Developing and Validating a Trust in Public Health Authorities Scale for Extreme Heat Guidelines

By

Riley Ann Achtemeier

A thesis

submitted in partial fulfillment of the

requirements for the degree of

Master of Science

University of Washington

2025

Committee:

Resham Patel

Nicole Errett

Program Authorized to Offer Degree:

Department of Occupational and Environmental Health Sciences

University of Washington

Abstract

Developing and Validating a Trust Assessment Scale to Evaluate Trust in Public Health Authorities and Extreme Heat Guideline Perceptions

Riley Ann Achtemeier

Chair of the Supervisory Committee:

Resham Patel

Department of Environmental and Occupational Health Science

In the summer of 2021, the Pacific Northwest (PNW) experienced a record-breaking "heat dome" that severely strained public health systems and disproportionately impacted vulnerable populations. While trust in public health authorities (PHAs) is known to influence disaster response and resource use, little research has examined trust in the context of extreme heat events (EHEs) guidelines. This study addresses that gap by assessing the face validity of an adapted survey tool to measure public trust in PHAs and acceptance of EHE guidelines. To adapt an existing survey, a literature review was conducted on existing EHE guidelines to develop themes and questions proposed to a discussion group. Questions were refined through a second discussion group resulting in eight finalized questions, those eight questions were combined with 12 PHA trust questions and demographic questions to create the adapted Trust in Public Health Authorities (TiPHA) questionnaire. The adapted TiPHA questionnaire was administered to six focus groups with 29 participants from Multnomah County, OR, King County, WA and Vancouver, BC to assess perceived clarity, accuracy, difficulty, length, and bias through facilitated discussion. The focus groups were professionally transcribed, and a content analysis was conducted. Overall, the adapted TiPHA questionnaire was found to be generally clear in format and question clarity, with minimal bias, and of appropriate length. However, minor

revisions were needed for specific questions and questionnaire elements, including definitions for key terms. This research begins to fill the gap for trust in PHAs and their climate-related hazard guidance, which will equip PHAs to assess if trust impacts adherence to EHE guidance and thus how to best deploy EHE communications to improve health outcomes.

Table of Contents.

List of Tables.

List of Figures.

Acknowledgements

I would like to acknowledge the research team that assisted me at every step of the way. Resham Patel and Nicole Errett's mentorship, time, and thoughtful assistance from research plan development to manuscript editing are invaluable. A grand thank you to Rachael Carter's for her help throughout the process, both as a research collaborator and as a friend and motivator. I would like to thank the Northwest Center for Public Health practice for their continued commitment to fund student research, which without, this research would not have been possible. Additionally, I would like to thank the University of Washington's School of Public Health faculty, who there are too many to name, for formal education in the classroom and informal education through panels and individual discussions. Finally, I would like to thank all my friends and family who assisted in editing this manuscript and for cheering me on along the way.

Analysis Team. Riley Achtemeier and Rachael Carter did not live in the PNW during the heat dome and were not affiliated with the local health jurisdictions (LHJs) in the study, however they are currently residents of King County. Nicole Errett and Resham Patel lived in the PNW during the heat dome and at that time Resham Patel worked for King County. Riley conducted the literature review for heat questions, developed the facilitation guide, led the focus groups, and conducted the data analysis. Rachael was the notetaker for the focus group and participated in code book development through co-coding. Nicole and Resham reviewed all materials and contributed their expertise in climate change, extreme heat, LHJs, and qualitative research.

Background.

The Pacific Northwest (PNW) is a temperate region with high annual rainfall, an average August temperature of 74°F and historically little need for air conditioning (AC).[1] The American housing survey shows that Seattle, the second largest city in the PNW, is one of the U.S. cities with the least in-home AC, with just 844,000 out of ~1,650,246 housing units in Seattle metropolitan area containing primary AC and 375,000 with central AC in 2021.[2] With limited central AC across the region and the increasing incidence of heatwaves during the summer months the health risk is high. Two different climate models predict that the PNW will have more extreme heat events (EHEs) and increase in summer average temperatures in the second half of the 21st century.[3,4] In the summer of 2021, it was 30°F hotter than the average temperatures of June, July, and August across the last 10 years.[5]

In late June of 2021, the PNW experienced an unprecedented, historic weather event characterized by a sprawling ridge of high pressure that led to an intense and prolonged heatwave, known as the "heat dome."[6] The heat dome set numerous temperature records, causing severe impacts across the states of Oregon, Washington, and parts of British Columbia. Daytime temperatures reached 120°F, well beyond the typical June daily high temperature of 72°F for the PNW.[7] Additionally, nighttime temperatures remained unusually high, preventing homes from cooling off at night.[8] The shear length of the heatwave, spanning 27 days, exacerbated the overall impact on communities' health and infrastructure.[9]

One of the most significant consequences of the 2021 heat dome was its adverse effect on the health of residents. Officials in British Columbia estimated 580 excess deaths – the number of deaths beyond the expected number of deaths in a timeframe – and both Oregon and Washington states reported at least 100 deaths from heat, respectively.[10,11] Furthermore, a study from the

University of Washington assessed injury deaths from 2014 to July 2021 and found that the 3-week period following the heat dome had 159 excess deaths compared to similar weeks in previous years.[12] The authors synthesized other data to hypothesize that the deaths could be from behavior or psychological changes, or injuries related to increased temperatures. National Public Radio reported that during one particular day of the heat dome, a total of 1,038 people across Oregon, Washington, Idaho, and Alaska went to the emergency room for heat-related illness – 1,029 more than the previous year.[11] Hospitals and emergency services experienced an influx of patients with heat-related illnesses, including heat exhaustion and heatstroke. [5,13–15] However, there could have been more heat-related deaths than originally counted. Weinberger et al. used individual level data and weather data for 297 counties from 1997 and 2006 to see how many excess deaths occurred because of EHEs. Their research found an average of 5,608 deaths per year were attributed to heat, far more than Center for Disease Control and Prevention's (CDCs) estimate of 658 per year.[16,17] When applying these findings to the heat dome, it could indicate that there were deaths categorized as a pre-existing conditions that were ultimately a result of heat exposure. Which would increase the total number of excess deaths.

The heat dome disproportionately impacted vulnerable populations, including older adults, unhoused people, and those living in heat islands – areas that are disproportionately warmer because of the built environment – than surrounding areas.[10,18–22] During EHEs and moderate heat events there is an increase risk in mortality from cardiovascular, respiratory, infectious, and digestive system diseases, diabetes, and mental and nervous system disorders.[23] Past literature has highlighted that the risk of heat-related mortality is highest among infants in their first week of life, older adults, women, widows, individuals with medical conditions, and those residing in nursing homes or healthcare facilities.[23,24] The greatest health effects have been observed in

cities with milder summers, lower prevalence of AC, and higher population density, and among people of color.[25,26] Beyond the health effects of the heat dome, the extreme temperatures strained existing infrastructure, leading to power outages that increased demand for cooling facilities and backup infrastructure, such as generators.[27] Addressing these challenges requires collaboration among non-governmental organizations, local and regional governments, and communities historically excluded from emergency outreach by public health authorities (PHAs).[28]

The 2021 heat dome prompted coordinated public awareness campaigns from local governments, emergency services, and community organizations to educate residents on the importance of staying hydrated, seeking cool shelter, and checking on vulnerable neighbors.[29,30] Cooling centers were established to provide refuge for those without access to AC.[31,32] Even with this coordinated response, the death toll indicates how unprepared the PNW was for this EHE.

The 2021 heat dome brought together academia, government, and community organizations for discussions, and analysis of PHAs response during the heat dome, and the development of preparedness plans for future EHEs in the PNW.[22] The University of Washington (UW), in collaboration with Multnomah County, OR; King County, WA; and Vancouver, BC, led initiatives including the Collaborative on Extreme Heat Events (or the Collaborative) to address EHEs in PNW cities.[33] Established in 2023 with support from UW, the Collaborative provided a platform for PHAs from Seattle, Portland and Vancouver to exchange 2021 heat dome experiences and share forward looking strategies for addressing EHEs.[33] The Collaborative aimed to build partnerships and explore innovative solutions to improve public health and community resilience. From 2023, the Collaborative co-developed an action and research agenda

through four webinars and one three-hour workshop with 60 attendees representing federal, state, and local public health agencies, academia, emergency management and other government agencies, housing organizations, Indigenous organizations, and health care coalitions. The diverse group allowed for interactive brainstorming sessions and breakout rooms for direct engagement.[34] During the workshop, the group discussed potential action, policy, and research initiatives. Research initiatives identified included; effective coordination efforts and ways to evaluate them, ways to reach communities, effective strategies for risk communication, and how a community responds to and perceives heat and health.[34] Taken collectively, these research ideas underscore the need for additional evidence to support local health jurisdictions to provide trusted communications to reduce public health risk during future EHEs.

Literature Review.

TRUST IN PHAS. Trust in PHAs can be defined as the belief in the competence, transparency, and integrity of institutions or individuals responsible for managing public health "even in the absence of scrutiny."[35–38] Trust in PHAs shapes how communities respond to health crises and emergencies.[36,39–44] In the United States (U.S.), trust in the federal government has been studied since 1958 in the "National Elections Study" at which time trust was highest at 75% of U.S. voting individuals.[45] However, since 1958, government trust has declined to 50% through 2001 and then declining even further to 25% through the last survey administered in 2024.[45] This trend has been observed internationally, with prior studies—mostly using surveys—showing low levels of trust in governments during public health emergencies, particularly among people of color. For example, a quantitative Likert survey of 1,545 people in Monrovia, Liberia during the 2014-15 Ebola epidemic found that only 24% of respondents expressed general trust in the government, while 73% trusted international non-governmental organizations (NGOs),

indicating a lower level of trust in PHAs for Monrovian people in comparison to NGOs.[42] Similarly, during the H1N1 pandemic in the United States, a survey of 1,543 respondents revealed a mean government trust score of 2.30 on a 4-point scale, indicating low overall trust, particularly when asked about government's commitment and ability to protect individuals.[46] The decline in public trust has only worsened since the onset of the COVID-19 pandemic in 2020.[47–50] In the U.S., both Democrats and Republicans have reported reduced trust in the government's handling of the COVID-19 crisis, with a notable 15% decline in vaccine trust among Republicans.[47] Distrust during the COVID-19 pandemic impacted health outcomes, with countries with higher trust in their government experiencing fewer cases and fatalities.[51]

Trust in PHAs can be significantly shaped by unmet expectations from past disaster responses and further eroded by socio-demographic disparities such as age, gender, race and socioeconomic status.[52,53] Growing income inequality has also contributed to this erosion, particularly among marginalized populations.[36] Research shows that people who are younger, those with less education, and people of color are more likely to report lower trust in local health officials.[54] Studies on the factors that determine trust highlighted that marginalized groups, particularly African Americans, tend to be more distrustful of institutions, often due to negative experiences such as discrimination.[55,56] This lack of trust in PHAs is concerning because marginalized groups are at increased risk of adverse health events and impacts from EHEs. Additionally, marginalized populations are more likely to be exposed to disaster.[57,58] A 2021 report from the Environmental Protection Agency found that Black individuals are projected to face disproportionately higher health risks from climate change, including increased risk of EHE-related deaths.[59] Therefore, with increased incidence of extreme weather events and disasters, trust in public health is needed for equitable emergency response.

INDIVIDUAL TRUST. Trust is important for adherence to public health guidelines, as residents who trust PHAs are more likely to view information and protocols given by PHAs as credible and reliable.[60] A study of 1,010 Italian residents aged 18 and older, conducted during the H1N1 pandemic, revealed that trust in both the media and health ministry significantly influenced resident adherence to recommended health behaviors.[61] Another study, conducted in the United States during the first wave of the H1N1 pandemic, surveyed 1,543 adults and found that trust in PHAs correlated positively with vaccine acceptance.[44] Similarly, in the Democratic Republic of the Congo, low institutional trust and widespread misinformation hampered the adoption of Ebola prevention behaviors, including vaccination.[62] Similarly, a survey of 1,545 individuals in Monrovia, Liberia, during the 2014-15 Ebola epidemic found that increased trust in the government increased compliance to social distancing measures and safe burial practices.[42] Additionally, the authors found that those who contracted Ebola had less trust in PHAs, creating a cycle of distrust and non-adherence.[42] Government neglect of those who live in Kenyan slums resulted in government mistrust prior to the COVID-19 pandemic which undermined pandemic preparedness and public health guideline adherence.[63] The 2009 H1N1 pandemic, the Ebola outbreak in West Africa, and COVID-19 pandemic all illustrate that low levels of individual trust in PHAs can significantly hinder compliance with public health recommendations, early warning efforts, and preventive measures, ultimately leading to more avoidable deaths.

TRUST IMPACTS ON COMMUNITY RESILIENCE. Greater trust in PHAs fosters resilient communities that are better prepared for public health emergencies.[39,64] A qualitative study conducted in April 2016 with 38 residents of Chañaral and Diego de Almagro, Chile, revealed that trust in PHAs played a role in fostering bonding and social capital during disaster response, recovery, and reconstruction phases.[65] However, Chilean residents without trust in PHAs resulted

in poor communication and resource distribution, which hindered community collaboration and weakened resilience after flooding and mudflow disasters.[65] Similarly, 193 interviews, 8 focus groups and 4 case studies conducted in villages affected by the 2013 cyclones in Bangladesh demonstrated that favoritism of aid distribution and corruption eroded trust, leading to community conflicts and slower recovery.[66]

In communities with high trust in government, individuals are more likely to assist one another by sharing resources and providing shelter, financial support and emotional aid. A 2015 survey of 3,666 Southern Indiana residents who experienced deadly tornadoes showed that those with higher trust in their government officials had a quicker recovery compared to those with low trust in government.[67] Additionally, a peer review of 40 articles found that high levels of community trust expedite recovery efforts, which emphasizes that trust in PHAs is essential across all disaster management phases, promoting adherence to health programs and enabling effective response and recovery.[39] Trust during crisis – such as disasters or public health emergencies – promotes adherence to health programs, mobilizes resources for surveillance and support, and enables more effective response, recovery, and risk mitigation.[68]

TRUST IN PHAS SURVEYS. Due to low trust in PHAs, research has increasingly focused on understanding trust and its implications for public health. A systematic review of 68 articles published in 2021 found there are notable gaps in trust research, including missing vulnerable populations, longitudinal studies, analysis of mass media and personal networks interactions, and integrative model building and theory development.[69] Of these 68 articles, this research team could access 40 full articles. The remaining 28 articles were inaccessible because they were not in English, or the full paper was unavailable. Of the 40 full articles reviewed, there were 20

quantitative-descriptive surveys, 2 mixed methods with a quantitative survey, 10 qualitative studies, and 8 mix methods/case studies focused on public trust in PHAs.[69]

Additionally, of the 20 quantitative-descriptive surveys, only 9 discussed the validation process of their instruments, and 9 retested or reused past trust scales. Increased use of validated survey tools across contexts and communities is needed to support the development of the evidence based related to trust in public health, including its determinants. Validation ensures the reliability and accuracy of the instruments used, and retesting scales is needed to measure trust consistently across studies. Reviews also highlighted that many studies using trust-related measures have not reported psychometrics or demonstrated evidence of validity.[44,70,71] Furthermore, 14 of the 20 studies provided their survey or interview questions. Without transparency and availability of research questions, other researchers or PHAs cannot replicate the survey in their jurisdiction.

Of the 22 quantitative surveys, the average length was 29 questions. The field requires measurement tools that are both brief and capable of effectively capturing the multidimensional nature of trust-related constructs. While the surveys focused on the effects of trust and health events, none focused on EHEs and trust, which is a notable gap given the rise in global impacts experienced from climate change. This highlights the need to develop a tool for environmental disasters, such as EHEs, that can measure trust routinely in a simple, quick, and resource-efficient manner.

TRUST IN PUBLIC HEALTH AUTHORITIES SCALE (TIPHA): SUMMARY OF EXISTING SCALE. During the COVID-19 pandemic, researchers at Johns Hopkins University developed a questionnaire to gauge public trust in PHAs and vaccine hesitancy. Their research was in response to the increase in anti-vaccination discussions in politics.[54] The researchers highlighted

that although trust has been measured in various domains including government, healthcare providers, and insurers, there was no established, validated scale to identify levels of trust in PHAs. Their study sought to fill a gap in public health research by providing a validated measure of trust that could inform strategies to improve public compliance with health recommendations, such as vaccine acceptance.[54] It aimed to develop and validate the original TiPHA questionnaire, which is designed to assess the U.S. population's levels of trust in PHAs, identify how this trust varies across demographic groups, and explore its associations with vaccine attitudes, particularly vaccine acceptance or hesitancy.

Original TiPHA developers first identified content domains for measuring trust in PHAs based on a review of existing literature on trust in government, risk communication, and vaccine acceptance. Ten key trust domains were selected: beneficence, efficiency, innovation, objectivity, competence, equity, transparency, responsiveness, accuracy, and integrity. From these domains, a 20-item survey using a 4-point Likert was created, with six items adapted from previous studies and 14 newly developed.[54] A Likert rating scale can be used to understand the participant's motives and attitudes, extrapolating from a set of agree and disagree statements.[80] In addition to trust-related items, their survey collected demographic data such as gender, age, education, income, race and parental status. The researchers conducted a pretest with 131 individuals and interviews with 20 individuals by phone, resulting in revisions to improve clarity and response accuracy.

The final survey was administered to 1,925 adults in early 2020 through Qualtrics, an online survey platform, with the sample designed to match the U.S. demographic profile. The final survey was used to assess both the original TiPHA questionnaire's trust domains and for final data analysis to answer their question on how trust in PHAs impacts vaccine acceptance and

vaccine guidelines. They found that of the original TiPHA questionnaire's trust in PHA domains (beneficence, efficiency, innovation, objectivity, competence, equity, transparency, responsiveness, accuracy and integrity), beneficence and competence best conceptualized trust in PHAs. Beneficence (accounting for 64% of the variance) includes items related to PHAs helping the public and using resources efficiently, while competence (accounting for 36% of the variance) covers items related to information sharing and problem-solving by authorities.[54] The reliability of these domains was strong, with Cronbach α values – a measure of how reliable the scale is – of 0.92 for beneficence and 0.87 for competence out of 1. The validity analysis confirmed that beneficence and competence domains fit the data better than the other domains. This was confirmed with better fit compared to the one-, three-, and four-domain models, with superior fit statistics: a lower Root Mean Square Error of Approximation (RMSEA) value (0.000), higher Comparative Fit Index (CFI) value (0.987), higher Tucker-Lewis Index (TLI) value (0.985), a lower Standardized Root Mean Square Residual (SRMR) value (0.019), and a significant chi-square improvement.[54] These results created the final 14-item trust in PHA questions, reducing the trust in PHA questions from 20 to 14.

These 14 trust in PHA questions were then compared to the vaccine adherence and acceptance questions by first grouping individuals into high or low trust categories using only the 14 PHA items from the original TiPHA questionnaire. Each respondent's answers were summed to create an overall trust score, and the median score was used as the cut-off point: those scoring above the median were categorized as having "high trust," while those below were categorized as having "low trust," turning trust into a binary variable. To assess the prevalence of trust across the population, they used descriptive statistics to observe general trends and Pearson's chi-square tests to determine whether differences in trust were statistically significant across subpopulations

such as race, age, or gender. They then conducted multiple logistic regression analyses to examine whether individuals' vaccine-related attitudes, beliefs, and acceptance were associated with their level of trust in PHAs, controlling for demographic factors like gender, income, education, race, age, geographic region, and parental status. Finally, they ran both adjusted and unadjusted odds ratios for each vaccine-related question, comparing responses based on high or low trust levels to further evaluate these relationships. They found that trust in PHAs highly associated with adherence to vaccine recommendations.

However, TiPHA study authors note several limitations, and suggest that the scale requires further validation to capture its application to different types of PHAs and use among groups with lower levels of trust. For example, the current tool may not fully capture variability in trust across different types of PHAs, such as local health departments versus national bodies (e.g., CDC), since the scale did not differentiate between types of PHAs. Moreover, the pretest was subject to selection bias due to the online nature of the survey, which may have excluded participants with lower trust in public health. They also suggest that future research should explore how trust relates to adherence to other public health recommendations, such as social distancing or handwashing during the COVID-19 pandemic.[54]

RESEARCH RATIONALE. The original TiPHA questionnaire provides a tool that can be used in future research on trust in public health authorities and can help guide interventions aimed at improving trust and public adherence to health guidelines. However, additional research is necessary to adapt this tool for EHE guidelines, rather than vaccination for SARS-CoV-2. As temperature rise and frequency of EHEs increase in the PNW, a simple, effective and low-cost measure is needed to assess trust in programs responding to EHEs. Building on the original TiPHA questionnaire, this study sought to refine, and face validate a 14-item adapted TiPHA

questionnaire for use in EHEs. Specifically, we aimed to develop and validate a simple, low-cost, systematic tool to assess public trust that can be used by PHAs facing EHEs. Following adaptation, the scale was evaluated through focus groups with residents from Multnomah County, OR; King County, WA; and Vancouver, BC.

This adapted tool can support how PHAs evaluate the effectiveness of programs designed to build EHE-related trust, assess trust's association with adherence to EHEs public health recommendations, and investigate the factors that influence trust across different demographic groups. The findings from this research could be used across multiple sectors to understand current impacts of trust in PHAs on EHEs guidelines, or recurrently to see how changes to EHE guidelines or outreach to groups with low trust changed adherence to EHE guidance.

Methods.

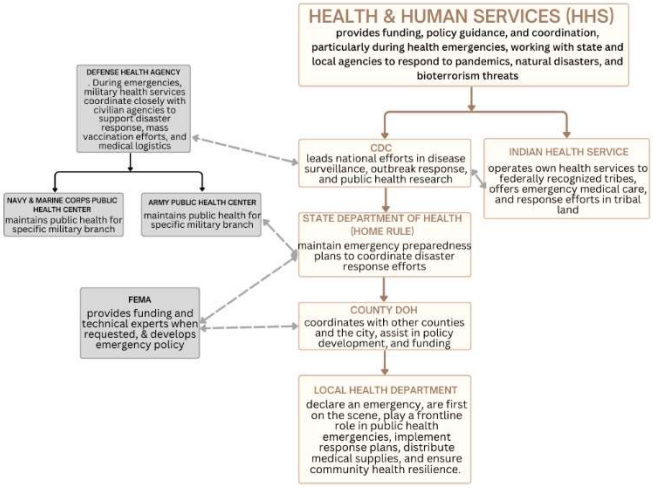
This qualitative study involved two virtual discussion groups with two representatives from each of the three health departments leading the Collaborative to co-create heat questions for an adapted TiPHA Questionnaire on trust and EHE guideline perceptions and compliance. Discussion groups can be used in qualitative research method to engage stakeholders in the decision-making process in research, rather than as research subjects that produce data.[72] Following this co-creation process with members of the Collaborative, we held six virtual focus groups to gather feedback on the adapted questionnaire. Each focus group was composed of four to six residents from Multnomah County, OR, King County, WA and Vancouver, BC The focus group discussions were transcribed, coded, and summarized using qualitative content analysis methods.[73]

STUDY LOCATION. The selected study locations—Multnomah County, OR; King County, WA and Vancouver, BC— offer a diverse representation of demographics, rural and urban areas, experience with EHEs, employment opportunities, and perspectives from two countries.

Table 1. Study location demographics and information[74–79]

	Multnomah County	King County	Vancouver, BC
County Size	466 mi², smallest by geographic size in Oregon	2,116 mi²	44.39 mi²
Population	815,428, largest population in OR	2,269,675, including the City of Seattle	2,642,825
Median Age (yrs)	39	38	42
Top three Languages Spoken	82% English 9% Spanish 5% Asian and Pacific Islander languages	69% English 7% Spanish 5% Cantonese and Mandarin	85% English 14% Cantonese and Mandarin 9.2% Punjabi
Median Household Income	$83,583	$120,824	$90,000
Percentage of Residents living in Poverty	12.9%, concentrated among those 65 and older	8.8%, concentrated among those under 18	14%
Racial Composition	66% White, 13% Hispanic/Latino, 8% Asian, and 6% Black/African American	56% White, 20% Asian, 11% Hispanic/Latino, and 7% Black/African American	46.2% White, 45.9% Asian, 1.6% Latin American, 2% Aboriginal (1.3% First Nations, 0.6% Metis), 1% Black.
Average July Temperature[75,77,79]	82°F	65°F, a 1.12°F increase in average summer temperatures from 2000 to 2023 compared to the past decade	73°F, and a notable warming trend has been observed since the 1940s, along with projections for increased extreme weather events

STUDY LOCATION: PUBLIC HEALTH SYSTEMS.



U.S. Public Health System.[80–83] The U.S. public health system operates at federal, state, and local levels, focusing on disease prevention, health promotion, and emergency preparedness rather than direct medical care (Figure 1a).

Canada's Public Health System.[84,84,85]

Figure 1a. US Public Health System

Canada's public health system operates at federal, provincial, and local levels (Figure 1b).

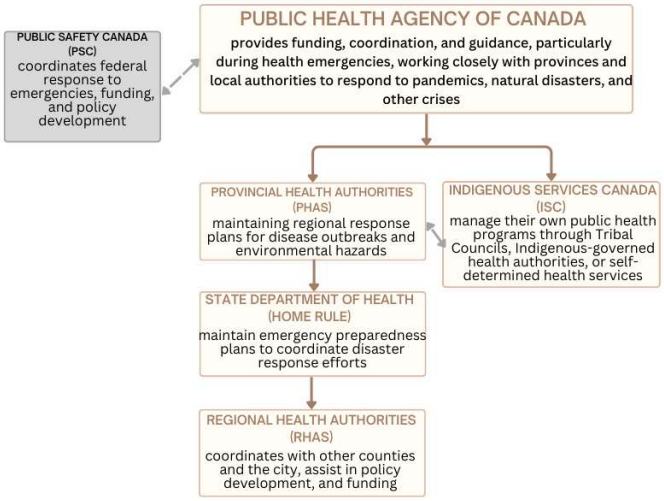


Figure 1b. Canadian Public Health System

PROCESS DIAGRAM. A process diagram is a visual representation that illustrates the sequence of steps in a particular process. For this research, it helps clarify the first and second sections of this research by showing how different components of the research are interconnected.

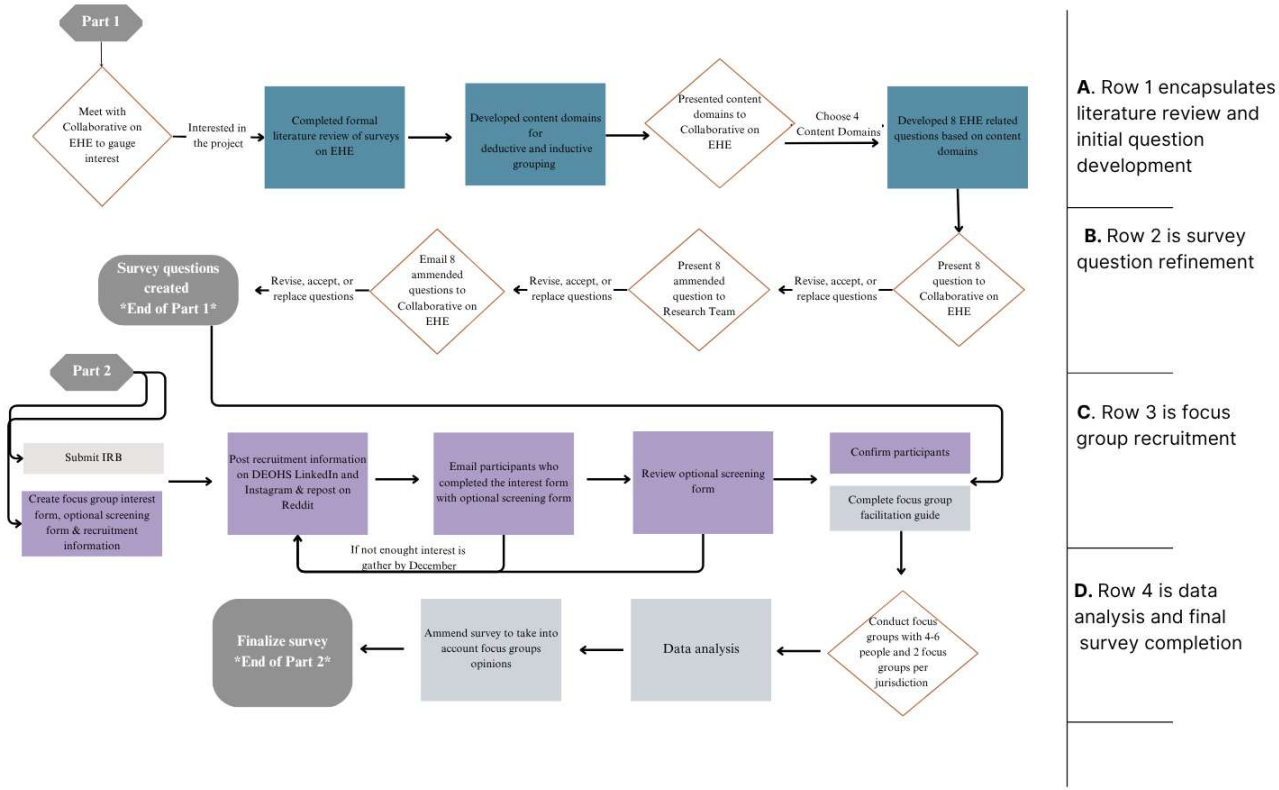
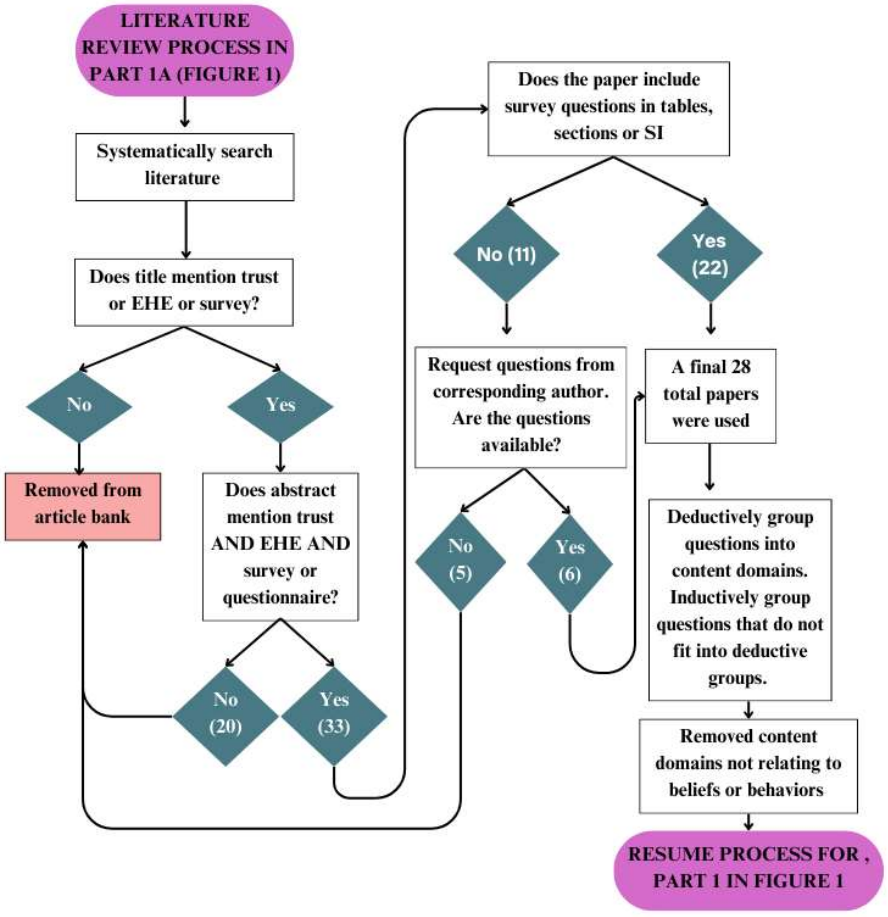


Figure 2. Process diagram for the two parts of our research process where grey ovals represent tangible products, brown diamonds represent engagement with stakeholders, blue rectangles represent question development, and purple rectangles represent recruitment.

PART 1: EHE QUESTION DEVELOPMENT. Prior to starting adaptation of the adapted TiPHA questionnaire, we met with the Collaborative to gauge the level of interest in a questionnaire on trust in PHA during EHEs (Figure 2a). Based on their interest, we amended the second half of the original TiPHA questionnaire from questions concerning SARS-CoV-2 to EHEs.[54] The eight questions in the original TiPHA questionnaire related to SARS-CoV-2 vaccine acceptance, hesitancy, attitudes, and beliefs were adapted to address EHEs guideline acceptance, hesitancy, attitudes, and beliefs. In addition to those eight questions, the questionnaire includes six demographic questions, and 14 trust questions.

To effectively amend the eight questions, we first conducted a literature review. The literature review involved a systematic search of studies related to EHEs (Figure 2a, Figure 3). The initial search consisted of "extreme heat," "heat wave," or "excessive heat," combined with "survey" or "questionnaire." A follow-up search was conducted querying for "risk perception" or "information." Relevance was first assessed by reviewing study titles to check if EHE terms combined with “survey” or “questionnaire” were



mentioned. The abstracts of 53 studies were reviewed to see if they mentioned EHE and survey or questionnaire, 20 studies were removed. 33 papers were read and there was removal of five studies for not being primary research, six for lacking complete surveys, two for focusing on medical symptoms, five for targeting medical staff instead of the community, one for addressing urban planning, and one due to inaccessible content (Figure 3).

Figure 3. Flow diagram of the literature review in part 1 to develop the content domains

Twenty-two of the studies included survey questions. Eleven of the studies discussed survey questions related to EHEs and residents, but the questionnaire was not publicly available. In this case, the corresponding author was contacted to request access to the research questions. Nine of the studies responded and provided the survey questions; six of these studies had relevant survey questions. Therefore, a total of 28 papers were included.

A total of 113 survey questions were extracted from these papers and were then categorized into content domains using the following groupings found in Abrahamson et al (2009): perceptions of vulnerability, behavior change, knowledge and perceived utility of protection measures, and perceptions of the usefulness [of EHEs plans]. Questions that did not fit into the Abrahamson et al. groupings were placed into an “other” category and grouped inductively afterward.[86]

Table 2. Content domains and descriptions

Content Domains	Description of Content Domains	Proposed Content Domains for Discussion Group	Content Domains Selected by Discussion Group	Number of Proposed Questions
Perceptions of vulnerability to the adverse effects of heat[86] & beliefs on EHE	Measures the individual's perceived threat from an EHE, including why there are EHE events, if EHE is a concern, and if EHE relates to climate change.	Yes	Yes, specified to "Is heat a health concern?"	3
Knowledge and perceived utility of protection measures provided for people living in the community[86]	Measures the individual's knowledge about protective measures provided to the community and whether they view the measures as helpful.	Yes	Yes, specified to "Do you think public health authorities are (un)prepared?"	3
Information seeking during a heat emergency	Measures where the individual finds their information during an EHE, and if that is different than everyday information seeking.	Yes	Yes, specified to "What types of messaging will increase/decrease trust for EHE for the residents?"	3
Behavior change during a heat wave[86]	Measures the individual's behavior change during an EHE regardless of public health guidelines.	Yes	No	N/A
Adherence to EHE guidelines	Measures the individual's awareness of EHE guidelines and whether they follow them via their actions.	Yes	No	N/A
Perceptions of the usefulness of other components of [EHE plans][75]	Measures the individual's thoughts on an EHE plan.	No, this study does not ask about EHE plans.	N/A	N/A
Knowledge of EHE symptoms and Risk groups	Measures the individual's understanding of medical symptoms related to EHE and who is most at risk.	No, content domain does not have a trust impact relationship.	N/A	N/A
Experience with EHE symptoms	Measures the individual's experience with EHE	No, content domain does not have a trust impact relationship.	N/A	N/A

	symptoms for themselves or when responding to others.			
Perceived Experience with EHE	Measures the individual's thoughts on whether they think they have experienced EHE.	No, content domain does not have a trust impact relationship. *Included a question in the background*	N/A	N/A
Vulnerability Assessment	Measures the individual's potential vulnerabilities to EHE.	No, content domain does not have a trust impact relationship.	N/A	N/A

After grouping questions into content domains, content domains that did not pertain to beliefs or behaviors were excluded, such as domains related to vulnerability assessment rather than trust (Table 2). The final set of five content domains was proposed to a discussion group made up of two representatives from each of the three PHAs that lead the Collaborative. The 20-minute session was hosted on Zoom®, a video conversation platform, and was held in early October 2024. Questions were amended based on the expertise of the group members.

Developing Heat Questions. The discussion group identified the following content domains based on importance for PHAs' knowledge: beliefs on EHE, information seeking during a heat emergency, and knowledge and perceived utility of protection measures. Although there was not a formal process for selecting the top content domains, through facilitated discussion, the group highlighted which domains answered questions they most wanted to know. In the October meeting, they refined each content domain to address relevant overarching questions (Table 2). In a November meeting, three questions each from the first two content domains and two questions from the last content domain were proposed to the discussion group. Questions were developed by identifying and synthesizing relevant questions from the literature review. Each of the eight questions proposed was asked in two different ways to help the discussion group think about word choice and phrasing (Table 4).

Demographic questions. The original TiPHA questionnaire included six demographic questions and 14 trust questions. For this research, the trust questions were not amended. However, three demographic questions were changed (Table 3). While the specific demographic questions included in the original TiPHA questionnaire were not published, general domains and answer options were published. The question included in the original TiPHA questionnaire regarding participants' race and ethnicity was updated to “What race(s) or ethnicity(s) do you consider yourself to be?” (Table 3). The potential answer options were expanded to include Latino/a/x/e, and Middle Eastern or North African. A question on experience with EHEs replaced the question regarding parental status. Parental status was necessary to stratify vaccine questions in the original TiPHA questionnaire and was deemed not relevant for EHEs (Table 3).

Table 3. Demographic Questions

Original TiPHA Scale Question	**Amended Question**
Age: ● 18–24 years ● 25–34 years ● 35–44 years ● 45–54 years ● 55–64 years ● 65 years or older	What is your age range? ● 18-24 ● 25-34 ● 35-44 ● 45-54 ● 55-64 ● 65 years or older
Race: ● White ● Black ● American Indian/Native American ● Asian ● Native Hawaiian or Pacific Islander ● Not reported	What race(s), or ethnicity(s) do you consider yourself to be? (Select all that apply) ● White or Caucasian (European American) ● Black or African American ● American Indian or Alaska Native ● Asian (East Asian, Southeast Asian, Asian American) ● Native Hawaiian or Pacific Islander ● Hispanic or Latino/a/x/e ● Middle Eastern or North African ● Self-identified race or ethnic origin not listed (please specify):
Ethnicity: ● Hispanic ● Non-Hispanic	
Household Income: ● Under $49,999 ● $50,000 – $99,999508 ● $100,000 – $149,999236 ● $150,000 or more	What is your yearly household income? ● Under $49,999 ● $50,000-$99,999 ● $100,000-$149,999 ● $150,000 or more
Education: ● Some high school or graduate ● Some college or college graduate ● Post-graduate	What is the highest level of education you have completed? ● Some high school or graduate ● Some college or college graduate ● Post-graduate
Parent Status: ● Not a parent ● At least one child ≤10 years of ● At least one child 11–17 years of age ● At least one child aged 18 or older ● Not reported	Have you ever experienced a heat wave? ● Yes ● No ● Maybe

Discussion group. Once initial questions were developed as described above, the full questionnaire was sent to representatives from the PHAs leading the Collaborative. In November, the Collaborative met via Zoom® for 30-40 minutes for a second discussion group

(Figure 1b). The discussion group was used to get feedback on the face validity of each question, or the way the question was posed, to ensure it accurately captured the intent of the question.[87]

The researcher (RA) asked discussion group participants about the questions' relevance, clarity, perceived offensiveness, accuracy, grammar/syntax, and potential opportunities to introduce bias.[87] The complete set of questions proposed to the discussion group can be found in Table 4. Detailed notes were taken during the discussion to inform subsequent modifications to the question(s)/instrument.[88] Discussion group feedback, alongside changes made in response, are detailed in Table 4.

Table 4. Eight EHE questions refinement

Proposed Question (Original)	Discussion Group Feedback Summary	Revised Question (After Discussion Group)	Research Team Feedback Summary	**Revised Question (After Research Team Discussion)**
1. I am *concerned* [afraid/worried] about the *health risk* [health problems] associated with heat waves.	-The discussion group thought the question was effective and approached the topic well. -The discussion group preferred *concern* or *afraid* are over *worried*. -The discussion group preferred the *italicized text over* [brackets].	I am concerned about the health risks associated with heat waves.	-The research team had no additional comments.	**I am concerned about my health during heat waves.**
2. I do not think heat will cause *me harm* [hurt me].	-The discussion group preferred *italicized* text over [brackets]. -The discussion group thought prospective participants may not perceive themselves at risk but believe others are. -The discussion group thought we should consider framing statements regarding "in my community." -The discussion group considered differentiating between general harm (e.g., wage loss) and specific health-related harm. -The discussion group emphasized that health-specific harm is a good point to clarify the focus.	I do not think heat will harm the health of people in my community.	The research team recommended revising this question to shift focus from the individual to the community because people tend to underestimate their personal risk. -The research team recommended splitting into two questions: individual risk and community risk. -The research team consistently recommended using “heat waves” (vs heat) throughout the survey.	**2. I do not think heat waves will harm the health of people in my community.**
3. Public health authorities are *prepared to address* [ready to help] the needs of populations at risk (e.g., people who are elderly, low-income, houseless) during heat waves.	-The discussion group had no comments or suggestions.	Public health authorities are prepared to address the needs of populations at risk (e.g., older adults, low-income, houseless) during heat waves.	-The research team recommended changing from "those who are elderly" to "older adults" for more inclusive language.	**3. Public health authorities are prepared to address the needs of populations at risk (e.g., older adults, low-income, houseless) during heat waves.**
4. I am confident in the ability of public health authorities to respond effectively to heat waves. OR I feel confident that public health authorities can help during heat waves.	The discussion group preferred the second option because the term “help” was better than “respond effectively.”	I feel confident that public health authorities can help during heat waves.	-The research team thought the question was vague but is reflective of the discussion group’s suggestions.	**4. I feel confident that public health authorities can help during heat waves.**
5. Public health authorities *communicate effectively with the public* [share important information with people] about heat wave risks and how to stay safe.	-The discussion group thought the question "Do you feel well informed on extreme heat?" could fit within the demographic section. -The discussion group preferred the bracketed version. -The discussion group thought it was unimportant if communication comes from public health authorities, but general "Authorities" could encompass public health, public safety, emergency response, weather services, and local news sources.	Authorities share important information with the public about heat wave risks and how to stay safe. OR Authorities share important information with the public that make me feel informed on extreme heat.	-The research team thought the current wording "authorities" is broad and may be interpreted as law enforcement rather than public health (PHA). -The research team recommended defining the acronym PHAs early on. The research team thought this question overlapped with Q7, but this question focuses on information shared, whereas question 7 focuses on information received.	**5. The information that public health authorities share with the public makes me feel informed about heat waves.**
6. *Public health communication* [the information from public health officials] during heat waves is relevant to my culture and way of life.	-The discussion group preferred the bracketed version. -The discussion group thought it was unimportant if communication comes from public health authorities, but general "Authorities" could encompass public health, public safety, emergency response, weather services, and local news sources.	The information from authorities during heat waves is relevant to my culture and way of life.	-The research team thought the current wording, "authorities," is broad and may be interpreted as law enforcement rather than public health (PHA).	**6. The information from public health authorities during heat waves is not relevant to my culture.**

7. It is difficult to distinguish between facts and fiction in heat warnings. OR It is hard to tell what is true and what is not in heat warnings.	-The discussion group thought the second question option was better. - The discussion group wanted information about behavior modification to understand when a heat warning is needed, or if public health communication is too alarmist nor insufficient.	The information from authorities I hear during a heat wave is not too alarming nor insufficient.	-The research team thought the revised question is interesting but differs from the original focus on fact/fiction or true/not. -The research team thought the new version is double-barreled, addressing both alarming-ness and sufficiency. -The research team recommended reverting back to the original question to align with the survey goal or split the question into two to address the discussion group's input.	**7. The information from public health authorities is sufficient in order to take action during heat waves.** **I can see myself adopting at least one of the recommendations made by public health authorities during a heat wave.**
8. I do not go to cooling centers because *heat is not dangerous [*I do not think heat is dangerous] for me.	-The discussion group thought this question required high engagement or literacy about heat and health harms, which may not be true for all participants. -The discussion group thought some may not be aware of cooling centers or receive related messages. -The discussion group thought the double-negative structure was confusing; consider rephrasing or striking it altogether. -The discussion group thought we should broaden the "cooling centers" concept to include other resources like spray parks. -The discussion group thought more precise phrasing, such as "Cooling centers are intended for people like me," might improve clarity. -The discussion group thought it could be challenging to interpret responses due to diverse reasons for disagreement (e.g., awareness, beliefs about heat dangers, personal usage). -The discussion group thought the question may be too specific or less useful due to challenges in participant understanding. -The discussion group preferred the *italicized text*.	*Removed question*	-The research team recommended skipping the cooling centers/risk question due to its standalone nature and need for additional background information.	

PART 2: ADAPTED TIPHA QUESTIONNAIRE VALIDATION. Focus groups of residents from Multnomah County, OR; King County, WA; and Vancouver, BC were used to evaluate the adapted TiPHA questionnaire and component questions for clarity, accuracy, difficulty, length, and bias (Figure S1). There were two focus groups from each of these three geographic areas, and each focus group included four to six participants. The number of focus groups was determined based on prior research on saturation of new themes (i.e., code saturation) and information (i.e., meaning saturation). Past literature has found that three to six focus groups are needed for code saturation, and two groups per stratum are necessary for meaning saturation.[89–92]

The focus groups began with participants completing the adapted TiPHA questionnaire from part 1. Then they were asked a set of detailed, semi-structured questions from a facilitation guide (Figure S2). Focus groups were conducted via Zoom® and lasted up to 70 minutes. Recordings of the Zoom® allowed for more complete professional transcription.

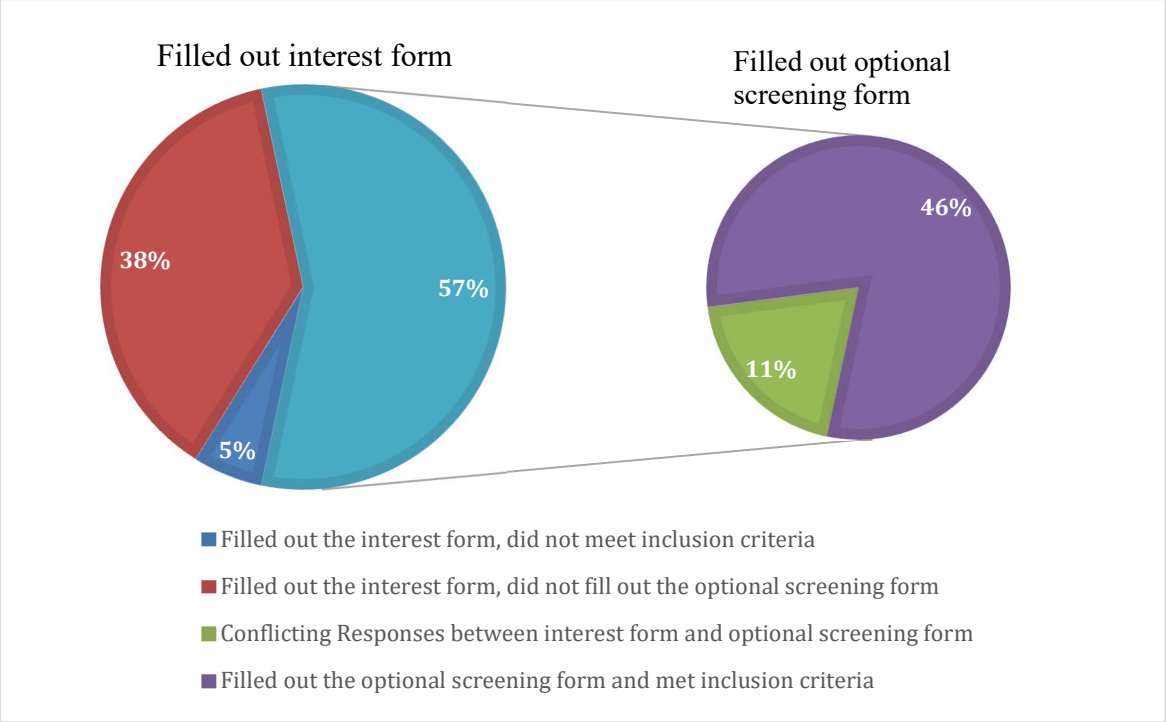
IRB Proposal. In November 2024, the UW Human Subjects Division determined this research to be human subjects research that qualifies for category two exempt status (Study number: 00021693).[93] This study was exempt because the methods used involved surveys and interviews, and only included adults.

Recruitment. In early November 2024, participants were recruited using the UW Department of Environmental and Occupational Health Sciences (DEOHS) social media pages on LinkedIn and Instagram, which prompted interested individuals to answer a focus group interest form (Figure S3, Figure S4). However, only three people responded to the focus group interest form during this initial recruitment. As a result, in early December, recruitment was expanded to posting on virtual boards, including Nextdoor® and Reddit® groups. On Reddit®, the same recruitment post from DEOHS LinkedIn® was cross-posted on r/Portland, r/PacificNorthwest,

r/KingCounty, and r/VancouverJobs, which resulted in 68 people filling out the interest form (Figure 1c). In early January, the Reddit® post was cross-posted again on r/VancouverJobs to address a need for additional Vancouver participants who met the inclusion criteria and schedule availability. Twenty additional people filled out the focus group interest form following this cross-post. The research team attempted to post on other Reddit® groups- r/Seattle, r/SeattleWA, and r/vancouvercanada. However, since there was no prior engagement in those communities by the researcher's Reddit® account, the group moderators did not approve the post.

In total, ninety-one people filled out the focus group interest form. The focus group interest form prompted the participant to provide their name and email address, select which of the predetermined focus group discussion times they were available to participate in, and confirm that they met the study's inclusion criteria (i.e., that they were over 18 years old, were proficient in English, their county of residence, and if they were physically present in the PNW during the 2021 Heat Dome) (Figure S4). Eighty-five out of 91 (30 Multnomah County, 34 Vancouver, 21 King County) individuals who responded to the interest form met the inclusion criteria. These individuals were sent a follow-up optional screening form prompting zip code of current residence, age range, race(s) and ethnicity(s), and gender identity (Figure S5). Fifty-one out of 85 participants filled out the optional screening form, 10 of which were excluded due to listed zip codes outside the study area or conflicting zip codes between the interest form and the optional survey (Figure 3). Additionally, four participants who filled out the optional screening form did not fill out the original interest form and were excluded from the study. Participants were not excluded based on any other demographic information collected on the optional screening form besides zip code.

Figure 3. Breakdown of interest form and optional screen form engagement, where the first pie chart is the interest form, and the second pie chart is the optional screening form.



We used a two-part approach to participant selection. In the first part, we used convenience sampling – a method where participants are chosen by location, availability, and accessibility – to select participants who met inclusion criteria and were available during scheduled focus group days/times. Those who met the inclusion criteria then moved to part 2 where we used purposive sampling, a method where participants are chosen by specific characteristics or experiences, to select a sample of participants from each of the included geographic locations (King County, WA; Multnomah County, OR; and Vancouver, BC) from a variety of demographic backgrounds reflective of diversity in each jurisdiction. The 13, 12, and 12 selected participants from King County, Multnomah County, and Vancouver, respectively, were contacted by the researcher

(RA) via email to confirm participation and share the Zoom® link. Five participants opted out after the confirmation email was sent out, and three confirmed but did not attend.

Focus Group Facilitation Guide (Figure S2). Before the focus groups convened, a detailed semi-structured focus group facilitation guide containing questions and potential follow-ups/prompts was developed. The focus group facilitation guide contained questions designed to gather participants' feedback on the adapted TiPHA questionnaire, including their perspectives on question clarity, appropriateness, accuracy, comprehensibility, and bias. The UW-based research team (RA, NE, RP) reviewed this guide to ensure clarity, comprehensiveness, and flow. While the same guide was used for all focus groups, follow-on questions/prompts were used to explore different aspects of the guide further based on the discussion. RA facilitated all focus groups, and notes were taken by RC, who also managed the chat function. At the start of the Zoom® meeting, participants were asked for verbal consent to participate and for recording of the Zoom® meeting. They then took the adapted TiPHA questionnaire and were asked questions from the facilitation guide. Participants received a $40 gift card incentive for their participation.

Transcription. A duplicate of the video recording was made; the duplicate was shortened to remove the researcher's introduction and consent script and professionally transcribed by TranscribeMe®. Each transcript was reviewed and edited by a member of the research team to remove identifying information (e.g., names), correct any errors, remove conversational niceties, and insert questions in brackets (e.g., [Q1: PHAs do everything they should to protect the health of the population]).

Data was managed following UW Human Subjects Data Security Level 2 requirements by limiting access to only the research team, protecting data through unique strong passwords, securely storing laptops, and using private Wi-Fi connections.[94]

DATA ANALYSIS.

Data Familiarization. The researcher (RA) read all six cleaned transcripts and the corresponding note-taker notes and wrote a summary memo describing the focus group discussion. The researcher (RA) then re-read each transcript to identify key concepts related to question clarity, accuracy, difficulty, length, and bias using a deductive approach based on the facilitation guide. This process revealed three high-level concepts, "heat wave," "PHA," and "opinions on PH trust," beyond specific facilitation guide questions. The researcher (RA) drafted an initial codebook from these identified concepts, organized codes into code groups, and added descriptions, inclusion/exclusion criteria, and examples for each code (Figure S6). Another member of the UW-based research team (RP) then reviewed the initial codebook and suggested minor revisions to streamline the coding process (e.g., streamlining subcodes).

Co-Coding. The qualitative data analysis followed a conventional content analysis approach, incorporating co-coding using O'Connor and Joffe's technique.[24] The researcher (RA) used Atlas.ti to create a bundle containing the codebook along with two transcriptions (VanA, MultA). The researchers (RA & RC) independently coded both transcripts, recording notes on potential code additions, modifications, or areas of confusion. Afterward, both researchers (RA, RC) merged both coded versions and met to manually review the transcripts, calculate percent agreement for each code, and discuss any coding discrepancies. In this review, the codebook was refined to add, remove, and merge codes. Once agreement was reached, the codebook was updated and the researcher (RA) coded transcript KingA following the same process as outlined above. An advisor (RP) then reviewed the finalized codebook before full coding proceeded.

Coding. The researcher (RA) applied the finalized codebook to all six transcripts, including the three that were previously co-coded. After coding, the researcher combined codes "overall survey" and "overall questions" due to noting the ambiguity between those two codes. No other codes were changed or added.

Data Interpretation. Coded data was systematically organized and synthesized to draw conclusions. The researcher (RA) summarized the content within the coded text for each focus group. Summaries were entered into a matrix to facilitate cross-group comparisons and thematic synthesis. In the matrix, rows corresponded to codes (e.g., question clarity, accuracy, difficulty, length, bias), while columns corresponded with individual units of analysis (i.e., each focus group). Within each cell, the researcher (RA) input the synthesized summaries from the contact sheets, allowing for a structured and systematic comparison of responses across different focus groups. This approach enabled the identification of overarching themes, patterns of agreement or divergence among participants, and any unique perspectives that emerged within specific groups. In this process, the researcher (RA) specifically called out commonalities and counterpoints. Key insights that can be used to inform revisions to the adapted TiPHA questionnaire instrument were highlighted.

Results.

PARTICIPANT DEMOGRAPHICS. In January 2025, six focus groups were conducted over Zoom® with 29 total participants. All participants lived in the PNW during the 2021 heat dome, were over 18 years old, and were current residents of King County (n=9), Multnomah County (n=11), or Vancouver (n=9). The focus groups were racially, economically, and educationally diverse (Table 5). Most participants were in the 25-40 age bracket, with some participants in the older than 45 age brackets. Additionally, there was a higher percentage of those who identified

as Black or African American in the focus groups than match the demographics of all three areas.

Table 5. Demographics information

Characteristics		***N (%)***
Age (years)	18-24	8 (28%)
	25-34	12 (41%)
	35-44	7 (24%)
	45-54	1 (3%)
	55-64	0 (0%)
	65 years or older	1 (3%)
Yearly Household Income	Under $49,999	5 (17%)
	$50,000-$99,999	13 (45%)
	$100,000-$149,999	9 (31%)
	$150,000 or more	2 (7%)
Race and ethnicity	Black or African American	14 (47%)
	White or Caucasian	7 (33%)
	American Indian or Alaskan Native	1 (3%)
	Asian (East Asian, Southeast Asian, Asian American)	5 (17%)
	Hispanic or Latino/a/x/e	2 (7%)
Education	Some High School or High School Graduate	3 (10%)
	Some College or College Graduate	15 (50%)
	Post-graduate	11 (40%)

OVERVIEW.

Focus group participants generally found the adapted TiPHA questionnaire clear, the structure appropriate, and the length acceptable (Figure S1). Participants had mixed perspectives about the use of specific terminology, such as "heat wave" and “Public Health Authority (PHA)," and their definitions. Participants reported limited concerns related to the adapted TiPHA questionnaire bias in the ways questions were asked or framed. They found the adapted TiPHA questionnaire to be balanced and contain an equal number of negatively and positively worded questions. For the two-part survey, the first part on trust in PHAs from the original TiPHA

questionnaire and the second part on the adapted EHEs guideline questions are referred to as PH-Q# and HW-Q#, respectively.

KEY THEMES.

Several themes emerged across the focus group discussions. Each theme is listed below, followed by a detailed description synthesizing relevant content.

- The adapted TiPHA questionnaire is generally clear, but revisions to specific questions (HW-Q6, P-Q3, P-Q3, HW-Q7, and P-Q4) and introductory information could improve comprehension.
- Modifying the adapted TiPHA questionnaire format could enhance its usability, and adding space for open-ended responses could allow for fuller insight into participants' thoughts.
- The terminology “heat wave” and “Public Health Authority (PHA)” require clarification through stronger definitions.
- The adapted TiPHA questionnaire maintains neutrality, though minor revisions to certain questions could further reduce bias.
- The adapted TiPHA questionnaire length is adequate to collect relevant information, and not too long as to cause disengagement.

The adapted TiPHA questionnaire is generally clear, but revisions to specific questions (HW-Q6, P-Q3, P-Q3, HW-Q7, and P-Q4) and introductory information could improve comprehension.

Across all focus groups, participants indicated that the adapted TiPHA questionnaire was generally clear and straightforward. This perception was attributed to the use of plain language and direct questions that were well-aligned with the topic, even with the intensity of its content. However, certain questions were brought forward due to concerns over ambiguous phrasing, topic relevance, question context, and repetition. Participants in two focus groups expressed confusion about whether certain questions asked what PHAs *should* do versus what they *currently* do and noted that their answers would change depending on their interpretation.

While participants generally found the adapted TiPHA questionnaire clear, participants in multiple groups identified confusion with particular words or phrases, indicating that revisions could improve precision and comprehension. HW-Q6 (The information from authorities during heat waves is not relevant to my culture) was discussed in two focus groups, with participants pointing out that the term "culture" was ambiguous, making it difficult for respondents to interpret its intent. Some participants struggled to understand whether the question referred to personal experience or a broader cultural perspective, which led to uncertainty about how to answer.

> *"In the 2021 heat dome, I was pretty low income at the time and didn't have air conditioning. But I was like, 'I don't think that's the culture they're asking. They're not asking about my financial status.' I think it just means, your ethnic culture or other backgrounds. But I think the way I was thinking of it could have been relevant too." (MultB, P7)*

Beyond the intent behind the term, a participant expressed discomfort with generalizing beyond their individual experience. In response, one participant suggested that the question could be more clearly worded to reflect whether information from the PHA is personally relevant to the individual respondent.

"I can't speak for my own people, basically. Everyone's got different opinions on that. So I was just like, 'I'm not sure how to properly say this or how to answer that." (VanA, P3)

In P-Q3 (PHAs use resources well), the term "resources" led to similar confusion among participants in one focus group, who reported the term could be interpreted as funding, data, or information sharing.

Moreover, focus group participants noted three questions (P-Q2, HW-Q7, P-Q4) as being unfocused or unrelated to the overall topic of EHEs. In P-Q2 (PHAs are partly responsible for the illegal drug problems in this country) focus groups questioned the connection between the usage of illicit drugs and EHEs, which led to confusion about the purpose of the adapted TiPHA questionnaire. RA then verbally explained that the first set of questions addressed trust in PHAs across all departments, and the second set of questions were specific to heat. The confusion about the two-part adapted TiPHA questionnaire was discussed in three focus groups. Although they were able to answer the question, the participants expressed uncertainty about its relevance.

"I don't necessarily associate that [drugs] with heat waves in any way. So that question felt a little out of place." (VanB, S2)

In HW-Q7 (The information from PHAs is sufficient to take action during heat waves), one focus group mentioned that it was unclear whether the question asked about their behavior or the behavior of others. However, they and others in the group ultimately answered the question based on their personal experience. Additionally, participants in one focus group found the wording of P-Q4 (PHAs waste money on health problems) to be ambiguous with respect to the type of health problem being referenced.

In addition to term confusion and question relevance, participants in several focus groups expressed concern that certain questions assumed a level of knowledge about PHA actions or guidance beyond their expertise. As a result, they answered based on assumptions or general impressions rather than specific knowledge. For HW-Q8 (I can see myself adopting at least one of the recommendations made by PHAs during a heat wave), one focus group participant described how the question seemed to presume awareness of official PHA recommendations. Although the participant agreed with the statement, they explained that their agreement was based on assumptions rather than confirmed information. Similarly, a participant in another focus group described how P-Q1 (PHAs do everything they should to protect the health of the population) also assumed knowledge of PHA activities or responsibilities.

> *"But what I was saying is that me, personally … I don't really know if the PHA are doing anything or fulfilling their responsibilities because most of the population here don't even know what's happening and all of that. Unless if you have an immediate family member that is working there or something … I just figured probably they're doing their responsibility." (VanA, P4)*

A participant in a third focus group echoed this sentiment when reflecting on P-Q5 (PHAs keep trying the same things to help the public, even when they don't work very well) and P-Q6 (PHAs come up with new ideas to solve health problems). They remarked that both questions assumed familiarity with PHA actions.

> "*That question did kind of assume that you know what the public health is up to, and I don't. I mean, I'm not in that field, so I don't know. But I'm just assuming they're not trying the same thing over and over again. Maybe they are, but it's not my impression … I think I actually have good feelings about public health. And so I said I disagreed [with the question]." (KingA, P3)*

Participants across multiple focus groups noted that several adapted TiPHA questionnaire questions (P-Q1& P-Q4, P-Q3 & P-Q4, P-Q10 &P-Q14, P-Q11 & P-Q12) appeared to be asking the same or similar things, often with only slight variations in wording. While some participants

viewed this as an intentional design to check response consistency, others raised concerns about redundancy.

Modifying the adapted TiPHA questionnaire format could enhance the usability, and adding space for open-ended responses could allow for fuller insight into participants' thoughts.

Participants across several focus groups expressed ideas for changing the adapted TiPHA questionnaire format to improve readability and provide more opportunities for open-ended responses. One suggestion mentioned by participants in KingA, MultA, and KingB was that the top Likert scale header (Strongly Disagree to Strongly Agree) should remain visible as they scrolled through the questions. This would improve the ability to track their responses, especially on smaller screens. Participants in VanA, KingB, and MultB suggested providing more opportunities for participants to elaborate on their answers, especially in the absence of follow-up focus groups. An optional open-ended section at the end of the adapted TiPHA questionnaire could offer a deeper understanding of community trust and identify areas for improvement in public health responses.

The terminology "heat wave" and "Public Health Authority (PHA)" require clarification through stronger definitions.

Many respondents expressed uncertainty about what level of government "PHA" referred to (e.g., local, state, provincial, or federal). This resulted in varied interpretations because they viewed each level of government with different effectiveness and trust.

> *"I did come to the occasional question where … I'm like, 'Oh, well, I feel one way in regards to the county but maybe another way in regards to the state or the federal government.'" (MultA, P2)*

Additionally, some saw it as referring specifically to local or state agencies because of the locality of the heat waves.

> *"Since this was sort of mainly about local issues or it seems to be local in our area, I kind of answered more in if the public health authority was a local or state agency." (MultA, P4)*

In Canadian focus groups, national terminology further complicates the issue, where "PHA" refers to "Provincial Health Authorities." This led to confusion about whether the adapted TiPHA questionnaire referred to provincial, federal, or other entities.

> *"This is probably just a Canadian thing ... I know it says Public Health Authorities, but for me, I kept thinking Provincial Healthcare Authorities, which is something a little bit different because of the way Canada is structured ... Because we have something else similarly with similar abbreviations, that's also like that." (VanA, P3)*

Beyond confusion over government levels, participants interpreted the term "PHA" in various ways. They described linking the term with specific individuals (e.g., local health officials), healthcare professionals (versus public health professionals), and networks of institutions or agencies, including police, health departments, and weather institutions. One focus group mentioned that they did not associate PHAs with environmental health at all, instead opting for a more clinical or biomedical framework for public health. Additionally, no other focus groups included environmental health in their PHA definitions.

> *"I don't think of [PHAs] when I think about heat. Medicine and epidemiologists are in one part of my brain, and climate collapse and the fires are in another part of my brain." (MultA, P5)*

In addition, participants had inconsistent definitions of the term "heat waves." Participants described heat waves using various criteria, including trapped hot air, prolonged high temperatures, humidity, smoke events, and warm nighttime conditions. Participants

provided synonymous terms for “heat wave,” such as temperature surge, solar burn, extreme hot weather, extreme heat, heat dome, heat surge, and heat spell. Additionally, some participants used synonyms when defining heat waves, suggesting that certain phrases might be more intuitive for different audiences.

> *“Another term is temperature surge, and heatwave is prolonged hot weather. So that's the meaning of heat wave to me.” (KingA, P5)*

The inconsistency of understood definitions could lead to confusion or misalignment in adapted TiPHA questionnaire responses. To address this, participants suggested including a clear and standardized definition within the adapted TiPHA questionnaire to ensure a shared understanding across respondents. Some expressed uncertainty on what temperature threshold qualifies as EHEs and suggested that specific temperature range(s) be included for clarity.

> *“I'm wondering if it would be helpful to put in the survey when you describe extreme heat, what's the threshold that categorizes it as extreme heat? Is it over 102? Is it over a 110?” (MultA, P3)*

The adapted TiPHA questionnaire maintains neutrality, though minor revisions to certain questions could further reduce bias.

Overall, when asked about bias, participants across all focus groups reported limited concerns. Three groups raised negatively worded questions (PQ-4, PQ-5, HW-Q3 & HW-Q2) expressing how the adapted TiPHA questionnaire could capture diverse perspectives, including those different from their own.

> *“I don't know whether I'm the only one who thinks that any public office, you can’t have all the people having the same opinion. So whoever was setting the questions to [sic] this survey wanted to make sure that they have included everyone … So I think when it comes to a survey, that is why you have the option of agreeing or not agreeing. They have to really set these questions in a very broad way so that they can be able to capture every opinion from a diverse population.” (KingA, P2)*

Furthermore, another group perceived value in having both positively and negatively worded questions in reducing social desirability bias.

> *"They kind of feel almost like opposite like [sic] three is they use resources well, and four is they're wasting money. So having both of those kind of balances out the survey, I think, in terms of that. I don't feel like it's kind of trying to make me answer one way or another." (Van B, P-Q03 & P-Q04, P2)*

Although it was not a widely mentioned issue, one participant pointed out that disability was noticeably absent from both the demographic questions and the list of at-risk populations and described the impacts of this omission. The participant thought that EHEs disproportionately affect people with disabilities thus including disability in these sections would provide a more comprehensive view of the populations most affected by heat waves and public health interventions.

> *"As a disabled person, it's exhausting. It's always seeing demographics and questions, but never being asked about disability, which impacts a significant portion of the population and should always be considered. I would assume especially for public health things and especially for heat things, which, by my understanding, pretty disproportionately impacts disabled folks. I don't have a clear suggestion on how to change anything. I just would like to say I felt the absence once again and just longed for a disability lens to make itself known somewhere in the phrasing here ... it's not only in the demographics. It's in the question (HW-Q3), 'Public health authorities are prepared to address the needs of populations at risk, e.g., older adults, low-income, houseless.' It's a great place to throw disabled in … Someday, people are going to think about us, I swear." (MultA, P5)*

Additionally, in the question P-Q2 (PHAs are partly responsible for the illegal drug problems in this country), the phrase "illegal drug problems" raised concerns about unintended connotations, particularly given the broader cultural and political associations with the word "illegal." Some respondents worried that this language might make certain groups feel targeted, even if that was not the adapted TiPHA questionnaire's intent.

> *"I think there's a lot of really heightened language around the legal … I know that's not what you're asking in this question, but around illegals in this country and illegals doing drugs in this country. And it was only the second question. And I was like, 'The illegal drug problems in this country.' What does this have to do with the survey about heat? And is there going to be some bias written into the survey? … Even just taking out the word illegal." (MultA, P5)*

The adapted TiPHA questionnaire length is adequate to collect relevant information, and not too long as to cause disengagement.

All but one participant described the adapted TiPHA questionnaire as appropriately short and manageable. The majority appreciated the concise structure, indicating it was enough to cover key issues without leading to disengagement.

> *"I felt like every question was important, and I felt like the answer I gave was something that was affecting me directly." (KingA, P2).*

Discussion.

The 2024 U.S. "National Elections Study" found only 25% of respondents trust the federal government. This is particularly concerning amid increasing extreme weather events and disasters.[45] Low trust can increase community recovery time, delay individuals' response to early warning efforts, create inequitable health outcomes, and lead to avoidable deaths.[39,46–50,60,64,67] PHAs need to understand and improve trust in PHAs as EHEs become increasingly common due to climate change.[3,4] However, there are notable gaps in public health research on trust, particularly a lack of validated and reusable survey instruments.[69] Many existing surveys are lengthy, their questions are often inaccessible in published literature, and none specifically address the relationship between trust and EHEs.[69] This questionnaire was created to meet these needs, and was assessed through focus groups consisting of residents of three Pacific Northwest cities recently affected by EHEs. With minor changes to questions HW-Q6, P-Q3, and HW-Q7,

added clarification in the introductory paragraph, and minor formatting improvements, the final product can serve as a practical tool for PHAs, including as one-time or longitudinal assessment of trust, or to evaluate the effectiveness of new initiatives aimed at improving public trust and understanding of EHE guidance.

ADAPTED TiPHA QUESTIONNAIRE AMENDMENTS.

Question revisions. Focus group feedback confirmed that the adapted TiPHA questionnaire was generally clear, of appropriate length, and questions were neutrally phrased. Yet, participants identified specific areas for revision. Questions such as HW-Q6 and HW-Q7 required clarification the term "culture". The term "culture" was unclear as to whether it referred to religion, geographic community, financial status, demographics, or sexual orientation. Even within anthropological professions there is no singular definition, and people often exist at the intersection of many subcultures.[95,96]As a participant recommended, a more individualized question may be more straightforward, such as, "The information from authorities during heat waves is not relevant to [me]". However, this change would adjust the meaning of the question, which was specifically asked for by the discussion groups due to the concern that certain groups of people were missing EHE guidance. To address this change in meaning, this question could be stratified with the demographics questions to identify differences based on individuals' identities. PHAs could also include more demographic questions such as religion, if it would be relevant to their area. Additionally, participants recommended revising HW-Q7 (The information from PHAs is sufficient to take action during heat waves) to more explicitly be from the participant's point of view, since a perspective cannot be generalized to an entire population or culture, as discussed above. Which would change the question to "The information from PHAs is sufficient **for me** to take action during heat waves".

Introduction revisions. Participants also needed further clarification in the introduction paragraph to fully understand the adapted TiPHA questionnaire's intent and scope. The introduction needs to clarify that the questions are asked based on respondents' perceptions of what PHAs are *currently* doing, not what they *should* be doing. This distinction is vital to ensure the survey measures perceptions of present practices rather than aspirational goals. Additionally, participant confusion around the unrelated nature of some of the questions to EHEs necessitates additional context in the introduction; specifically, to clarify that Part 1 of the adapted TiPHA questionnaire measures general perceptions of PHAs, while Part 2 focuses specifically on EHE-related actions. This intentional division facilitates a comparison between the relationship of trust in PHAs and perceptions of EHE guidance through calculation of odds ratios.[54]

Furthermore, the definition of "PHAs" needs to be refined. The original TiPHA questionnaire provided the following definition of PHAs: "Public health authorities include local, state, provincial, and federal health departments." The paper describing the original TiPHA questionnaire noted that a limitation could be participants' definitions of PHAs and that a clear definition could be needed.[54] Indeed, our study participants varied in how they defined PHAs. For example, none of the participants included environmental health in their definition, with one participant going so far as to say they explicitly excluded environmental health concerns from their working definition of public health work. This lack of understanding of the field of environmental health has been echoed in national level surveys. For example, a 2019 survey of 4,464 U.S. adults found that 63% of people said they knew very little about environmental health scientists.[97] This could be because in the 19th and 20th centuries, public health and environmental health were largely separate, siloed bodies.[98]

Participants also discussed that their perception of PHAs differed across local and federal levels, introducing challenges when answering questions. A 2023 telephone survey of 1,016 adults across all 50 states found that U.S. adults trust local government more than the federal government. An additional study, a 2021 survey of 6,152 adults across 41 states attributed the same finding to mere physical closeness.[99,100] Additionally, some participants mentioned that since heat waves are localized events, the survey should be used to assess trust in local PHAs. Based on participant feedback, a refined PHA definition is included in the updated adapted TiPHA questionnaire (Figure S7).

Our questionnaire did not include a definition for “heat wave,” and participants had varying definitions spanning from heat and smoke events, humidity, temporality, and a range of temperature values. Moreover, they used terms synonymous with heat wave. This lack of consistency in term definition and use is unsurprising since the definition of "heat wave" has been found to differ among policymakers, climatologists, and epidemiologists, with varying focus on physical temperature or heat outcomes.[101] Participants mentioned that having a locally adaptable definition of a “heat wave” (e.g., “15°F above normal for your area”) would help to answer the questions. In fact, although EHE and extreme cold affect all regions, research analyzing daily temperature and mortality data in 306 communities in 12 countries found that individuals' sensitivity to extreme hot and cold varies by region.[102] Another study using 22 years of Medicare data, along with NASA and NOAA climate projections for all 50 states and Puerto Rico, found that cooler places have lower mortality rates during cold events and warmer places have lower mortality rates during EHE.[103] This is partially because geographic areas have infrastructure made for their climate (e.g., increased prevalence of AC in warmer places, power grids prepared for cold weather in cooler places).[103]

Therefore, depending on where the adapted TiPHA questionnaire is administered, a geographically specific definition of heat wave could be provided along with the survey tool. However, a content analysis of 21 Heat Action Plans in the U.S. found that 95% of Heat Actions Plans use National Weather Service advisories, non-specific to local health impacts, to determine when to announce a heat wave.[104] Future research should assist PHA in updating there Heat Action Plans to determine threshold based on anticipated health impacts. An approach to providing such a geographically specific definition is included in a one-pager developed to accompany the questionnaire (Figure S8).

HW-Q8 was noted for assuming awareness of official PHA recommendations, so this question was updated to include a parenthetical section with a link to Public Health –Seattle King County's "Hot Weather Preparedness Guidance" as an example reference (Figure S7).[105] It is recommended that the link should be specified for specific agency public health guidance based on the location/PHA of interest. If the location does not have specific heat wave guidance, survey administrators should consider a nearby state or location with similar seasonal weather patterns.

Format revisions. Format improvements were also suggested by the focus groups. A frozen questionnaire header was recommended for ease of use. Another proposed format change was to add an optional open-ended comment box. While not essential, this addition reflects growing trends in mixed-methods data collection and public engagement, where qualitative context helps interpret quantitative trust and EHEs metrics more accurately.[106] However, the optional comment box should only be included if jurisdictions have the capacity to analyze the qualitative data.[107]

Although not specifically mentioned by focus group participants, the research team also identified two demographic questions where minor revisions could enhance inclusivity and clarity. First, the question "What is the highest level of education you have completed?" could benefit from another option for those who have not started high school. Indeed, the National Center for Education Statistics released its 2022 dropout rates statistics with 5.3% U.S. adults not completing high school in 2022, and an unknown percentage of U.S. adults did not finish middle school.[108] Additionally, to improve consistency with other Likert scale questions in the survey, it was suggested to replace the "maybe" response option to "I don't know" for the question, "Have you ever experienced a heat wave?"

Bias revisions. Participants also raised points about perceived bias of question phrasing of certain concepts in the overall instrument. Although only one participant mentioned an exclusion of disability in this research, it underscores the importance of inclusiveness in questionnaire design. Expanding the demographic section to include a disability question and adding "people with disabilities" to HW-Q3's "at-risk populations" would enhance the questionnaire's comprehensiveness and accuracy, as people with disabilities face disproportionate risk during EHEs.[109–112]. Exclusion of those with disabilities is apparent within health research. In 2020, when early COVID-19 surveillance data was published, there was no disability data included; making it difficult to assess the pandemic's full impact on this population.[113] This is so common that disability health experts wrote a debate article arguing that people with disabilities experience significant health disparities, but are frequently excluded from public health surveillance, interventions, and research.[114] The authors call for the formal recognition of people with disabilities as a health disparity population and highlight the apparent

ableism within public health.[114] Small modifications in wording and framing could make adapted TiPHA questionnaire more inclusive without compromising its neutrality.

Questions not revised.

Comments regarding the original TiPHA questionnaire PHA trust questions were not amended. This is because this half of the questionnaire has already been validated and the two questions P-Q3 (PHAs use resources well), and P-Q2 (PHAs are partly responsible for the illegal drug problems in this country) were each only discussed by one participant in one focus group. Further research could assess if these questions should be amended due to P-Q3 uncertainty whether the term “resources” referred to personal, financial, or technical capacities. Since, past research has found that unclear terms can skew data by increasing bias and reducing replicability, especially if the term has multiple definitions.[115–117] However, this question was intended to be broad to understand their general perspective about resource use. (Figure S7).

Additionally, the recommendation to change "illegal" in P-Q2 because of the way language can carry stigma and unintended connotations should be more broadly reviewed, especially in places with different social and political climates than the PNW. The association between the term “illegal” (referring to drugs in this questionnaire) could affect how participants interpret the questions due to the U.S. usage of the term “illegal immigrants.” The term “illegal immigrants” was brought into mainstream U.S. media and households during the first Donald Trump presidency in 2018 when the United States Department of Justice (DOJ) told attorneys to use “illegal immigrants” instead of “undocumented immigrants.”[118] This was followed by a flurry of press releases by conservative groups supporting the change and liberal groups urging media and government agencies to refrain from using the term.[118] Since this question does not

ask about immigration, the same meaning would be accomplished with a change of term, such as "illicit" drugs. "Illicit drugs" are already considered a synonym for "illegal drugs" and include cannabis, ecstasy, amphetamines, cocaine, heroin, barbiturates, and methadone.[119] Potentially, revising such wording could help ensure all respondents feel comfortable engaging with the adapted TiPHA questionnaire.

LIMITATIONS. Our sampling frame was limited to three jurisdictions with large metropolitan areas in the PNW, potentially limiting generalizability of findings to other geographies and demographics (e.g., predominantly rural warmer communities). Additionally, focus group participants were not segregated by- age, county zip code, neighborhood, gender, and race, which might introduce social desirability bias. Social desirability bias is where participants change their answers to conform to social norms or accepted behaviors, or based on cultural power dynamics.[120] This has been observed in those who identify as men in focus groups with other genders and those with higher social or economic positions within research studies.[121–123] In research, social desirability bias skews the data to overly depict "positive" or homogenous responses and attitudes.[120–122] In our research, this could have led to participants not expressing whether a question was unclear or differing thoughts on questions, limiting input on questionnaire adaptation.[120]

Another limitation is that individuals without social media may not have been exposed to the recruitment efforts for the focus groups. While they were not intentionally excluded, exposure to the population without social media may have been limited to word of mouth. This could help explain why fewer people over the age of 45 filled out the interest form compared to those under 35, as younger adults are more likely to use social media platforms regularly.[124] Additionally, the

study was limited to English speaking participants thus missing the perspectives of other language speakers.

Finally, the capacity of PHAs to use this tool may limit its utility and impact in practice. To reach populations that are more likely to be distrustful of health authorities, PHAs must go beyond simply distributing the survey online. Engaging with these communities may require additional resources and efforts, such as attending in-person gatherings, printing paper copies of the survey, or partnering with trusted community members or organizations. However, these approaches may be especially challenging in areas where trust in PHAs is already low. In addition, PHAs would need the technical capacity to collect, process, and analyze both quantitative data and any qualitative responses provided through optional text boxes. This could necessitate further support, such as collaboration with a university or assistance from their state health department.

Conclusion.

This study aimed to adapt the original TiPHA questionnaire to develop the first public trust survey instrument specific to EHEs. This tool addresses a critical gap in public health and climate resilience research by providing a method to assess how trust in PHAs evolves, particularly in response to targeted communication strategies or recommendations during EHEs. While previous research has explored trust in government and health systems more broadly, no tools have examined trust in the lens of EHEs. By focusing on the concept of trust related to an emerging climate change concern, EHEs, this study offers a novel contribution to measurement and practice.

Overall, the adapted TiPHA questionnaire was well received by focus group participants. However, minor revisions were suggested to clarify or improve neutrality of specific questions and the instrument overall, including definitions for key terms. Future research should pilot the adapted TiPHA questionnaire at the community level to assess reliability and further refine face validity. The adapted TiPHA questionnaire should also be evaluated in jurisdictions with different political contexts and risk profiles than the PNW to ensure its broader applicability and effectiveness. Additionally, a future study would be needed to translate and validate the adapted TiPHA questionnaire into other languages.

This research was motivated by the 2021 PNW heat dome, which exposed the region's vulnerability to EHE due to infrastructure (healthcare, homes, and public spaces) not designed for heat, and which resulted in hundreds of excess deaths.[11,12] The event disproportionately affected vulnerable populations and prompted collaborative efforts among public health agencies, governments, and communities to improve future EHE preparedness, communication, and resilience. Trust in PHAs influences individual compliance with health guidance, shapes community resilience during crises, and varies across demographics, with historically marginalized groups often reporting lower trust due to past inequities.[43,49,63,64,69] Ultimately, this highlights that building and maintaining trust is essential for effective emergency response and equitable health outcomes.

Bibliography

1. What one of Seattle's hottest starts to july means for the rest of the summer. *The Seattle Times*. https://www.seattletimes.com/seattle-news/weather/what-one-of-seattles-hottest-starts-to-july-means-for-the-rest-of-summer/. July 12, 2024.

2. *2021 Seattle- Heating, Air Conditioning, and Appliances- All Occupied Units*. US Census Bureau https://www.census.gov/programs-surveys/ahs/data/interactive/ahstablecreator.html?s_areas=42660&s_year=2021&s_tablename=TABLE3&s_bygroup1=1&s_bygroup2=1&s_filtergroup1=1&s_filtergroup2=1

3. Meehl GA, Tebaldi C. More Intense, More Frequent, and Longer Lasting Heat Waves in the 21st Century. *Science*. 2004;305(5686):994-997. doi:10.1126/science.1098704

4. Šeparović L, Alexandru A, Laprise R, et al. Present climate and climate change over North America as simulated by the fifth-generation Canadian regional climate model. *Clim Dyn*. 2013;41(11-12):3167-3201. doi:10.1007/s00382-013-1737-5

5. USDA. *2021 Northwest Heat Dome: Causes, Impacts and Future Outlook | USDA Climate Hubs.*; 2021. https://www.climatehubs.usda.gov/hubs/northwest/topic/2021-northwest-heat-dome-causes-impacts-and-future-outlook

6. Liberto T. *Record-Breaking June 2021 Heatwave Impacts the U.S. West*. NOAA; 2021. https://www.climate.gov/news-features/event-tracker/record-breaking-june-2021-heatwave-impacts-us-west

7. Weather Spark. Climate and Average Weather Year Round in Pacific. Weather Spark. https://weatherspark.com/y/896/Average-Weather-in-Pacific-Washington-United-States-Year-Round

8. Loikith P. The 2021 Pacific Northwest Heatwave (Heat Dome). *Oregon Encyclopedia*. https://www.oregonencyclopedia.org/articles/heat-dome-2021/.

9. Jain P, Sharma AR, Acuna DC, Abatzoglou JT, Flannigan M. Record-breaking fire weather in North America in 2021 was initiated by the Pacific northwest heat dome. *Commun Earth Environ*. 2024;5(1):202. doi:10.1038/s43247-024-01346-2

10. Heat Wave 2021. Published online 2021. https://doh.wa.gov/emergencies/be-prepared-be-safe/severe-weather-and-natural-disasters/extreme-heat/hot-weather-precautions/heat-wave-2021

11. Ryan J. 2021 heat wave is now the deadliest weather-related event in Washington history. *KUOW NPR Network*. https://www.kuow.org/stories/heat-wave-death-toll-in-washington-state-jumps-to-112-people. July 19, 2021.

12. Casey JA, Parks RM, Bruckner TA, Gemmill A, Catalano R. Excess Injury Mortality in Washington State During the 2021 Heat Wave. *Am J Public Health*. 2023;113(6):657-660. doi:10.2105/AJPH.2023.307269

13. Wettstein ZS, Hall J, Buck C, Mitchell SH, Hess JJ. Impacts of the 2021 heat dome on emergency department visits, hospitalizations, and health system operations in three hospitals in Seattle, Washington. *JACEP Open*. 2024;5(1):e13098. doi:10.1002/emp2.13098

14. Schramm PJ, Vaidyanathan A, Radhakrishnan L, Gates A, Hartnett K, Breysse P. Heat-Related Emergency Department Visits During the Northwestern Heat Wave — United States, June 2021. *MMWR Morb Mortal Wkly Rep*. 2021;70(29):1020-1021. doi:10.15585/mmwr.mm7029e1

15. Nori-Sarma A, Milando C, Weinberger KR, Hess JJ, Errett NA, Wellenius GA. Association Between the 2021 Heat Wave in Portland, Oregon, and Seattle, Washington, and Emergency Department Visits. *JAMA*. 2022;328(23):2360. doi:10.1001/jama.2022.20665

16. Weinberger KR, Harris D, Spangler KR, Zanobetti A, Wellenius GA. Estimating the number of excess deaths attributable to heat in 297 United States counties. *Environmental Epidemiology*. 2020;4(3):e096. doi:10.1097/EE9.0000000000000096

17. Gasparrini A, Armstrong B, Kenward MG. Multivariate meta-analysis for non-linear and other multi-parameter associations. *Statistics in Medicine*. 2012;31(29):3821-3839. doi:10.1002/sim.5471

18. Wang Y, Akbari H. The effects of street tree planting on Urban Heat Island mitigation in Montreal. *Sustainable Cities and Society*. 2016;27:122-128. doi:10.1016/j.scs.2016.04.013

19. Anderson BG, Bell ML. Weather-Related Mortality: How Heat, Cold, and Heat Waves Affect Mortality in the United States. *Epidemiology*. 2009;20(2):205-213. doi:10.1097/EDE.0b013e318190ee08

20. Urban Head Island Analysis. *Earth Economics*. Published online 2020. https://greenseattle.org/wp-content/uploads/2020/07/SeattleWA_HeatIsland_061120.pdf.

21. Saldanha A. Seattle's growth is heating up the region — literally. *The Seattle Times*. Published online August 5, 2023. https://www.seattletimes.com/seattle-news/seattles-growth-is-heating-up-the-region-literally-see-where/

22. *In the Hot Seat: Saving Lives From Extreme Heat in Washington State*. University of Washington; 2023. https://cig.uw.edu/projects/in-the-hot-seat-saving-lives-from-extreme-heat-in-washington-state/

23. Basagaña X, Sartini C, Barrera-Gómez J, et al. Heat Waves and Cause-specific Mortality at all Ages. *Epidemiology*. 2011;22(6):765-772. doi:10.1097/EDE.0b013e31823031c5

24. Stafoggia M, Forastiere F, Agostini D, et al. Vulnerability to Heat-Related Mortality: A Multicity, Population-Based, Case-Crossover Analysis. *Epidemiology*. 2006;17(3):315-323. doi:10.1097/01.ede.0000208477.36665.34

25. Schwartz J. Who is Sensitive to Extremes of Temperature?: A Case-Only Analysis. *Epidemiology*. 2005;16(1):67-72. doi:10.1097/01.ede.0000147114.25957.71

26. Medina-Ramón M, Schwartz J. Temperature, temperature extremes, and mortality: a study of acclimatisation and effect modification in 50 US cities. *Occup Environ Med*. 2007;64(12):827-833. doi:10.1136/oem.2007.033175

27. Geranios N. Rolling blackouts hit Pacific Northwest as cities swelter in record-breaking heat wave. *Los Angeles ATimes*. https://www.latimes.com/world-nation/story/2021-06-29/rolling-blackouts-us-northwest-heat-wave. June 29, 2021.

28. UNEP. *Awareness and Preparedness for Emergencies at Local Level: A Process for Improving Community Awareness and Preparedness for Technological Hazards and Environmental Emergencies.* United Nations; 2015.

29. Haggerty B. Local Goverment Response to the 2021 Pacific Northwest Heat Dome. Presented at: NOAA. https://cpo.noaa.gov/wp-content/uploads/2024/03/Haggerty_NIHHIS.pdf

30. Seattle Met Staff. *Under the Heat Dome*. Seattle Met; 2022. https://www.seattlemet.com/news-and-city-life/2022/06/hottest-day-history-seattle-heat-dome-2021

31. Vigdor N. Pacific Northwest Heat Wave Shatters Temperature Records. *The New York Times*. https://www.nytimes.com/2021/06/27/us/heat-wave-seattle-portland.html. June 27, 2021.

32. KGW Staff. Places to escape the heat this weekend. *KGW News*. https://www.kgw.com/article/news/local/historic-heat-wave-cooling-centers/283-2c36a99f-571e-4cc7-9bf5-acac1c602fd5. June 23, 2021.

33. Collaborative on Extreme Heat Events. https://cdrc.uw.edu/key-initiatives/collaborative-on-extreme-heat-events/

34. Collaborative on Extreme Heat Events. *Action and Research Agenda for Pacific Northwest Extreme Heat Events*. University of Washington

35. Siegrist M, Zingg A. The Role of Public Trust During Pandemics: Implications for Crisis Communication. *European Psychologist*. 2014;19(1):23-32. doi:10.1027/1016-9040/a000169

36. IRFC, UNICEF. *Building Trust Within and Across Communities for Health Emergency Preparedness*.; 2020. Accessed October 17, 2024. file:///C:/Users/Riley/Downloads/GPMB-2020-ARBackgroundPaper3-IFRC-UNICEF.pdf

37. Lee Y, Li JQ. The role of communication transparency and organizational trust in publics' perceptions, attitudes and social distancing behaviour: A case study of the COVID-19 outbreak. *Contingencies & Crisis Mgmt*. 2021;29(4):368-384. doi:10.1111/1468-5973.12354

38. Miller AH, Listhaug O. Political Parties and Confidence in Government: A Comparison of Norway, Sweden and the United States. *Brit J Polit Sci*. 1990;20(3):357-386. doi:10.1017/S0007123400005883

39. Bonfanti RC, Oberti B, Ravazzoli E, Rinaldi A, Ruggieri S, Schimmenti A. The Role of Trust in Disaster Risk Reduction: A Critical Review. *IJERPH*. 2023;21(1):29. doi:10.3390/ijerph21010029

40. Czabanowska K, Kuhlmann E. Public health competences through the lens of the COVID-19 pandemic: what matters for health workforce preparedness for global health emergencies. *Health Planning & Management*. 2021;36(S1):14-19. doi:10.1002/hpm.3131

41. Cummings L. The "Trust" Heuristic: Arguments from Authority in Public Health. *Health Communication*. 2014;29(10):1043-1056. doi:10.1080/10410236.2013.831685

42. Blair RA, Morse BS, Tsai LL. Public health and public trust: Survey evidence from the Ebola Virus Disease epidemic in Liberia. *Social Science & Medicine*. 2017;172:89-97. doi:10.1016/j.socscimed.2016.11.016

43. Siegrist M, Zingg A. The Role of Public Trust During Pandemics: Implications for Crisis Communication. *European Psychologist*. 2014;19(1):23-32. doi:10.1027/1016-9040/a000169

44. Ozawa S, Sripad P. How do you measure trust in the health system? A systematic review of the literature. *Social Science & Medicine*. 2013;91:10-14. doi:10.1016/j.socscimed.2013.05.005

45. PRC. *Public Trust in Government: 1958-2024*. Pew Research Center; 2024. https://www.pewresearch.org/politics/2024/06/24/public-trust-in-government-1958-2024/

46. Freimuth VS, Musa D, Hilyard K, Quinn SC, Kim K. Trust During the Early Stages of the 2009 H1N1 Pandemic. *Journal of Health Communication*. 2014;19(3):321-339. doi:10.1080/10810730.2013.811323

47. Kirzinger A, Presiado M, Valdes I, Hamel L, Brodie M. The COVID-19 Pandemic: Insights from Three Years of KFF Polling. *KFF*. https://www.kff.org/health-misinformation-and-trust/poll-finding/the-covid-19-pandemic-insights-from-three-years-of-kff-polling/. March 7, 2023.

48. Algan Y, Cohen D, Davoine E, Foucault M, Stantcheva S. Trust in scientists in times of pandemic: Panel evidence from 12 countries. *Proc Natl Acad Sci USA*. 2021;118(40):e2108576118. doi:10.1073/pnas.2108576118

49. Pollard MS, Davis LM. Decline in Trust in the Centers for Disease Control and Prevention During the COVID-19 Pandemic. *Rand Health Q*. 2022;9(3):23.

50. Devine D, Gaskell J, Jennings W, Stoker G. Trust and the Coronavirus Pandemic: What are the Consequences of and for Trust? An Early Review of the Literature. *Political Studies Review*. 2021;19(2):274-285. doi:10.1177/1478929920948684

51. Bollyky TJ, Hulland EN, Barber RM, et al. Pandemic preparedness and COVID-19: an exploratory analysis of infection and fatality rates, and contextual factors associated with preparedness in 177 countries, from Jan 1, 2020, to Sept 30, 2021. *The Lancet*. 2022;399(10334):1489-1512. doi:10.1016/S0140-6736(22)00172-6

52. Adams RM, Evans CM, Mathews MC, Wolkin A, Peek L. Mortality From Forces of Nature Among Older Adults by Race/Ethnicity and Gender. *J Appl Gerontol*. 2021;40(11):1517-1526. doi:10.1177/0733464820954676

53. Appleby-Arnold S, Brockdorff N, Jakovljev I, Zdravković S. Disaster preparedness and cultural factors: a comparative study in Romania and Malta. *Disasters*. 2021;45(3):664-690. doi:10.1111/disa.12433

54. Holroyd TA, Limaye RJ, Gerber JE, et al. Development of a Scale to Measure Trust in Public Health Authorities: Prevalence of Trust and Association with Vaccination. *Journal of Health Communication*. 2021;26(4):272-280. doi:10.1080/10810730.2021.1927259

55. Eisenman DP, Williams MV, Glik D, Long A, Plough AL, Ong M. The Public Health Disaster Trust Scale: Validation of a Brief Measure. *Journal of Public Health Management and Practice*. 2012;18(4):E11-E18. doi:10.1097/PHH.0b013e31823991e8

56. Glaeser EL, Laibson DI, Scheinkman JA, Soutter CL. Measuring Trust*. *Quarterly Journal of Economics*. 2000;115(3):811-846. doi:10.1162/003355300554926

57. 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(1):30-38. doi:10.1017/s1935789300002391

58. Hallegatte S, Vogt-Schilb A, Rozenberg J, Bangalore M, Beaudet C. From Poverty to Disaster and Back: a Review of the Literature. *EconDisCliCha*. 2020;4(1):223-247. doi:10.1007/s41885-020-00060-5

59. US EPA. *Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts.* US Environmental Protection Agency; 2021.

60. Gilson L. Trust and the development of health care as a social institution. *Social Science & Medicine*. 2003;56(7):1453-1468. doi:10.1016/S0277-9536(02)00142-9

61. Prati G, Pietrantoni L, Zani B. A Social-Cognitive Model of Pandemic Influenza H1N1 Risk Perception and Recommended Behaviors in Italy. *Risk Analysis*. 2011;31(4):645-656. doi:10.1111/j.1539-6924.2010.01529.x

62. Vinck P, Pham PN, Bindu KK, Bedford J, Nilles EJ. Institutional trust and misinformation in the response to the 2018–19 Ebola outbreak in North Kivu, DR Congo: a population-based

survey. *The Lancet Infectious Diseases*. 2019;19(5):529-536. doi:10.1016/S1473-3099(19)30063-5

63. Bearak M. Kenya's prexisiting condition: Mistrust in the goverment.https://www.washingtonpost.com/world/africa/kenyas-preexisting-condition-mistrust-in-the-government/2020/05/08/ed41e624-9062-11ea-9322-a29e75effc93_story.html. May 8, 2020.

64. Hendrickson K, Francis K, Clarke A. *Public Trust, Community Resilience, and Disaster Response in the U.S. Virgin Islands*.; 2022. https://hazards.colorado.edu/public-health-disaster-research/public-trust-community-resilience-and-disaster-response-in-the-u-s-virgin-islands#fn:Adams,%202020

65. Castro-Correa CP, Aldunce Ide P, Wyndham Vásquez K, Mena Maldonado D, Pérez Tello S. Transformation of social capital during and after a disaster event: the cases Chañaral and Diego de Almagro, Atacama Region, Chile. *Nat Hazards*. 2020;103(2):2427-2440. doi:10.1007/s11069-020-04091-9

66. Islam R, Walkerden G. How bonding and bridging networks contribute to disaster resilience and recovery on the Bangladeshi coast. *International Journal of Disaster Risk Reduction*. 2014;10:281-291. doi:10.1016/j.ijdrr.2014.09.016

67. Sadri AM, Ukkusuri SV, Lee S, et al. The role of social capital, personal networks, and emergency responders in post-disaster recovery and resilience: a study of rural communities in Indiana. *Nat Hazards*. 2018;90(3):1377-1406. doi:10.1007/s11069-017-3103-0

68. McGowan CR, Takahashi E, Romig L, et al. Community-based surveillance of infectious diseases: a systematic review of drivers of success. *BMJ Glob Health*. 2022;7(8):e009934. doi:10.1136/bmjgh-2022-009934

69. Sopory P, Novak JM, Day AM, et al. Trust and Public Health Emergency Events: A Mixed-Methods Systematic Review. *Disaster med public health prep*. 2022;16(4):1653-1673. doi:10.1017/dmp.2021.105

70. Nong P, Raj M, Creary M, Kardia SLR, Platt JE. Patient-Reported Experiences of Discrimination in the US Health Care System. *JAMA Netw Open*. 2020;3(12):e2029650. doi:10.1001/jamanetworkopen.2020.29650

71. Taylor LA, Nong P, Platt J. Fifty Years of Trust Research in Health Care: A Synthetic Review. *Milbank Quarterly*. 2023;101(1):126-178. doi:10.1111/1468-0009.12598

72. Hochberg CH, Eakin MN. Keys to Successful Survey Research in Health Professions Education. *ATS Sch*. 2024;5(1):206-217. doi:10.34197/ats-scholar.2023-0112RE

73. Rose H, McKinley J, eds. *The Routledge Handbook of Research Methods in Applied Linguistics*. Routledge; 2020.

74. *Multnomah County, Oregon*. US Census Bureau Accessed September 6, 2024. https://data.census.gov/profile/Multnomah_County,_Oregon?g=050XX00US41051#race-and-ethnicity

75. *Multnomah County, Oregon Climate Averages*. Accessed September 30, 2024. https://www.weatherworld.com/climate-averages/or/multnomah+county.html

76. *King County, Washington*. United States Census Bureau Accessed September 30, 2024. https://data.census.gov/profile/King_County,_Washington?g=050XX00US53033

77. *King County, Washington Weather Data*. National czenters for Environmental Information Accessed September 30, 2024. https://data.theadvertiser.com/weather-data/king-county/53033/2024-06-01/

78. *Vancouver Census Profile, 2021 Census of Population*.; 2024.

79. *Climate Change Adaption Strategy*. City of Vancouver https://vancouver.ca/files/cov/vancouver-climate-change-adaptation-strategy-2024-25.pdf

80. CDC. *Office of Readiness and Response*. US Center for Disease Control; 2024. https://www.cdc.gov/orr/about/index.html

81. HHS. *Emergency Preparedness & Response*. https://www.hhs.gov/programs/emergency-preparedness/index.html

82. Homeland Security. *National Response Framework*.; 2019. https://www.fema.gov/sites/default/files/documents/NRF_FINALApproved_2011028.pdf

83. IHS. *Emergency Medical Services*. https://www.ihs.gov/dccs/ems/

84. PHAC. *Emergency Preparedness and Response*. Public Health Agency of Canada; 2025. https://www.canada.ca/en/public-health/services/emergency-preparedness-response.html

85. ISC. *Emergency Management Assistance Program*. Indigenous Services Canada; 2025. https://www.sac-isc.gc.ca/eng/1534954090122/1535120506707

86. Abrahamson V, Wolf J, Lorenzoni I, et al. Perceptions of heatwave risks to health: interview-based study of older people in London and Norwich, UK. *Journal of Public Health*. 2008;31(1):119-126. doi:10.1093/pubmed/fdn102

87. Tsang S, Royse C, Terkawi A. Guidelines for developing, translating, and validating a questionnaire in perioperative and pain medicine. *Saudi J Anaesth*. 2017;11(5):80. doi:10.4103/sja.SJA_203_17

88. Doria N, Condran B, Boulos L, Curtis Maillet DG, Dowling L, Levy A. Sharpening the focus: differentiating between focus groups for patient engagement vs. qualitative research. *Res Involv Engagem*. 2018;4(1):19. doi:10.1186/s40900-018-0102-6

89. Hennink M, Kaiser BN. Sample sizes for saturation in qualitative research: A systematic review of empirical tests. *Social Science & Medicine*. 2022;292:114523. doi:10.1016/j.socscimed.2021.114523

90. Hennink MM, Kaiser BN, Weber MB. What Influences Saturation? Estimating Sample Sizes in Focus Group Research. *Qual Health Res*. 2019;29(10):1483-1496. doi:10.1177/1049732318821692

91. Coenen M, Stamm TA, Stucki G, Cieza A. Individual interviews and focus groups in patients with rheumatoid arthritis: a comparison of two qualitative methods. *Qual Life Res*. 2012;21(2):359-370. doi:10.1007/s11136-011-9943-2

92. Guest G, Namey E, McKenna K. How Many Focus Groups Are Enough? Building an Evidence Base for Nonprobability Sample Sizes. *Field Methods*. 2017;29(1):3-22. doi:10.1177/1525822X16639015

93. *Human Subjects Divisions*. University of Washington https://www.washington.edu/research/hsd/getting-started/

94. *Policies, Procedure and Guidance- Guidance Data Security Protections*. Office of Research, University of Washington https://www.washington.edu/research/policies/guidance-data-security-protections/

95. A Formal Definition of Culture. In: *Advances in Group Decision and Negotiation*. Springer Netherlands; 2013:1-26. doi:10.1007/978-94-007-5574-1_1

96. A. L. Kroeber, Clyde Kluckhohn. *Culture: A Critical Review of Concepts and Definitions*. Peabody Museum Press; 1952:247.

97. Funk C, Hefferson M, Kennedy B, Johnson C. *Trust and Mistrust in Americans' Views of Scientific Experts*. Pew Research Center; 2019. https://www.pewresearch.org/science/wp-content/uploads/sites/16/2019/08/PS_08.02.19_trust.in_.scientists_FULLREPORT_8.5.19.pdf

98. Negev M, Levine H, Davidovitch N, Bhatia R, Mindell J. Integration of health and environment through health impact assessment: Cases from three continents. *Environmental Research*. 2012;114:60-67. doi:10.1016/j.envres.2012.02.003

99. Jones J. *Americans Trust Local Government Most, Congress Least*. Gallup; 2024. https://news.gallup.com/poll/512651/americans-trust-local-government-congress-least.aspx

100. O'Leary J, Welle A, Agarwal S. *Improving Trust in State and Local Government*. Deloitte; 2021. https://www2.deloitte.com/us/en/insights/industry/public-sector/trust-in-state-local-government.html

101. Boni Z, Bieńkowska Z, Chwałczyk F, Jancewicz B, Marginean I, Serrano PY. What is a heat(wave)? An interdisciplinary perspective. *Climatic Change*. 2023;176(9):129. doi:10.1007/s10584-023-03592-3

102. Guo Y, Gasparrini A, Armstrong B, et al. Global Variation in the Effects of Ambient Temperature on Mortality: A Systematic Evaluation. *Epidemiology*. 2014;25(6):781-789. doi:10.1097/EDE.0000000000000165

103. Heutel G, Miller NH, Molitor D. Adaptation and the Mortality Effects of Temperature Across U.S. Climate Regions. *The Review of Economics and Statistics*. Published online August 16, 2021:1-14. doi:10.1162/rest_a_00936

104. Randazza JM, Hess JJ, Bostrom A, et al. Planning to Reduce the Health Impacts of Extreme Heat: A Content Analysis of Heat Action Plans in Local United States Jurisdictions. *Am J Public Health*. 2023;113(5):559-567. doi:10.2105/AJPH.2022.307217

105. King County. *Hot Weather Prepardness*. https://kingcounty.gov/en/dept/dph/health-safety/safety-injury-prevention/emergency-preparedness/personal-preparedness/hot-weather

106. Wasti SP, Simkhada P, van Teijlingen ER, Sathian B, Banerjee I. The Growing Importance of Mixed-Methods Research in Health. *Nepal J Epidemiol*. 2022;12(1):1175-1178. doi:10.3126/nje.v12i1.43633

107. Creswell J, Plano Clark V. *Designing and Conducting Mixed Methods Research*. SAGE Publications; 2017.

108. NCES. *National Center of Education Statistics Dropout Rates*.; 2024. https://nces.ed.gov/programs/coe/indicator/coj/status-dropout-rates

109. Chakraborty J. Heatwave frequency and disability status: Thermal inequities in the U.S. South. *Disability and Health Journal*. 2025;18(1):101665. doi:10.1016/j.dhjo.2024.101665

110. Kang Y, Park J, Jang DH. Compound impact of heatwaves on vulnerable groups considering age, income, and disability. *Sci Rep*. 2024;14(1):24732. doi:10.1038/s41598-024-75224-4

111. Kim S, Lee JT. Extreme temperature, health, and disability: A comparison of health effects between people with and without disabilities. *ISEE Conference Abstracts*. 2021;2021(1):isee.2021.P-375. doi:10.1289/isee.2021.P-375

112. Kang Y, Baek I, Park J. Assessing heatwave effects on disabled persons in South Korea. *Sci Rep*. 2024;14(1):3459. doi:10.1038/s41598-024-54015-x

113. Reed NS, Meeks LM, Swenor BK. Disability and COVID-19: who counts depends on who is counted. *The Lancet Public Health*. 2020;5(8):e423. doi:10.1016/S2468-2667(20)30161-4

114. Berghs M, Atkin K, Hatton C, Thomas C. Rights to social determinants of flourishing? A paradigm for disability and public health research and policy. *BMC Public Health*. 2019;19(1):997. doi:10.1186/s12889-019-7334-8

115. Talbott M, Lee J. Ambiguous Terminology: A Challenge in Teaching Social Science Research. *International Journal of Learning in Higher Education*. 2020;32:519-527.

116. Fowler, Jr. FJ. How Unclear Terms Affect Survey Data. *Public Opinion Quarterly*. 1992;56(2):218. doi:10.1086/269312

117. *Reference Manual on Scientific Evidence: Third Edition*. National Academies Press; 2011:13163. doi:10.17226/13163

118. Callister AH, Galbraith Q, Carlile A. Politics and Prejudice: Using the Term "Undocumented Immigrant" over "Illegal Immigrant." *Int Migration & Integration*. 2022;23(2):753-773. doi:10.1007/s12134-021-00852-y

119. Houck MM, Siegel JA. Illicit Drugs. In: *Fundamentals of Forensic Science*. Elsevier; 2010:305-340. doi:10.1016/B978-0-12-374989-5.00013-2

120. Bergen N, Labonté R. "Everything Is Perfect, and We Have No Problems": Detecting and Limiting Social Desirability Bias in Qualitative Research. *Qual Health Res*. 2020;30(5):783-792. doi:10.1177/1049732319889354

121. Kelly CA, Soler-Hampejsek E, Mensch BS, Hewett PC. Social Desirability Bias in Sexual Behavior Reporting: Evidence from an Interview Mode Experiment in Rural Malawi [. *IPSRH*. 2013;39(01):014-021. doi:10.1363/3901413

122. Johnson T, Van de Vijver F. Social Desirability in Cross-Cultural Research. *Psychosomatic Medicine*.:193-202.

123. Grimm P. Social Desirability Bias. In: Sheth J, Malhotra N, eds. *Wiley International Encyclopedia of Marketing*. 1st ed. Wiley; 2010. doi:10.1002/9781444316568.wiem02057

124. *Social Media Use in 2021*. Pew Research Center; 2021. https://www.pewresearch.org/internet/wp-content/uploads/sites/9/2021/04/PI_2021.04.07_Social-Media-Use_FINAL.pdf