Smith KL, Gilbert L, Choudhury S, et al. Health disparities and climate change: the intersection of three disaster events on vulnerable communities in Houston, Texas. Int J Environ Res Public Health 2021;19:35. https://doi.org/10.3390/ijerph19010035
26. Dziuban EJ, Peacock G, Frogel M. A child's health is the public's health: progress and gaps in addressing pediatric needs in public health emergencies. Am J Public Health 2017;107:S134-7. https://doi.org/10.2105/AJPH.2017.303950
27. Andrulis DP, Siddiqui NJ, Gantner JL. Preparing racially and ethnically diverse communities for public health emergencies. Health Aff Proj Hope 2007;26:1269-79. https://doi.org/10.1377/hlthaff.26.5.1269
28. Berberian AG, Gonzalez DJX, Cushing LJ. Racial disparities in climate change-related health effects in the United States. Curr Environ Health Rep 2022;9:451-64. https://doi.org/10.1007/s40572-022-00360-w
29. California Department of Forestry and Fire Protection. 2020 Fire Season Incident Archive. July 27, 2023. Accessed March 23, 2022. https://www.fire.ca.gov/incidents/2020
30. The California Department of Forestry and Fire Protection (CAL FIRE. Incident archive. 2025. Accessed February 12, 2025. https://www.fire.ca.gov
31. 2023 FEMA National Household Survey on disaster preparedness. Federal Emergency Management Agency. 2024. Accessed April 23, 2024. https://fema-community-files.s3.amazonaws.com/2023-National-Household-Survey.pdf
32. Abrams SA, Duggan CP. Infant and child formula shortages: now is the time to prevent recurrences. Am J Clin Nutr 2022;116:289-92. https://doi.org/10.1093/ajcn/nqac149
33. Cohen R, Pettoello-Mantovani M, Giardino I, Carrasco-Sanz A, Somekh E, Levy C. The shortage of amoxicillin: an escalating public health crisis in pediatrics faced by several Western countries. J Pediatr 2023;257:113321. https://doi.org/10.1016/j.jpeds.2023.01.001
34. Shachar C, Gruppuso PA, Adashi EY. Pediatric drug and other shortages in the Age of supply chain disruption. JAMA 2023;329:2127. https://doi.org/10.1001/jama.2023.4755
35. Fetters MD, Curry LA, Creswell JW. Achieving integration in mixed methods designs-principles and practices. Health Serv Res 2013;48:2134-56. https://doi.org/10.1111/1475-6773.12117
36. Creswell J, Plano V. Designing and conducting mixed methods research. 3rd ed. Los Angeles, CA: SAGE Publications; 2017.
37. Creswell JW, Creswell JD. Research design: qualitative, quantitative, and mixed methods approaches sixth edition. 6th ed. Los Angeles, CA: SAGE Publications; 2022.
38. KidaData.org. All data: los Angeles county. 2021. Accessed March 23, 2024. https://kidsdata.org/region/364/los-angeles-county/results#ind=&say=&cat=6,1
39. Zamboni LM, Martin EG. Association of US households' disaster preparedness with socioeconomic characteristics, composition, and Region. JAMA Netw Open 2020;3:e206881. https://doi.org/10.1001/jamanetworkopen.2020.6881
40. Federal emergency Management Agency: national Household Survey on disaster preparedness. 2021. Accessed April 29, 2021. https://www.fema.gov/about/openfema/data-sets
41. Al-Rousan TM, Rubenstein LM, Wallace RB. Preparedness for natural disasters among older US adults: a nationwide survey. Am J Public Health 2015;105:S621-6. S614-620. https://doi.org/10.2105/AJPH.2013.301559r
42. Dunlop PD, McNeill IM, Boylan JL, Morrison DL, Skinner TC. Preparing … for what? Developing multi-dimensional measures of community wildfire preparedness for researchers, practitioners and households. Int J Wildland Fire 2014;23:887. https://doi.org/10.1071/WF13141
43. Velez ALK, Diaz JM, Wall TU. Public information seeking, place-based risk messaging and wildfire preparedness in southern California. Int J Wildland Fire 2017;26:469. https://doi.org/10.1071/WF16219
44. Paveglio TB, Edgeley CM, Stasiewicz AM. Assessing influences on social vulnerability to wildfire using surveys, spatial data and wildfire simulations. J Environ Manage 2018;213:425-39. https://doi.org/10.1016/j.jenvman.2018.02.068
45. Centers for Disease Control and Prevention. Behavioral risk factor surveillance System questionnaire. 2012. Accessed January 31, 2021. https://www.cdc.gov/brfss/annual_data/annual_2012.html
46. Abunyewah M, Gajendran T, Maund K, Okyere SA. Strengthening the information deficit model for disaster preparedness: mediating and moderating effects of community participation. Int J Disaster Risk Reduct 2020;46:101492. https://doi.org/10.1016/j.ijdrr.2020.101492
47. Cutter SL, Boruff BJ, Shirley WL. Social vulnerability to environmental hazards. Soc Sci Q 2003;84:242-61. https://doi.org/10.1111/1540-6237.8402002
48. Schneider NC, Coates WC, Yarris LM. Taking your qualitative research to the next level: a guide for the medical educator. AEM Educ Train 2017;1:368-78. https://doi.org/10.1002/aet2.10065
49. Olmos-Vega FM, Stalmeijer RE, Varpio L, Kahlke R. A practical guide to reflexivity in qualitative research: AMEE Guide No. 149. Med Teach 2022;45:1-11. https://doi.org/10.1080/0142159X.2022.2057287
50. Guetterman TC, Fetters MD, Creswell JW. Integrating quantitative and qualitative results in health science mixed methods research through

joint displays. Ann Fam Med 2015;13:554-61. https://doi.org/10.1370/afm.1865
51. Williams AP, Abatzoglou JT, Gershunov A, Guzman-Morales J, Bishop DA, Balch JK, et al. Observed impacts of anthropogenic climate change on wildfire in California. Earths Future 2019;7:892-910. https://doi.org/10.1029/2019EF001210
52. Gowan ME, Sloan JA, Kirk RC. Prepared for what? Addressing the disaster readiness gap beyond preparedness for survival. BMC Public Health 2015;15:1139. https://doi.org/10.1186/s12889-015-2440-8
53. DeBastiani SD, Strine TW, Vagi SJ, Barnett DJ, Kahn EB. Preparedness perceptions, sociodemographic characteristics, and level of household preparedness for public health emergencies: behavioral risk factor surveillance System, 2006-2010. Health Secur 2015;13:317-26. https://doi.org/10.1089/hs.2014.0093
54. Kohn S, Eaton JL, Feroz S, Bainbridge AA, Hoolachan J, Barnett DJ. Personal disaster preparedness: an integrative review of the literature. Disaster Med Public Health Prep 2012;6:217-31. https://doi.org/10.1001/dmp.2012.47
55. Méndez M, Flores-Haro G, Zucker L. The (in)visible victims of disaster: understanding the vulnerability of undocumented Latino/a and indigenous immigrants. Geoforum J Phys Hum Reg Geosci 2020;116:50-62. https://doi.org/10.1016/j.geoforum.2020.07.007
56. Messias DKH, Lacy EC. Katrina-Related health concerns of Latino survivors and evacuees. J Health Care Poor Underserved 2007;18:443-64. https://doi.org/10.1353/hpu.2007.0041
57. Cassady D, Castaneda X, Ruelas MR, Vostrejs MM, Andrews T, Osorio L. Pandemics and vaccines: perceptions, reactions, and lessons learned from hard-to-reach latinos and the H1N1 campaign. J Health Care Poor Underserved 2012;23:1106-22. https://doi.org/10.1353/hpu.2012.0086
58. Tam G, Huang Z, Chan EYY. Household preparedness and preferred communication channels in public Health Emergencies: a Cross-Sectional Survey of residents in an Asian developed urban City. Int J Environ Res Public Health 2018;15:1598. https://doi.org/10.3390/ijerph15081598
59. Cong Z, Feng G, Chen Z. Disaster exposure and patterns of disaster preparedness: a multilevel social vulnerability and engagement perspective. J Environ Manage 2023;339:117798. https://doi.org/10.1016/j.jenvman.2023.117798
60. Adams RM, Eisenman DP, Glik D. Community advantage and individual self-efficacy promote disaster preparedness: a multilevel model among persons with disabilities. Int J Environ Res Public Health 2019;16:2779. https://doi.org/10.3390/ijerph16152779
61. Shukla M, Amberson T, Heagele T, McNeill C, Adams L, Ndayishimiye K, et al. Tailoring household disaster preparedness interventions to reduce health disparities: nursing implications from machine learning importance features from the 2018-2020 FEMA National Household Survey. Int J Environ Res Public Health 2024;21:521. https://doi.org/10.3390/ijerph21050521
62. Gershon RR, Portacolone E, Nwankwo EM, Zhi Q, Qureshi KA, Raveis VH. Psychosocial influences on disaster preparedness in San Francisco recipients of home care. J Urban Health Bull N Y Acad Med 2017;94:606-18. https://doi.org/10.1007/s11524-016-0104-3
63. Mays GP, Hogg RA. Economic shocks and public health protections in US metropolitan areas. Am J Public Health 2015;105:S280-7. https://doi.org/10.2105/AJPH.2014.302456
64. Aung TW, Sehgal AR. Prevalence, Correlates, and impacts of Displacement because of natural disasters in the United States from 2022 to 2023. Am J Public Health 2025;115:55-65. https://doi.org/10.2105/AJPH.2024.307854
65. Sharpe JD, Wolkin AF. The epidemiology and geographic patterns of natural disaster and extreme weather mortality by race and ethnicity, United States, 1999-2018. Public Health Rep Wash DC 1974 2022;137:1118-25. https://doi.org/10.1177/00333549211047235
66. Karaye IM, Horney JA. The impact of social vulnerability on COVID-19 in the U.S.: an analysis of spatially varying relationships. Am J Prev Med 2020;59:317-25. https://doi.org/10.1016/j.amepre.2020.06.006
67. Flavelle C. As wildfires get worse, insurers pull back from riskiest areas. The New York Times Company. 2019. Accessed October 15, 2024. https://www.nytimes.com/2019/08/20/climate/fire-insurance-renewal.html
68. Boomhower J, Fowlie M, Gellman J, Plantinga A. How are insurance markets adapting to climate change? Risk classification and pricing in the market for homeowners insurance. Cambridge, MA: National Bureau of Economic Research; 2024. doi:10.3386/w32625.
69. Murphy ST, Cody M, Frank LB, Glik D, Ang A. Predictors of emergency preparedness and compliance. Disaster Med Public Health Prep 2009;3:1-10. https://doi.org/10.1097/DMP.0b013e3181a9c6c5
70. Friedman S, Fussell E, Nakatsuka M, Yucel R. Hispanic disaster preparedness in the United States, 2017: examining the Association with residential characteristics. Cityscape Wash DC 2021;23:205-39.
71. Lee JY, Van Zandt S. Housing tenure and social vulnerability to disasters: a review of the evidence. J Plan Lit 2019;34:156-70. https://doi.org/10.1177/0885412218812080
72. Hassani A, Flores M, Streuli S, Jiang Y, Guerra AW, Fielding-Miller R. After mandates end: complex decision making regarding COVID -19 masking in San Diego elementary schools through the social ecological model. J Sch Health 2025;95:597-603. https://doi.org/10.1111/josh.70026
73. Savitz DA, Wellenius GA. Can cross-sectional studies contribute to causal inference? It depends. Am J Epidemiol 2023;192:514-6. https://doi.org/10.1093/aje/kwac037
74. Kesmodel US. Cross-sectional studies - what are they good for? Acta Obstet Gynecol Scand 2018;97:388-93. https://doi.org/10.1111/aogs.13331
75. Belbasis L, Bellou V. Introduction to epidemiological studies. Methods Mol Biol Clifton NJ 2018;1793:1-6. https://doi.org/10.1007/978-1-4939-7868-7_1
76. Mann CJ. Observational research methods. Research design II: cohort, cross sectional, and case-control studies. Emerg Med J EMJ 2003;20:54-60. https://doi.org/10.1136/emj.20.1.54
77. Zini MLL, Banfi G. A narrative literature review of bias in collecting patient reported Outcomes measures (PROMs). Int J Environ Res Public Health 2021;18:12445. https://doi.org/10.3390/ijerph182312445
78. Lofters A, Vahabi M, Glazier RH. The validity of self-reported cancer screening history and the role of social disadvantage in Ontario, Canada. BMC Public Health 2015;15:28. https://doi.org/10.1186/s12889-015-1441-y
79. Latkin CA, Edwards C, Davey-Rothwell MA, Tobin KE. The relationship between social desirability bias and self-reports of health, substance use, and social network factors among urban substance users in Baltimore, Maryland. Addict Behav 2017;73:133-6. https://doi.org/10.1016/j.addbeh.2017.05.005
80. Johnson T, Fendrich M. Modeling sources of self-report bias in a survey of drug use epidemiology. Ann Epidemiol 2005;15:381-9. https://doi.org/10.1016/j.annepidem.2004.09.004
81. Okamoto K, Ohsuka K, Shiraishi T, Hukazawa E, Wakasugi S, Furuta K. Comparability of epidemiological information between self- and interviewer-administered questionnaires. J Clin Epidemiol 2002;55:505-11. https://doi.org/10.1016/s0895-4356(01)00515-7
82. Paveglio TB, Brenkert-Smith H, Hall T, Smith AMS. Understanding social impact from wildfires: advancing means for assessment. Int J Wildland Fire 2015;24:212. https://doi.org/10.1071/WF14091
83. Gonçalves A, Oliveira S, Zêzere JL. Assessing wildfire exposure and social vulnerability at the local scale using a GIS-based approach. MethodsX 2024;12:102650. https://doi.org/10.1016/j.mex.2024.102650