HEADS-UP and Beyond: Extension-Led Interventions for Weather-Related Disaster Readiness in Vulnerable Communities in Alabama

by

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Abstract

Rural communities in Alabama face high risks from weather-related disasters such as tornadoes and hurricanes due to poverty, substandard housing, limited access to emergency communication tools, and systemic barriers to preparedness education. This dissertation evaluates the effectiveness of the HEADS-UP (Helping Every Alabamian Develop Storm Understanding and Preparation Plans) led by the Alabama Cooperative Extension System (ACES), which seeks to address these challenges through targeted, community-based interventions.

Guided by the Extension Disaster Education Model (Black, 2012) and the Theory of Planned Behavior (Ajzen, 1991), this research addresses three related topics: (1) assessing disaster preparedness and risk perception among rural residents, (2) evaluating the impact of a structured 3-hour disaster preparedness workshop on participants' knowledge and preparedness behaviors, and (3) analyzing communication preferences and barriers in disseminating severe weather warnings to vulnerable populations.

Utilizing quantitative and mixed-method research methods, data was collected from residents in Alabama's most disaster-prone counties, primarily older adults and women. Key findings indicate significant gaps in risk awareness, shelter access, and understanding of weather alert terminology. Results also demonstrate that targeted educational interventions

and tailored communication campaigns substantially enhance preparedness and resilience, particularly among seniors and residents of mobile homes. These findings underscore the effectiveness of community-specific, extension-led disaster education programs and advocate for their continued expansion. Future research should explore broader implementation and assess long-term impacts.

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Chapter 1: Prologue

Introduction and Significance of the Project

Alabama is one of the most disaster-prone states in the United States, frequently experiencing severe weather events such as tornadoes and hurricanes (FEMA, 2019; Brown, 2021). These weather-related disasters disproportionately impact rural and economically disadvantaged communities, where residents often face vulnerabilities due to poverty, inadequate housing, and limited access to essential preparedness resources (CDC, 2012; Cutter et al., 2003). Rural Alabama counties, such as those within the Black Belt region, are characterized by high poverty rates, use of mobile homes, and insufficient infrastructure, significantly increasing their vulnerability during extreme weather events (Watters, 2019).

Recognizing these challenges, the Alabama Cooperative Extension System (ACES) developed the Helping Every Alabamian Develop Storm Understanding and Preparation Plans (HEADS-UP) project. This disaster education program aims to improve storm readiness through targeted communication campaigns, distribution and education on the use of NOAA weather radios, and practical preparedness training workshops. HEADS-UP addresses critical gaps identified through previous surveys and research, particularly the limited public understanding of weather warnings, inadequate emergency communication infrastructure, and the need for localized

disaster preparedness education (Black, 2012; Alabama Cooperative Extension System, 2022).

Over the past 70 years, Alabama has experienced more than 87 natural disasters, ranking it the eighth highest state in terms of disaster frequency and severity in the United States (FEMA, 2019). Alarmingly, Alabama averages 14 tornado-related fatalities per year, a statistic exacerbated among impoverished communities (Brown, 2021). Moreover, studies highlight that residents living in mobile homes face notably higher risks during tornadoes, primarily due to structural inadequacies and limited access to safe shelters (Gore, 2015).

This dissertation builds on and extends existing research by evaluating the HEADS-UP initiative through three interconnected studies. Specifically, the research examines rural residents' baseline preparedness and risk perception levels, assesses the effectiveness of short-term educational interventions delivered through structured workshops, and analyzes communication preferences and barriers in disseminating weather-related disaster warnings to vulnerable populations. This research seeks to inform policymakers, emergency management professionals, and Extension educators on best practices for disaster preparedness education, emphasizing community-tailored approaches and inclusive communication strategies. By critically evaluating the impact of HEADS-UP, this dissertation contributes to a broader understanding of effective disaster readiness programming, offering a scalable and replicable model

capable of enhancing resilience within vulnerable communities across Alabama and potentially other similarly at-risk rural areas.

Definitions

Disaster Preparedness:

Disaster preparedness encompasses proactive measures and strategies implemented to reduce the impact of disasters. This includes comprehensive knowledge dissemination, systematic planning, effective communication strategies, regular training exercises, community engagement, and ensuring the availability of essential resources and emergency supplies. These measures collectively aim to build resilience and minimize potential harm or damage caused by natural or human-made disasters (Li & Mostafavi, 2022).

Risk Perception:

Risk perception refers to the subjective judgment and interpretation of threats associated with an approaching disaster by individuals or communities. It involves understanding how people perceive the likelihood, severity, and potential consequences of a disaster event, which significantly influences their decisions, behaviors, and overall preparedness actions in anticipation of such threats.

NOAA Weather Radio (NWR):

Weather Radio is a specialized radio broadcasting service provided by the National Oceanic and Atmospheric Administration (NOAA). It delivers continuous, real-time weather alerts, warnings, watches, forecasts, and emergency information

directly from the local National Weather Service (NWS) offices. This service is designed to promptly inform the public of hazardous weather conditions and facilitate immediate protective actions.

Vulnerable Communities:

Vulnerable communities refer to groups or populations that possess increased susceptibility to disasters and adverse outcomes due to underlying socioeconomic factors, infrastructure inadequacies, limited access to resources, health disparities, or geographic location. These communities often face significant barriers to effective disaster preparedness, response, recovery, and mitigation efforts, exacerbating their vulnerability during crises.

HEADS-UP (Helping Every Alabamian Develop Storm Understanding and Preparation Plans):

An educational and outreach initiative led by the Alabama Cooperative Extension System (ACES) aimed at improving disaster preparedness among Alabama residents through training, resource distribution, and community engagement.

Assumptions

1. Residents of Alabama's rural areas cannot easily access valid disaster information.
2. Preparedness behaviors will be enhanced through educational interventions.
3. Proven local systems (e.g., Extension services) efficiently provide disaster education.
4. Communication gaps can be addressed by weather radios and workshops.

5. The older adults and the mobile home dwellers are disproportionately vulnerable.

Theoretical Framework

The theoretical framework guiding this dissertation integrates the Theory of Planned Behavior (TPB), formulated by Ajzen (1991), with the evaluation framework by Braverman and Engle (2009), alongside the Extension Disaster Education Network (EDEN) model.

Theory of Planned Behavior (TPB)

At the core of TPB is the concept that intentions, which are regarded as indicators of an individual's propensity to engage in specific behavior, are influenced by three primary determinants: attitudes towards the behavior in question, subjective norms, and perceived behavioral control (Ajzen, 1991). Attitudes are defined as an individual's positive or negative evaluations of specific behaviors. Subjective norms are defined as the perceived social pressures or expectations that influence an individual's decisions. Perceived behavioral control is defined as an individual's belief in their capacity to execute a behavior successfully, reflecting self-efficacy and perceived influence over external factors (Ajzen, 2011). This theory is a common framework used when studying and understanding safety related concepts in agriculture (Hancock et al., 2023).

Within the context of disaster preparedness, TPB functions as a valuable framework for the exploration of preparedness behaviors among rural communities in Alabama, which are frequently impacted by severe weather events such as tornadoes

and hurricanes. This theory posits that preparedness activities (including the usage of weather radios, attendance at educational workshops, and the identification of safe shelters) are significantly influenced by residents' attitudes, perceived community expectations, and their confidence in performing these actions (Ajzen, 2011).

Evaluation Framework:

The TPB is complemented by Braverman and Engle's (2009) evaluation framework, which emphasizes rigorous methodological planning and the use of logic models in extension program evaluations. The proposed framework is designed to facilitate a structured assessment of extension-led interventions, with the aim of aiding in clearly defining expected outcomes, identifying critical mediators, and systematically evaluating impacts on community preparedness.

Extension Disaster Education Network (EDEN):

The present dissertation's theoretical foundation is further reinforced by the Extension Disaster Education Network (EDEN). EDEN focuses on leveraging Cooperative Extension's extensive educational network to promote localized, research-based disaster education and community resilience strategies. The network fosters collaborative and community educational approaches aimed at enhancing disaster preparedness, mitigation, and recovery capacities in vulnerable communities.

Furthermore, the state model and curricula of the Heads-Up project will be shared with other state Extension systems via the EDEN through invited presentations at annual meetings (McKibben et al., 2024), on the EDEN website at

www.extensiondisaster.net, on the EDEN list-serv and EDEN webinar series. Project leadership will share these findings beyond the EDEN network with other stakeholders, particularly those in the southern region, as the team considers a multi-state or regional approach to disaster preparedness. Evaluation findings and lessons learned through implementation will inform future ACES programmatic efforts and the pursuit of additional extramural funds to sustain this work.

Dissertation Purpose

The purpose of this study is to assess and enhance disaster preparedness among vulnerable, rural communities in Alabama through structured educational interventions and strategic communication initiatives led by the Alabama Cooperative Extension System (ACES). Specifically, it aims to evaluate baseline disaster preparedness, examine the effectiveness of disaster education workshops, and analyze communication methods and barriers affecting the dissemination and reception of severe weather alerts. This work seeks to inform policymakers, emergency management professionals, and Extension educators regarding the best practices and scalable strategies for increasing resilience among underserved populations facing frequent weather-related disasters.

Research Objectives

The aim of this dissertation is to evaluate and improve disaster preparedness strategies for vulnerable populations in rural Alabama. This will be achieved by

examining knowledge levels, communication methods and the effectiveness of interventions led by the Extension Service. To achieve this, the study is organized into three interrelated articles, each with distinct yet complementary objectives. Together, they provide a comprehensive understanding of disaster awareness, behavioral change and outreach effectiveness across at-risk communities. The specific objectives for each article are as follows:

Article 1:

1. Assess the baseline knowledge of Alabama residents about disaster warnings and preparedness.
2. Identify gaps in disaster readiness and barriers to information dissemination.
3. Identify common sources of weather information used by residents, and determine which tools are most trusted and relied upon during severe weather events.
4. Evaluate the effectiveness of existing educational and communication tools.

Article 2:

1. Measure changes in knowledge and confidence related to disaster preparedness immediately following the workshop by using pre and post workshop survey
2. Evaluate shifts in awareness and usage of communication tools, particularly the NOAA Weather Radio, after workshop participation.

3. Determine the effectiveness of educational interventions in enhancing disaster resilience among vulnerable populations, including older adults and residents of high-risk counties.

Article 3:

1. Identify the most reliable communication methods for disaster warnings in rural areas.
2. Analyze how Alabama's communication preferences in 2019 resemble or differ from those in Florida in 2017**.**
3. Develop strategies to improve the effectiveness of Extension Services in reaching rural communities.

Limitations

Although this study provides valuable insights into disaster preparedness behaviors and the impact of interventions led by the Extension Service in rural Alabama, it is important to acknowledge its limitations.

The study focuses on selecting Alabama counties that were identified as being at high risk of severe weather events. Therefore, the findings may not be applicable to the wider Alabama population or rural communities in other states with different socio-economic, cultural or infrastructural contexts. Also, the sample was disproportionately made up of elderly people, with most participants being aged 60 and over. While this reflects the demographics of many rural communities and high-risk populations, it may have introduced age-related bias in terms of perceptions,

technology use and preparedness behaviors. The views of younger age groups were underrepresented, which limits the applicability of the findings to all age demographics.

Furthermore, the data collected in this study were based on self-reported surveys and assessments, which can introduce biases such as social desirability bias, inaccurate memory, and underestimation of preparedness actions and knowledge levels. The study evaluates short-term changes in knowledge and awareness in the immediate aftermath of the educational intervention. It does not assess sustainability or long-term behavioral changes that may occur weeks or months afterwards. Therefore, the lasting impact of the program on participants' preparedness practices and response behaviors remains unknown.

To build on these findings, future research should consider longitudinal approaches, include a more demographically diverse sample and incorporate objective measures of preparedness.

Chapter 2: An assessment of disaster preparedness and risk perception among rural residents in Alabama

Abstract

Rural communities in Alabama face significant challenges when it comes to preparing for weather-related natural disasters such as tornadoes and hurricanes. Due to poverty, inadequate housing and limited access to reliable communication tools. This study evaluates the levels of knowledge and preparedness among residents in disaster-prone counties through the HEADS-UP initiative led by the Alabama Cooperative Extension System (ACES). Participants were surveyed using a structured instrument focused on risk awareness, warning system comprehension, and communication preferences. The findings showed that, although most participants recognized the value of NOAA weather radios, only a small percentage used them regularly. Television remained the most common source of alerts, while confusion surrounding weather terminology, especially the difference between 'watch' and 'warning', was widespread. Moreover, many respondents were unaware of nearby storm shelters and tended to delay taking shelter until a tornado had been confirmed. To translate awareness into effective action, targeted, community-specific disaster education and follow-up training need to be provided.

Keywords: Disaster preparedness, Rural communities, NOAA weather radio, Weather warnings

Introduction

Alabama is among the most disaster-prone states in the U.S., facing frequent tornadoes, hurricanes, and severe storms. Rural communities are particularly vulnerable due to high poverty rates, limited access to storm shelters, and reliance on mobile homes, which are structurally weaker against severe weather. Additionally, many residents struggle to differentiate between weather alerts, leading to delayed or ineffective responses during emergencies.

The "Heads-Up" program, developed by the Alabama Cooperative Extension System (ACES), aims to improve disaster preparedness through community education, weather radio distribution, and partnerships with local organizations. This study evaluates the current levels of knowledge and preparedness among rural Alabama residents, identifying key gaps in understanding and access to critical resources. The findings will help refine disaster education strategies and enhance community resilience.

Literature Review

Over the past 70 years, Alabama has suffered 87 natural disasters, making Alabama the eighth most likely state to deal with the lasting effects of natural disasters (FEMA, 2019). The two most deadly weather events Alabama faces are

tornadoes and hurricanes. In the 22 years since 2000, there have been 17 named hurricanes. In the first four months of 2022, the National Weather Service (NWS) issued 115 tornado warnings for Alabama counties. Alabama had 14% of all the tornadoes to strike the United States and is third nationally in tornado strikes in 2022 (J. DeBlock, 2022). Frequent disaster events constitute a serious threat to the lives and property of residents and have a continuing negative impact on local socio-economic development. Alabama averages 14 tornado deaths a year, which is the highest in the nation among those in poverty. From 1950 to 2016, 630 people have died in tornadoes in Alabama compared to 550 in Texas (Brown, 2021).

Rural communities in Alabama are particularly vulnerable to natural disasters such as hurricanes and tornadoes, due to several interconnected social, economic, and infrastructural challenges. First, many rural counties have high poverty rates, making it difficult for residents to afford adequate protection or resilient housing to withstand severe storms (Watters, 2019). Second, a significant number of rural residents live in mobile homes, which are structurally weaker and less capable of surviving intense winds and tornado conditions (Gore, 2015; DeBlock, 2022). Additionally, these areas often lack robust communication infrastructure, leading many residents to rely on informal channels such as word-of-mouth, thereby delaying critical responses to weather alerts (Chiu, 2013; Deventer, 2021). Lastly, limited availability of storm shelters and safe locations further exacerbates the danger faced by rural residents

during severe weather events (CDC, 2012). These factors significantly heighten the disaster risks for rural populations in Alabama (Yawn, 2019).

Disaster prevention and preparedness play a crucial role in reducing the impacts of natural disasters. Effective strategies include the development of early warning systems, building emergency shelters, and implementing community education and intervention programs. Weather warning devices, particularly NOAA Weather Radios (NWR), are essential in disaster management as they provide timely and accurate warnings to residents. Research has highlighted that NWR systems can quickly disseminate critical information to the public, enabling communities to respond proactively to imminent threats, significantly reducing casualties and property damage (Crawford, 2005). Additionally, Li and Mostafavi (2022) emphasized that incorporating location intelligence technologies into warning systems improves their effectiveness and the speed at which communities respond, thus enhancing overall preparedness. The establishment of proper shelters and emergency facilities is fundamental to protecting lives and maintaining public health during disasters. Nath et al. (2017) indicated that inadequate emergency shelters could lead to overcrowding and poor sanitation, causing secondary health issues such as infectious disease outbreaks. In contrast, well-designed shelters provide safe, sanitary conditions that significantly reduce health risks following a disaster. The study also stressed the importance of evaluating shelters using standardized indicators to ensure they meet

the basic needs of affected populations, thereby supporting long-term community recovery (Nath et al., 2017).

Integrating effective early warning systems, constructing reliable emergency shelters, and implementing targeted community education and intervention programs are vital strategies to strengthen community resilience against natural disasters and accelerate recovery processes. The Heads-Up program in Alabama focuses on comprehensive preparedness education to increase community awareness and response capabilities. Through targeted educational activities, the program effectively trains residents in storm preparation, weather radio use, shelter selection, and emergency financial planning. Special attention has been given to vulnerable groups such as low-income populations, minorities, and agricultural workers, ensuring tailored communication strategies to enhance their preparedness and resilience. Li and Mostafavi's (2022) research further underscore the importance of community-specific education, as preparedness levels significantly vary across regions, highlighting the necessity for localized intervention strategies.

The cooperative extension system has long played an important role in community disaster management, including the disaster preparedness, response, and recovery phases (Koundinya et al., 2020). Research shows that the extension system is effective in helping communities with disaster prevention and response, particularly in supporting vulnerable populations (Pitchford et al., 2024). For example, studies targeting individuals with intellectual and developmental disabilities (IDD) have

demonstrated that inclusive programs designed by extension services significantly improve preparedness and response capacities among these populations (Pitchford et al., 2024) and when systems suppor the inclusion of those with various learning capabilities those individuals and the presenters do better at including them (Smith et al., 2024). This highlights the inclusive nature of the extension education model. To implement disaster management programs more effectively, Extension personnel need targeted training in disaster response, such as emergency medical skills (CPR and AED usage), and in assessing and mitigating local disaster risks (Ricard et al., 2017). Koundinya et al. (2020) emphasize that extension professionals must understand regional disaster risks, be familiar with disaster response systems, and conduct relevant community education.

Furthermore, research by UConn Extension reveals that disaster preparedness at home and in the workplace is interconnected; improving preparedness in the home can drive improvements in workplace readiness as well (Ricard et al., 2017).

Theoretical Framework

The study is founded on two complementary theoretical frameworks: the Theory of Planned Behavior (TPB) and the evaluation framework proposed by Braverman and Engle (2009) for extension programs.

The Theory of Planned Behavior, developed by Icek Ajzen (1991), provides a comprehensive framework for understanding how individuals form intentions and translate them into behavior. TPB is a common framework when working in safety-

related contexts in agriculture (Hancock et al., 2023). According to the TPB, behavior is driven by three core components which are attitudes toward the behavior, subjective norms, and perceived behavioral control. These factors influence an individual's intention to perform action. In the context of this study, TPB helps explain how rural Alabama residents interpret and act upon severe weather warnings. For example, individuals who perceive high personal risk, strong community norms regarding preparedness, or confidence in their ability to respond are more likely to engage in protective behaviors such as seeking shelter or using NOAA Weather Radios. This framework is especially pertinent given that many weather-related decisions must be made quickly and under conditions of uncertainty. Also, it offers valuable lens for analyzing the behavioral intentions and levels of readiness of vulnerable populations in Alabama. Ajzen (2011) provided a comprehensive analysis of the strength and flexibility of TPB across a range of real-world applications, including public health and safety. The study emphasized the consistent shaping of behavioral intentions and actions by attitudes, norms, and control beliefs, even in complex or high-stakes environments such as disaster preparedness.

Complementing TPB, the Braverman and Engle (2009) evaluation framework offers practical guidance for program evaluation within extension. This framework advocates for the use of program theory and logic models to design, implement, and assess educational interventions. It emphasizes methodological rigor through structured approaches such as need assessments, process evaluations, and outcome

evaluations. The application of this framework is essential for the evaluation of Extension programs such as "Heads-Up," ensuring a systematic and measurable assessment of their impact on community disaster preparedness.

Purpose and Research Objectives

The purpose of this study is to determine the levels of knowledge and preparedness of rural Alabama residents in relation to natural weather-related disasters. The research seeks to better understand how individuals receive, interpret, and act on severe weather warnings by focusing on underserved populations, particularly those living in mobile or low-quality housing.

The following research objectives guided the research:

1. Assess the baseline knowledge of Alabama residents about disaster warnings and preparedness.
2. Identify gaps in disaster readiness and barriers to information dissemination.
3. Identify common sources of weather information used by residents, and determine which tools are most trusted and relied upon during severe weather events.
4. Evaluate the effectiveness of existing educational and communication tools.

Methodology

This study used a quantitative survey design to assess rural Alabama residents' baseline knowledge, behaviors, and preparedness levels related to severe weather events. The survey was part of the 'HEADS-UP' project, led by the Alabama Cooperative Extension System (ACES) in partnership with the National Weather Service. The study received approval from the Institutional Review Board (IRB) at Auburn University, ensuring ethical protection of all participants.

The survey was developed to measure residents' understanding and behavior regarding weather-related disaster preparedness. The instrument was delivered via the Qualtrics platform, allowing for efficient digital distribution and anonymous response collection.

The survey included the following sections:

1. Demographic information (e.g., age, gender, race/ethnicity, county, housing type)
2. Knowledge of severe weather risks, including identification of tornadoes, hurricanes, thunderstorms, etc.
3. Understanding of emergency communication tools (e.g., weather radios, smartphone apps, sirens, social media)
4. Perceptions of warning systems, including clarity of terms like "watch" vs. "warning".
5. Preparedness behaviors, such as shelter planning.

The project was able to reach 387 participants with awareness training and a free NOAA Weather Radio with instructions and demonstrations on how to set up the radio and use the radio. These participants were located mainly in Mobile, Hale, and Dallas counties which have significant weather impacts annually and most recently with severe weather tornadoes in Hale and Dallas (Selma) counties and multiple hurricane events in Mobile County. Most participants identified as female (75.1%), with 23.2% male; In terms of age distribution, the sample skewed older: 40.9% were aged 70 and above, and 33.1% were between 60 and 69, indicating that over 74% of participants were seniors.

Findings

Housing type is a key factor influencing weather vulnerability and varies across the sample. Significantly, 25.7% of participants reported living in manufactured or mobile homes, which are recognized as particularly vulnerable to high wind damage during tornadoes and hurricanes. This finding aligns with the 'HEADS-UP' program's focus on reaching high-risk populations in Alabama's rural areas. Additionally, although 39.0% of participants lived in more structurally resilient wood-frame homes with brick or stone exteriors, a significant percentage (20.3%) live in little wood-frame homes with no bricks/stone exterior, indicating another at-risk group. The percentage of temporary housing residents is 7.4%, which points to the diversity of structural environments and highlights the need for tailored disaster preparedness

messaging that considers housing type as a key factor in vulnerability and response capacity (Table 2.1).

Table 2.1

Housing Type Distribution Among Participants

Housing types	*%*	*n*
Wood frame residence with brick/stone	39.0	151
Manufactured home/mobile home	25.7	100
Wood frame residence (little to no brick/stone)	20.3	79
Apartment, condo, hotel/motel	7.4	28
Other	7.6	29
Total	100.0	387

The participants indicated they use a variety of communication tools to receive their weather warnings, which was a finding in and of itself as the recommendation by the weather enterprise in Alabama is to have as many ways as possible to receive this information. As shown in Table 2.2, television was the most frequently used communication tool (80.8%). This suggests that traditional media remains a primary and trusted source of information, especially in areas where internet or mobile connectivity may be inconsistent. 58.9% of participants reported using cell phone or smartphone weather apps, reflecting the growing role of mobile technology even in rural areas. However, due to differences in device ownership and internet access, the use of mobile apps may still be uneven, especially during severe weather extremes, where the success of users in receiving information is a concern. Other common tools included sirens (15.9%), word of mouth (13.2%), and local alert services (12.6%),

which collectively indicate a reliance on both community-based and publicly managed alert systems. Only 16.6% of respondents reported using NOAA weather radio, although reliable and independent of cellular or internet service, appear underutilized. The data shows that while digital and traditional media are widely used, there remains a substantial portion of the population that either lacks access to essential communication tools or relies on less reliable sources.

In this research, Television was the most relied upon tool at 30.8% (Table 2.3), reaffirming its continued importance in rural settings where it remains a widely accessible and familiar source of emergency information. Closely following was the NOAA weather radio (23.2%), determined that more than three-quarters of respondents did not rely on weather radios as their main source of alerts, despite their proven reliability, especially in areas with weak signal service or during power outages. Interestingly, 20.2% of participants reported that their most relied upon method was to walk outside and check the weather themselves, a behavior that may indicate limited access to reliable technology or a lack of trust in warning systems. Although this method may reflect lived experience and environmental awareness, it poses serious risks during rapidly developing severe weather events such as tornadoes. Additionally, social media (5.3%) was selected by a small group of participants, indicating some reliance on informal or peer-shared alerts, though it is not seen as dependable in critical moments.

This finding points to a gap not only in access, but in awareness, usage familiarity, and perceived relevance of weather radios among rural populations. Unlike smartphones or televisions, weather radios require manual setup, which may be barriers for individuals unfamiliar with the technology. Moreover, since these devices do not provide continuous entertainment or daily content like other media sources, they may be undervalued until an emergency arises. In many rural communities, especially those with lower technological literacy or limited extension, weather radios are not yet fully integrated into daily preparedness routines, which highlights the need for not just distribution, but continued hands-on training, reminders, and community demonstrations to reinforce the purpose and importance of NOAA weather radios as a vital, standalone alert system.

Table 2.2

Communication tools that participants use to receive severe weather warnings and similar types of weather information.

Communication tools	*%*	*n*
Television	80.8	122
Weather radio	16.6	25
Cell phone/smart phone weather apps	58.9	89
Sirens	15.9	24
Word of mouth	13.2	20
Local alert texts/phone calls	12.6	19

Table 2.3

Communication tools that participants rely on MOST to receive severe weather warnings and similar types of weather information.

Communication tools	*%*	*n*
Television	30.8	81
Weather radio	23.2	61
Cell phone/smart phone weather apps	4.9	13
Sirens	4.6	12
Social media	5.3	14
Walk outside and check the weather myself	20.2	53

As seen in table 2.4, participants already knew that the NOAA Weather Radio would help them be more prepared. The biggest concern is how to program them and how to use them properly, which was a goal of 'HEADS-UP' project. Although awareness of NOAA weather radios is high among participants, actual usage remains limited, only 6.8% of participants reported that they currently use a weather radio in their home (Table 2.5). In contrast, 23.3% of participants had used a weather radio (or owned one), while the large majority (68.4%) reported that they had never used a weather radio. These results highlighted a clear disconnect between ownership and usage, suggesting that simply possessing the device does not translate into increased preparedness. Despite participants' general understanding that weather radios can help them be more prepared, however, many lacked the technical knowledge or confidence to effectively set up, program, and operate a weather radio.

Table 2.4

Would a Weather Radio help you be more prepared?

Prepared	*%*
More	97.0
No difference	2.0
Less	< 1.0

Table 2.5

Usage of Weather Radio

Usage	*%*
Yes, but I do not use it now	23.3
Yes, and I currently use one in my home	6.8
No	68.4

The data of this study show that there is a significant ambivalence between public perception of disaster emergency resources and response behavior to warning messages. According to Table 2.6, less than half (35.9%) of participants reported knowing where the nearest storm shelter is located. In contrast, 45.8% of responders stated that they do not know, and 17.7% of them were unsure. These findings raise concerns about rural residents' access and awareness of safe sheltering options during extreme weather events. This knowledge is critical to disaster preparedness in communities that are regularly threatened by strong storms, especially tornadoes. The high percentage of participants who lacked this basic information underscores the urgent need for community-wide mapping, signs and education about shelter locations.

Meanwhile, Table 2.7 indicates that 50.6% of respondents would take shelter only upon confirmation of an active tornado, in contrast, preventive actions triggered

by “tornado warnings” accounted for only 25.2% of responses. Overreliance on definitive evidence such as visual confirmation of a tornado directly conflicts with the critical time window emphasized by the National Weather Service (NWS) in hierarchical alert system, which is ‘watches’ (potential threats) designed to initiate preparatory actions in advance, while ‘warnings’ (imminent threats) require immediate sheltering (National Weather Service, n.d.). However, only 9.5% of total responds to tornado warnings, suggesting a systematic failure to leverage such preparedness. This pattern of behavior reinforces the risks identified in Table 2.6, which 63.5% of participants lacked accurate knowledge of the location of storm shelters.

Table 2.6

Awareness of Nearest Storm Shelter

Response	*%*
Yes	35.9
No	45.8
Not sure	17.7

Table 2.7

Tornado-Related Warning Information that Motivates Immediate Shelter Action

Motivation	*%*	*n*
A confirmed tornado	50.6	207
A tornado warning	25.2	103
A tornado watch	9.5	39
A severe thunderstorm warning	7.3	30
Location	2.9	12

Pictures of an actual tornado	1.0	4
Video of an actual tornado	0.5	2
Timing	1.0	4

Table 2.8 shows the cognitive confusion of rural residents in Alabama about weather warning information, although 43.9% of participants claimed that they "did not find any confusion", more than half (56.1%) of the respondents had understanding barriers, suggesting that the complexity of risk communication is far from being addressed. The most notable confusion centered on the warning terminology system, 15.9% of participants were confused about the definition of "Warnings" and 14.6% had a confused concept of "Watches". Confusion among participants can directly reduce the preventive value of an early warning system (Li & Mostafavi, 2022). In addition, the lack of visualization tools limited the efficiency of information, 7.7% of participants were confused by 'Graphics' and 6.5% noted that 'Colors' were difficult to understand. It is noticeable that 7.7% of the respondents have difficulties in understanding 'Radar' information, reflecting the disconnect between technical content and the level of public awareness. Despite the importance of radar data in weather warnings, the public lacks the ability to understand dynamic radar charts, causing them to rely more on non-professional channels such as 'going out to observe the weather's behavior in Table 3.3.

Table 2.8

Confusion about Weather Warning Information

Confusion	%	n
I don't find anything confusing	43.9	108
Watches	14.6	36
Warnings	15.9	39
Advisories	6.9	17
Weather impacts	8.1	20
Location	11.3	28
Timing	9.8	24
Graphics/pictures/images	7.7	19
The colors used on graphics	6.5	16
Radar	4.1	10
The wording of the message	2.4	6

Conclusions, Implications, and Recommendations

This study revealed several critical issues into the state of disaster preparedness among rural residents in Alabama, with a particular focus on awareness, communication methods, and shelter accessibility. Although most participants recognized the importance of NOAA weather radios, only 6.8% are currently using them at home, indicating a significant disconnect between awareness and implementation. This gap is from a lack of operational skills, a lack of trust in the reliability of the equipment, and perceived relevance. Additionally, many residents relied on traditional tools such as television and word of mouth, also others still depended on physically checking the weather outdoors, which posed risks during an emergency weather event.

Additionally, more than half of the participants were confused in their understanding of weather warning terms, particularly the difference between ‘watch’ and ‘waring’, which issue that undermines the effectiveness of early warning systems and timely protective action. Significantly, only 35.9% of participants knew the

location of their nearest storm shelter, revealing a geographic vulnerability that severely limits safe responses during severe weather threats.

These findings further highlight the critical need for localized disaster education projects for vulnerable populations, such as the ‘HEADS-UP’ program, which promotes disaster awareness and response capabilities through community cooperation, educational activities, and the distribution of NOAA weather radios. As Black (2012) points out, the Cooperative Extension System (CES) is uniquely positioned within the national disaster prevention and preparedness system, particularly in its irreplaceable role in building long-term trust with communities and promoting inclusive emergency education. Moreover, this research supports the evaluation standards advocated by Braverman and Engle (2009), who emphasize that rigorous needs assessments and outcome evaluations are essential to the success of extension-based programming. Pitchford et al. (2024) also noted that combining CES with local governments and nonprofit organizations can significantly improve the coordination and resource integration of disaster response systems.

Based on the study's findings, several recommendations are proposed to enhance disaster preparedness among rural populations. Future outreach efforts should include younger and more diverse demographics to capture a wider range of perspectives and behaviors. The development of sustained training and follow-up programs is imperative to reinforce the use of preparedness tools such as NOAA Weather Radios and to ensure long-term behavior change. A long-term research design is

recommended to examine whether increased knowledge and intention lead to real action during severe weather events. The implementation of qualitative methods, such as interviews or focus groups, has the potential to offer a more detailed understanding of the residents' beliefs, motivations, and perceived barriers. Additionally, stronger partnerships with local organizations, religious institutions, and emergency services could improve the effectiveness of community-based communication networks.

Additionally, the population under study was primarily composed of older adults residing in rural communities, a significant proportion of who resided in mobile homes and encountered technological, physical or geographic limitations. It is important to note that these demographics represent some of the most vulnerable groups during severe weather events. These groups often face barriers such as limited mobility, lower digital literacy, and reduced access to reliable shelter or communication tools. Based on this, future educational interventions should consider customized strategies for older adults, such as simplified weather radio manuals, in-person demonstrations, and trusted messenger models that use local leaders or faith-based groups. For mobile home residents, special emphasis should be placed on shelter accessibility planning, including clear signage, transportation assistance, and community-based drills. Furthermore, technology access and literacy should be addressed through hands-on digital literacy workshops to help older or underserved populations navigate mobile apps, weather alerts, and emergency response platforms.

In conclusion, to enhance disaster preparedness in rural communities, the promotion of communication tools such as weather radios must shift from mere distribution to practical utilization through complementary training, continuous follow-up, and hands-on practice. Furthermore, public understanding of weather information terms needs strengthening to improve the precision and operational value of information dissemination. As advocated by the Extension Disaster Education Network (EDEN), extension services should serve as vital implementation platforms for the five cores national disaster management objectives which are prevention, protection, mitigation, response, and recovery (Black, 2012). Future extension programs should continue to deeply integrate with the community, bridging the gap between awareness and behavior to provide a solid guarantee against the growing challenges of extreme weather.

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Chapter 3: An evaluation of the impact of a 3-hour disaster preparedness workshop on participants' knowledge and behaviors.

Abstract

This study evaluates the effectiveness of a 3-hour disaster preparedness workshop conducted by the Alabama Cooperative Extension System (ACES) targeting rural residents in high-risk Alabama counties. Utilizing a pre- and post-survey design, the workshop aimed to enhance participants' knowledge, preparedness, confidence, and use of communication tools like NOAA Weather Radios. Most participants were older adults, received hands-on training on storm alerts, emergency kits, sheltering strategies, and post-storm recovery. The findings of the study indicate a substantial increase in the usage of weather radios from 21.9% before to the workshop to 60.4% after the workshop, and an enhancement in the motivation to seek shelter in response to tornado warnings and watches. Furthermore, there was a notable increase in awareness regarding the locations of proximate storm shelters, accompanied by a mixed pattern in the self-reported knowledge of critical preparedness subjects. The findings emphasize the pivotal function of brief, interactive educational initiatives in enhancing community disaster preparedness, particularly among vulnerable and elderly demographics. The study also emphasizes the importance of grassroots partnerships and customized content delivery through Extension programming. The

implications for future disaster education are twofold. Firstly, content accessibility for seniors must be enhanced. Secondly, longitudinal assessments of behavioral change must be conducted.

Keywords: Emergency communication, Disaster preparedness, Safety education

Introduction

Natural disasters pose significant threats to rural communities in Alabama, particularly in areas characterized by high poverty rates, inadequate housing, and limited access to essential resources and emergency shelters. Previous research emphasizes that rural populations, especially those living in mobile homes, are disproportionately vulnerable during severe weather events such as tornadoes and hurricanes (Cutter et al., 2003; Gore, 2015). The Cooperative Extension System (CES) plays a crucial role in addressing these vulnerabilities through targeted educational programs aimed at improving disaster preparedness (Black, 2012; Eighmy et al., 2012). The Heads-Up initiative by the Alabama Cooperative Extension System (ACES) specifically aims to equip rural citizens with critical knowledge and practical skills for effective disaster readiness. Short-term, interactive educational interventions, such as structured workshops, have been demonstrated to effectively raise awareness, improve understanding of weather warnings, and promote proactive safety behaviors (Klima et al., 2012). This study evaluates the impact of a 3-hour workshop designed by ACES to enhance disaster preparedness among rural residents

in Alabama, examining shifts in knowledge, perceived preparedness, and behavioral intentions immediately following participation.

Literature Review

Natural disasters, such as tornadoes and hurricanes, especially affect rural and low-income populations in Alabama. This is especially true in Black Belt counties, where high poverty rates, poor housing conditions, and limited access to shelters make residents particularly vulnerable. According to Cutter et al. (2003) indicate, such geographic areas of Alabama, characterized by a high degree of poverty and a significant proportion of mobile homes, are much more vulnerable to disastrous events. Alabama has over 14 percent of its population residing in mobile structures, and these arrangements are highly prone to tornados and hurricanes that cause loss of life (Alabama Cooperative Extension System, 2022). In addition, a study conducted by Black (2012) reveals that communities residing in these housing types tend to lack good infrastructure and, hence, become vulnerable to natural disasters because they are unprepared to face a disaster. The existence of mobile homes in general and especially in rural regions indicates the urgent necessity of readily available disaster education that could be applied to the problems unique to these groups directly. Like what is discovered in the research on hurricane risk perceptions, especially by Peacock et al. (2005), disaster vulnerability also depends on how the residents perceive the threat of disasters and how they react to them.

Safety education has been regarded as one of the critical issues in decreasing exposure to natural disasters for a long time. Le Tien et al. (2023) point out the significance of specific education programs on safety to enhance the readiness and response of the community in case of an emergency. These programs are intended to change the behavior by creating more awareness and offering hands-on know-how, which, in turn, helps communities respond more effectively to any disaster. The Cooperative Extension System (CES) has played a significant role in teaching disaster education in Alabama due to its Heads-Up, a target to teach rural citizens about storms and how to prepare against them (Alabama Cooperative Extension System, 2022). The program combines the grassroots approach and learning sessions to communicate with communities most vulnerable to tornadoes and hurricanes. Moreover, Eighmy et al. (2012) show that extending extension services in rural and frontier contexts is essential in providing disaster education, especially when delivering community-based training programs. When well applied, these programs can increase awareness of the risk of disasters and respond to the same in the future. According to Raphela and Ndaba (2024), good safety programs should have some form of a structured method of identifying risk factors in vulnerable communities, both in schools and rural areas.

The Cooperative Extension System (CES) has a central role in disaster education. Its role is especially predominant in rural regions because of the persistent lack of access to resources and knowledge. As Black (2012) explains, the field of CES

has enjoyed a long history of contributing to efforts to extend practical and scientifically based information to the communities in a way that facilitated the breakup of the chasm between expert knowledge and local demands. The CES in Alabama has managed to use a direct community involvement model to sensitize Alabama residents on disaster preparedness. Eighmy et al. (2012) elaborate on the roles of the Extension services in disaster planning, response, and recovery, as well as the importance of ensuring that Extension agents are locally entrenched to build faith and relay pertinent information. The model has worked well in the countryside, where extension agents are considered sources of credible information. The same results have been observed in disaster preparedness surveys in Florida, where perception of risk among the residents exerts a lot of pressure on response measures, as seen in the study done by Peacock et al. (2005). There has been considerable positive impact involved through the participation of the Extension agents in disaster preparedness workshops in Alabama in raising awareness and community preparedness (Alabama Cooperative Extension System, 2022).

Other educational interventions, like the 3-hour workshops on disaster preparedness used in Alabama, have enhanced the attendees' knowledge and sense of readiness. According to the research findings, short-term workshops involving pre- and post-test assessment proved effective in assessing the shift in the preparation against the disaster (Klima et al., 2012). The workshops facilitate the participants' acquisition of skills at the field level and their confidence in their ability to react to

disaster circumstances. These workshops have served as an evaluation tool for the impact that disaster preparation training has on the Alabama CES, as the quantitative results indicate a substantial change in the comprehension of storm preparation among the audiences (ACES, 2022). As Le Tien et al. (2023) remark, the training program on disasters through teaching functional exercises gives more opportunities to make the teaching practical and enables the learner to implement the acquired knowledge in a real-life situation. Such exercises are necessary for validating the knowledge acquired and enhancing retention. Thus, they are a crucial part of any disaster readiness program. Rockwell and Bennett (2004) also emphasize the need to apply program evaluations, e.g., pre-and post-tests, to evaluate the effectiveness of educational interventions and consequently test whether they are achieving their goals. Regarding preparedness, strategic agreements on disaster management objectives are pertinent, as pointed out in the tourism case. Van der Merwe and Higgs (2003) note strategic partnerships in marketing that might be associated with strategic alliances in disaster management preparedness.

Theoretical Framework

This study is based on the Theory of Planned Behavior (TPB), which was originally proposed by Ajzen (1991) and states that individual behavior is directly influenced by behavioral intentions. These intentions are shaped by three core components: attitudes towards behavior; subjective norms; and perceived behavioral control. TPB has been widely applied in public health, safety and disaster contexts,

espcially in agriculture (Hancock et al., 2023), due to its proven effectiveness in predicting intentional behavioral change in response to targeted interventions (Ajzen, 2011). Similarly, internal motivating factors such as personal safety often promote learning in situations where control can be gained from what is otherwise an uncontrollable situation (McKibben et al., 2023).

In the context of disaster preparedness, the TPB offers a valuable perspective on how rural residents decide to adopt safety behaviors, such as using NOAA Weather Radios or seeking shelter during severe weather events. Attitudes toward preparedness activities such as perceived benefits of radios or emergency kits, social norms such as perceived expectations from family or community, and perceived control all contribute to an individual's intention to act in a disaster situation.

This framework is particularly relevant when evaluating the effectiveness of the 3-hour educational workshop designed by the Alabama Cooperative Extension System (ACES). The workshop aimed to improve participants' knowledge, awareness and confidence, each of which aligns with TPB's constructions. This framework is particularly relevant when evaluating the effectiveness of the 3-hour educational workshop designed by the Alabama Cooperative Extension System (ACES). The workshop aimed to improve participants' knowledge, awareness and confidence, each of which aligns with TPB's constructions. For example, by clarifying weather alert systems and showing how to use weather radios, the workshop probably influenced participants' attitudes and their perception of their ability to act. In addition,

community-based delivery and partner organizations may have reinforced subjective norms that promote preparedness.

Furthermore, the TPB is closely aligned with the evaluation framework proposed by Braverman and Engle (2009), which focuses on evaluating program inputs, activities, and participant responses to measure changes in knowledge, attitudes, and behaviors. This theoretical foundation helps to establish the intervention as both an educational program and a behavior-change initiative aimed at increasing resilience in vulnerable populations.

Purpose and Objectives

The purpose of this study is to evaluate the effectiveness of a 3-hour disaster preparedness workshop developed by the Alabama Cooperative Extension System in improving rural residents' knowledge, confidence, and use of emergency communication tools, particularly NOAA Weather Radios. By comparing pre- and post-workshop responses, the study aims to assess changes in participants' understanding of severe weather risks, preparedness behaviors, and perceived ability to respond effectively to disasters.

The following research objectives guided the research:

1. Measure changes in knowledge and confidence related to disaster preparedness immediately following the workshop by using pre and post-workshop survey
2. Evaluate shifts in awareness and usage of communication tools, particularly the NOAA Weather Radio, after workshop participation.

3. Determine the effectiveness of educational interventions in enhancing disaster resilience among vulnerable populations, including older adults and residents of high-risk counties.

Methods

This study utilized pre-test and post-test survey methodology to assess the effectiveness of a 3-hour educational workshop on disaster preparedness among rural residents in Alabama. The workshop was designed as an interactive and instructional intervention, guided by Alabama Cooperative Extension System (ACES) agents. Quantitative research methods were used to directly assess changes in the same group of participants, taking advantage of repeated-measures designs. Surveys were carefully designed to measure baseline knowledge, perceived self-efficacy, and preparedness behaviors related to severe weather events, including tornadoes, hurricanes, and thunderstorms. These measures were taken both before and immediately following the workshop, which allows for clear attribution of any improvements to the training itself.

The targeted participants included rural residents from Alabama counties identified as particularly vulnerable due to high poverty rates, substantial populations residing in mobile homes, and limited access to disaster information resources. Specifically, counties such as Mobile, Hale, and Dallas were selected due to their high frequency of extreme weather events, including recent tornadoes in Hale and Dallas (Selma) counties, and multiple hurricane occurrences in Mobile County. The project

successfully engaged 387 participants, who received disaster awareness training along with a free NOAA Weather Radio. Participants were instructed through practical demonstrations on how to set up and effectively utilize these radios for timely severe weather warnings.

Most participants identified as female (75.1%), with 23.2% reporting to be male. In terms of age distribution, the sample skewed older: 40.9% were aged 70 and above, and 33.1% were between 60 and 69, indicating that over 74% of participants were seniors. Participants were recruited using grassroots methods including social media, local Extension offices, word-of-mouth, community bulletins, and partnerships with local organizations such as NAACP and the Alabama Coalition for Immigrant Justice (ACIJ).

The 3-hour workshop covered critical disaster preparedness topics structured into three modules as shown in Table 3.1.

Table 3.1

Workshop Content

Module	Content Covered
Module 1: Be Curious and Aware	- Pre-survey: Initial assessment of participants' disaster preparedness knowledge and confidence. - Understanding severe weather risks. - Clarifying definitions of storm advisories, watches, and warnings. - Effective use and benefits of NOAA Weather Radios, especially for nighttime tornado alerts.

	- Practical safety tips for weather events (lightning, thunderstorms, hail, damaging winds, hurricanes, winter weather). - Awareness of different emergency alert systems and effective utilization.
Module 2: Preparing for the Storm	- Creating a cost-effective “Go Bag” emergency kit. - Safe sheltering strategies during severe weather events, particularly when traditional shelters aren't accessible. - Guidance for timely evacuation decisions ("stay" or "go"). - Steps for turning off utilities and safely managing storm debris.
Module 3: Post-Storm Recovery and Financial Preparedness	- Post-storm financial recovery guidance and identifying available resources. - Financial preparedness education. - Distribution and practical training with NOAA Weather Radios to ensure reliable emergency information reception.

Quantitative data was collected using structured pre-test and post-test surveys administered immediately before and after the workshop sessions. Surveys assessed both knowledge, such as objective measures related to weather event definitions, safety protocols, and resource awareness and perceived preparedness such as subjective confidence in disaster preparedness and resilience. The surveys were developed and deployed using Qualtrics software, ensuring participant anonymity and confidentiality throughout the data collection process. Participants had the option to complete surveys digitally or via printed copies.

Data analysis was performed using descriptive statistics to characterize demographic data, knowledge gain, and shifts in preparedness perceptions. Data was

managed securely in the Qualtrics system, exported to Microsoft Excel, and analyzed using SPSS.

The study protocol, including the workshop content and survey instruments, was reviewed and approved by an Institutional Review Board (IRB) prior to implementation. All participants were informed of the study's purpose, methods, and use of data collected, with assurances of confidentiality and voluntary participation throughout the workshop and data collection process. The usefulness and results of the research were expressed to the participants to help encourage participation and connection to the work (McKibben et al., 2025).

Findings

The significant increase in participants motivated to seek immediate shelter in response to tornado watches and warnings reflects improved risk perception and response intention among workshop attendees. Prior studies indicated that rural populations, especially those residing in mobile homes, are often unaware of or underestimate weather risks (Cutter et al., 2003). Our study underscores that clear, direct instruction on differentiating between various storm alerts (watches, warnings and advisories) substantially enhances the perceived urgency and seriousness of these warnings. It further demonstrates that educational interventions not only build knowledge but also effectively influence participants' immediate intentions and decision-making during disasters.

Figure 3.1 illustrates participant responses regarding their use of various communication tools to receive weather alerts, as reported in the pre- and post-workshop surveys. This question was designed to assess participants' awareness and actual use of communication channels before and after attending the workshop. The goal was to identify shifts in preferred methods for receiving severe weather notifications, particularly in relation to tools emphasized during the training, such as the NOAA Weather Radio.

Before the workshop, the most used tools were television (35.6%), cell phone apps (21.9%), and weather radios (21.9%). Use of other methods, including social media (2.4%), word of mouth (3.8%), walking outside (0.9%), and scanners or other radio systems (0.2%), was relatively low. After training, weather radio usage rose substantially to 60.4%, while reported reliance on all other communication tools declined. Post-workshop responses showed a decrease in the use of TV (14.9%), cell

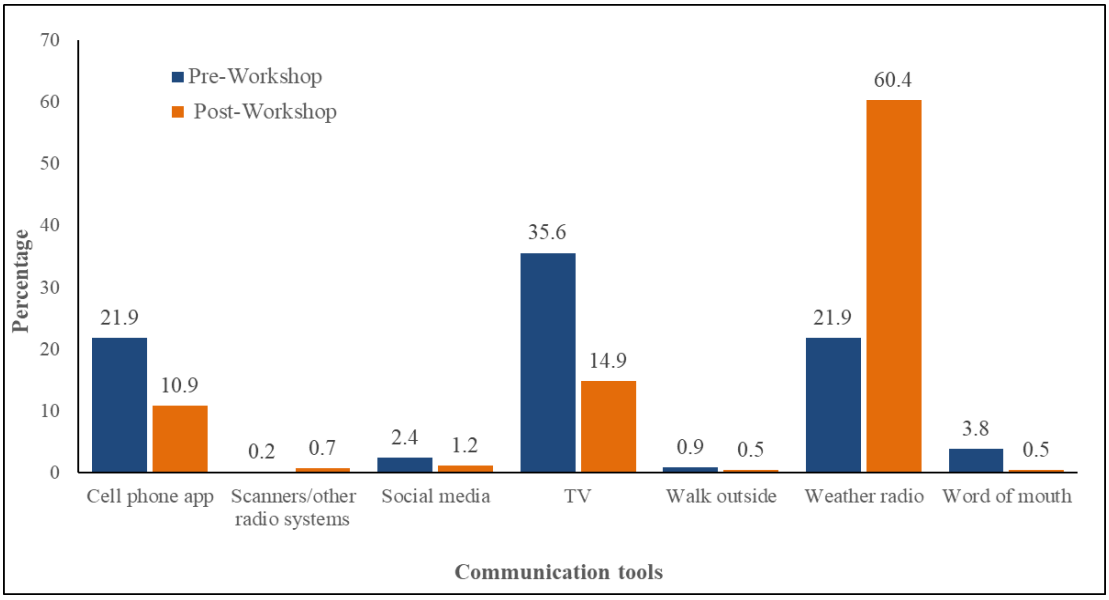

Figure 3.1 *Comparison of Communication Tools Used to Receive Weather Alerts Before and After the Workshop*

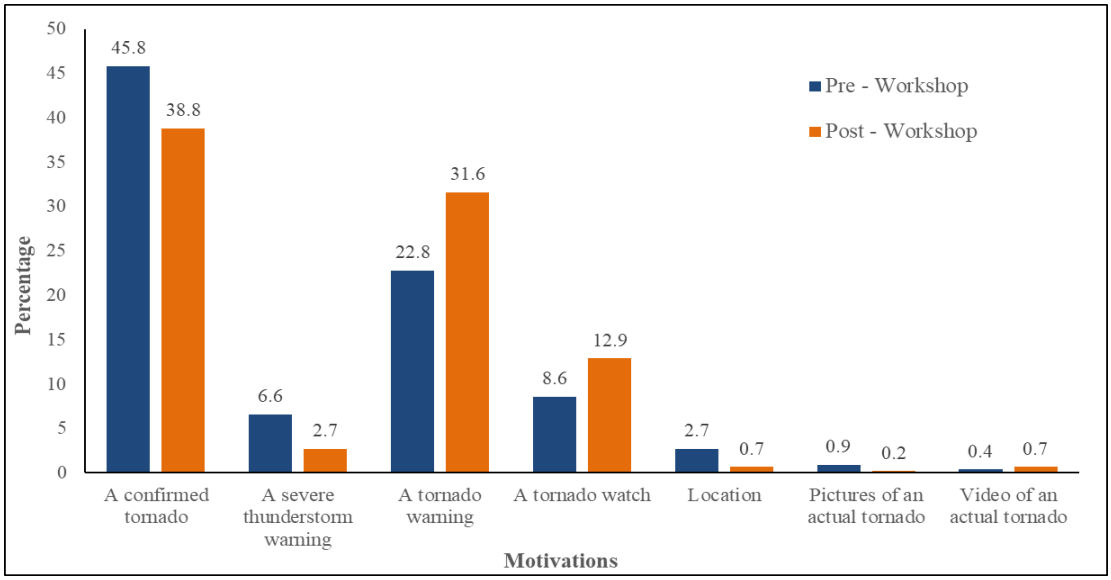

Figure 3.2 *Changes in Participants' Reported Motivations to Seek Shelter in Response to Tornado-Related Warnings Before and After the Workshop*

phone apps (10.9%), social media (1.2%), and word of mouth (0.5%), with minimal use still reported for scanners (0.7%) and walking outside (0.5%).

Figure 3.2 displays participants' responses regarding which types of tornado-related weather warning information would motivate them to take immediate shelter, as reported before and after attending the disaster preparedness workshop. The purpose of this survey was to assess changes in awareness and response intention concerning different levels and types of severe weather alerts. Before the training, the most frequently motivation was "a confirmed tornado" (45.8%), followed by "a tornado warning" (22.8%) and "a tornado watch" (8.6%). Fewer participants were motivated by "a severe thunderstorm warning" (6.6%), "location of the storm" (2.7%), or visuals such as pictures (0.9%) and videos (0.4%) of an actual tornado. After the training, there was a notable shift in responses. The percentage of participants who reported "a tornado warning" as a motivation rose to 31.6%, while "a tornado watch" increased to 12.9%. The number of respondents motivated by a confirmed tornado slightly decreased to 38.8%. Motivations associated with visual cues and location information remained low in both pre- and post-workshop responses. These results reflect reported changes in participants' perceptions of urgency and the meaning of various tornado-related alerts following the educational session.

Table 3.2

Perceived Helpfulness of a Weather Radio in Increasing Preparedness Before and After the Workshop

	Pre-Frequency	Post-Frequency	Pre-Percent	Post-Percent
Less prepared	2	13	0.4	3.2

More prepared	388	339	85.8	84.3
No difference	8	6	1.8	1.5
Total	452	402	100	100

Table 3.2 presents participants' perceptions of how using a weather radio would affect their level of preparedness, measured before and after the workshop. Before the training, approximately 86% of participants believed that using a weather radio would help them feel more prepared. Only 0.4% of individuals (n = 2) reported that it would make them feel less prepared, and just under 2% said it would make no difference. After the workshop, the proportion of participants who felt that a weather radio would make them more prepared remained high, at just over 84%. However, the number of participants who selected "less prepared" increased to 13, 3.2% of the post-workshop sample. Responses indicating "no difference" remained low and stable, with a slight decline from eight individuals pre-training to six individuals post-training.

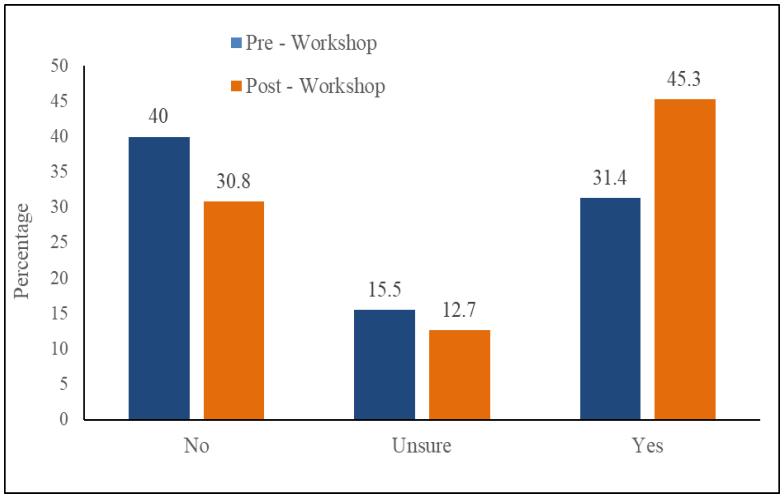

Figure 3.3. *Change in Participants' Knowledge of Nearest Storm Shelter Location Before and After the Workshop*

Figure 3.3 illustrates changes in participants' reported knowledge of the nearest storm shelter to their home before and after the workshop. The purpose of this survey was to assess baseline and post-training awareness of shelter locations, which is a critical component of disaster preparedness. Before the workshop, 40% of participants responded "No," indicating they did not know the location of the nearest storm shelter. 31.4% indicated "Yes," while 15.5% were "Unsure." After the training, the percentage of participants who responded "Yes" increased to 45.3%, while the number who responded "No" decreased to 30.8%. The proportion of those who responded unsure also declined slightly, from 15.5% to 12.7%

Table 3.3

Pre- and Post-Workshop Self-Reported Understanding of Key Disaster Preparedness Topics

Topic	Pre-Mean	Post-Mean	Pre-Median	Post-Median	Pre-Mode	Post-Mode	Pre-SD	Post-SD
How to set up a weather radio	2.44	2.63	2	2	2	2	1.01	1.13
Difference between advisories, watches, and warnings	2.96	2.99	3	4	3	4	0.78	1.06
Steps necessary to prepare for severe weather	3.01	2.95	2	2	4	2	0.73	1.06
Importance of sheltering during a tornado	3.40	3.25	4	4	4	4	0.72	0.99

Access to multiple weather information sources	3.15	3.15	3	4	3	4	0.72	1.03

Note. Participants rated their understanding using a 4-point Likert scale, which 1 = Strongly Disagree, 2 = Disagree, 3 = Agree, and 4 = Strongly Agree. Higher means indicate greater self-reported understanding. SD = Standard Deviation. N ≈ 380–400 (varies slightly per item).

Table 3.3 presents changes in participants' self-reported understanding of five key topics related to disaster preparedness. Notable improvement was observed in the topic of setting up a weather radio, with the average score slightly increasing from 2.44 pre-workshop to 2.63 post-workshop. Slight gains were also recorded in understanding the differences between storm alerts, with scores rising from 2.96 to 2.99. In contrast, participants reported a small decline in their confidence regarding the steps necessary for severe weather preparation (3.01 to 2.95) and the importance of sheltering during a tornado (3.40 to 3.25). Awareness of how to access weather-related information remained consistent, with no change in the mean score (3.15). Median and mode values generally remained stable, suggesting that participants frequently selected "Agree" or "Strongly Agree." Standard deviation values indicate moderate variation in responses, especially in topics requiring more technical understanding. Despite the slight upward trends observed in a few areas, the overall scale of change between pre- and post-workshop scores was insignificant. The increases in mean scores (0.19 for the question, "How to set up a weather radio?", and

0.03 for "Difference between advisories, watches, and warnings") suggest only modest improvements in perceived understanding. More importantly, two key areas even showed slight declines in self-reported knowledge after the workshop. The reduction in scores related to “steps necessary to prepare for severe weather” and “importance of sheltering during a tornado” raises concerns about either the clarity or the retention of information presented during the session. This may reflect participants becoming more aware of the complexity and potential challenges associated with effective disaster preparedness. This finding resonates with earlier research that educational interventions sometimes lead participants to reassess their actual preparedness critically, highlighting previously unrecognized vulnerabilities (Peacock et al., 2005). Such awareness is essential, as accurate self-assessment of preparedness is critical in driving future protective actions and long-term behavioral changes (Rockwell & Bennett, 2004).

Participants showed a noticeable shift towards increased reliance on NOAA Weather Radios following the workshop. Pre-training reliance on weather radios was relatively modest; however, post-training responses indicated that over half of the participants identified weather radios as their preferred communication tool during severe weather events. This finding highlights the effectiveness of hands-on demonstrations and interactive instruction in modifying behavior and improving safety practices. Such results confirm previous studies that emphasize the role of targeted safety education in fostering behavioral change (Raphela & Ndaba, 2024).

Furthermore, this outcome aligns with the objectives of the ACES "Heads-Up" program, emphasizing grassroots, community-oriented disaster education (ACES, 2022).

The significant increase in participants motivated to seek immediate shelter in response to tornado watches and warnings reflects improved risk perception and response intention among workshop attendees. Prior studies indicated that rural populations, especially those residing in mobile homes, are often unaware of or underestimate weather risks (Cutter et al., 2003). Our study underscores that clear, direct instruction on differentiating between various storm alerts (watches, warnings and advisories) substantially enhances the perceived urgency and seriousness of these warnings. It further demonstrates that educational interventions not only build knowledge but also effectively influence participants' immediate intentions and decision-making during disasters.

Regarding shelter awareness, the workshop effectively reduced uncertainty about shelter locations. Previous research emphasized the vulnerability of rural and low-income communities in Alabama due to limited shelter access and poor housing infrastructure (Black, 2012). Our findings confirmed that targeted educational initiatives can quickly improve awareness of vital resources such as storm shelters, potentially reducing casualties and injuries during disasters. While nearly half of the participants initially did not know their nearest storm shelter, a significant proportion

indicated clear knowledge after the workshop, suggesting that brief but focused training sessions can effectively address such gaps in knowledge.

Finally, our demographic analysis indicated a high proportion of elderly participants, suggesting vulnerability in the study population. This demographic skew highlights the importance of tailoring disaster preparedness education to older adults who might face additional mobility challenges or technology limitations during emergencies (Eighmy et al., 2012). Future extension efforts could benefit from customized modules specifically addressing the unique needs of senior residents, including additional training on accessible shelters, simplified technology use, and clear evacuation planning.

Conclusion, Implications, and Recommendations

This study assessed the effectiveness of a 3-hour disaster preparedness workshop conducted by the Alabama Cooperative Extension System among rural Alabama residents. Results clearly demonstrate significant improvements in participants' knowledge of severe weather risks, effective use of emergency communication tools such as NOAA Weather Radios, and increased awareness of shelter locations. Moreover, findings suggest that structured educational interventions delivered through Extension programs can meaningfully alter disaster preparedness behaviors and risk perception, particularly regarding tornado and hurricane warnings. Despite a slight decline in participants' confidence about specific preparation steps, this may reflect an increased awareness of disaster complexities, highlighting the workshop's

effectiveness in fostering critical self-assessment among participants (Peacock et al., 2005; Rockwell & Bennett, 2004). Given the demographic makeup of participants, predominantly older adults, future programs should focus on addressing specific vulnerabilities related to aging, accessibility, and technological limitations (Eighmy et al., 2012). Ongoing Extension-based disaster preparedness initiatives are crucial for building resilient rural communities, reducing vulnerability, and enhancing residents' overall capacity to effectively respond to severe weather threats.

The Cooperative Extension System should promote and replicate similar workshops in other high-risk counties and possibly incorporate refresher courses and follow-up surveys to assess long-term behavior change. Engaging with trusted community partners could further enhance outreach and engagement. Incorporating the Theory of Planned Behavior into the design and evaluation of future projects would strengthen our ability to track and promote knowledge acquisition and sustained behavior change related to emergency preparedness.

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Chapter 4: An analysis of communication preferences and barriers in delivering weather-related warnings to vulnerable communities.

Abstract

This study investigates communication preferences and barriers faced by vulnerable rural populations in Alabama when receiving weather-related warnings, using data from the HEADS-UP project. Grounded in the Theory of Planned Behavior, the research explores how trust, accessibility, and perceived behavioral control shape residents' response to disaster alerts. A pre- and post-survey design was implemented to measure changes in communication tool usage, especially the adoption of NOAA Weather Radios after Extension-led workshops. Results revealed a significant increase in reliance on weather radios (from 21.9% to 60.4%) and a continued dependence on traditional tools like television, while digital platforms such as social media and weather apps remained underutilized. Comparative analysis with Florida's 2017 hurricane communication strategies highlights the mismatch between modern digital outreach methods and the preferences of rural populations. The study emphasizes the need for hybrid, community-centered communication strategies that combine traditional and digital tools. Findings suggest that culturally relevant, accessible, and trust-based outreach through Cooperative Extension programs can

enhance preparedness and reduce disaster vulnerability among underserved communities.

Keywords: Disaster communication, Rural communities, Cooperative Extension, Weather warnings

Introduction

In recent years, hurricanes and other severe weather events have posed increasing threats to communities across the southeastern United States, particularly in rural and vulnerable populations. Effective disaster communication has become a central concern in mitigating the human and economic costs of these hazards (Moorthy et al., 2018). Extension services are in a unique position to bridge the gap between institutional messages and localized action, while federal and state agencies provide critical weather alerts. However, there remains a pressing need to better understand how rural populations perceive, receive, and act upon disaster-related information, especially in the context of trust, accessibility, and cultural relevance (Anthony et al., 2014).

Hurricanes and tornadoes are severe weather events that pose a serious risk to vulnerable populations and rural communities in the south-eastern United States. Without effective communication systems, these communities may lose human and economic potential in the event of a disaster (Moorthy et al., 2018). CES is well-placed to take institutional information about weather advisories and translate them into action on the ground. However, there are still difficulties in extending that reach

to rural populations (Anthony et al., 2014). The Florida Cooperative Extension reacted to the 2017 hurricane season, which led to a significant case study due to the authorities administered email, face-to-face interaction, and social media. Still, responses included only average community awareness (Mike et al., 2020). It is clear that more focus should be directed towards understanding the communication preferences, trust and barriers of rural residents, particularly in areas at high risk with no digital infrastructure, such as mobile home communities.

One of the outstanding cases of Extension participation in disaster communication was cited by the Florida Cooperative Extension's response to the 2017 hurricane season. In contrast, Extension professionals coordinated a local emergency management unit during Hurricanes Irma and Harvey, sharing the vital information with them by using, inter alia, email, face-to-face communication, and social media (Mike et al., 2020). However, the awareness of the communication efforts undertaken by the extension agents was low, so the effectiveness and scope of these channels still seem to be in doubt. These issues can be reflected in other states, such as Alabama, where rural citizens, who can live in mobile homes or not have an internet connection, can be more limited to conventional or communal communication solutions (Gore, 2015; Cutter et al., 2003).

This research project will determine the disaster communication patterns and the degree of trust among the rural population in Alabama and how they compare to the communication patterns adopted by extension systems, as in the case of Florida in

2017. Moreover, the article dwells upon alignment or misalignment between the preferred communication channel of vulnerable populations and the channel of their communication by Extension professionals in a disaster situation. By revealing these gaps and overlaps, this study aims to enhance the performance of disaster education and outreach conducted by Extension.

The conceptual research is based on the Theory of Planned Behavior (Ajzen, 1991), which predicts that people's intentions to behave in a particular way can be determined by their attitudes towards the behavior, their intentions on the perceived social norms, and their perceived behavioral control. This framework is applied in an investigation of the beliefs of the rural residents towards different channels of communication and how their beliefs affect their willingness to act when they receive weather warnings in the context of disaster preparedness. For example, it considers factors such as the level of trust in Extension messaging, the usefulness of weather radios and access to available alerts in determining whether residents are ready to go to shelter after a thunderstorm warning.

Literature Review

Effective communication of disasters is essential to reducing the socio-economic costs of severe weather events, which are significantly higher for rural populations, particularly vulnerable ones (Anthony et al., 2014). The effectiveness of alerts is dependent on how rural communities interpret, receive and respond to the information, considering factors such as trust, access and cultural differences. These

alerts are issued at both the federal and state levels. This review summarizes existing literature on disaster communication, assessing preferred channels, identified barriers and the role of different information sources.

Many academic articles refer to the role of strategic communications in disaster preparedness, response and recovery. While all populations may struggle to access accurate and timely disaster-related information, rural populations face additional challenges due to geographic isolation, inadequate infrastructure, and socioeconomic issues. For example, the digital divide, which is usually defined as unreliable internet access, means that rural populations often receive alerts via traditional communication methods rather than email or social media (Koundinya et al., 2020). This challenge is particularly significant in rural communities with a high proportion of mobile homes or older people, who are less likely to use digital platforms.

Steelman et al. (2015) point out that television is widely accepted as a reliable source of information during crises. However, the usefulness of mass media can decrease if people lose electricity, resulting in individuals using battery-operated radios or talking to friends or neighbors. Generally, people have similar levels of usage for mass media sources such as television and radio, but perceived usefulness and credibility can be different. Television often be seen as "over-dramatizing" events, thereby lowering its credibility. However, local radio stations tend to retain usefulness and credibility because they can still provide customized information and remain operational (Steelman et al., 2015). Redmond (1995) researched NOAA Weather

Radio (NWR) specifically as a form of emergency communication and found a high rate of NWR receiver ownership among households, but low levels of ongoing attentiveness. As a result, NOAA Weather Radio had a limited level of usefulness and was not a reliable public warning system, particularly for low-income people.

The role of informal networks, such as family, friends, and neighbors, is significant and should not be overlooked. Informal connections with family and friends have been widely reported as sources of information in real and potential disasters, and these sources of information are especially pertinent when there are delays or discrepancies in official information (Steelman et al., 2015). Although informal sources are frequently used, they are not always considered as credible as official sources. This suggests that people often look for familiar contacts, particularly in rapidly changing situations where the mass media may be slow to provide immediate, local information.

Official sources, usually government agencies, are often thought of as credible and useful information sources. People typically believe and react more when warnings come from official sources (Steelman et al., 2015). Local government sources and first responders, such as local fire departments and law enforcement agencies, are often trusted more than federal officials. This is primarily due to public experience and direct contact, which creates familiarity and credibility in their community. Steelman et al. (2015) noted that, although official sources such as local fire departments and Forest Service agents were rated highly for usefulness and

trustworthiness, they were used less frequently, perhaps because access to the source was limited, or people were not familiar with it before the event.

A significant case for analyzing the Florida Cooperative Extension's reaction during the hurricane season of 2017. Extension professionals principally used email, in-person, and social media to disseminate information (Mike et al., 2020). Despite using all available communication methods, public recognition of their communications was moderate at best (Hancock, 2024). Since the Extension faced expenditure on raising awareness among patrons in rural areas who perhaps do not use technology to access information, it is recognized that social media and technology-based communication have limitations in disaster situations, such as lack of access (Houston et al., 2015). Cheng (2016) stated that social media offers a quick way to disseminate information, but only as long as one's organization supports the existing technology landscape and audience awareness. This sentiment is also present in agricultural disasters where agricultural communicators are using a variety of channels, including social media, with respect to delivering information (Irlbeck & Moore, 2020). All of this is compounded by apprehension with writing common in the community of agricultural extension (Cletzer, 2023)

It is clear that "one-size-fits-all" disaster communication does not work. Effective strategies will account for the technological and infrastructural realities of targeted audiences, merging new technology with trusted low-tech practices to improve preparedness and trust in areas that have been underserved. In the Theory of

Planned Behavior (Ajzen, 1991), beliefs by residents surrounding communication channels affect their action intentions for warning messages along three ways, which are value, social norms, and perceived behavioral control. These perceptions and actions contribute to the building of community resilience to natural hazards (Klein et al., 2003). Good disaster communication generally involves using traditional and new media to foster trust while navigating the complex interactions between formal agencies and informal, self-organizing communities. Future strategies must be based on communication and relationship building, evolve in response to demands for faster information, and build on existing community engagement while ensuring accountability.

Theoretical Framework

This study is based on the Theory of Planned Behavior (TPB), initially proposed by Ajzen (1991). TPB is widely recognized for explaining and predicting human behavior, particularly emphasizing three determinants of behavioral intentions: attitudes toward the behavior, subjective norms, and perceived behavioral control.

According to TPB (Ajzen, 199), attitudes toward the behavior which represent an individual's positive or negative evaluations regarding performing a behavior. In this study, attitudes refer explicitly to the residents' evaluation of the effectiveness, trustworthiness, and accessibility of different disaster communication tools such as weather radios, television and social media. This aligns directly with the study's objective of identifying preferred communication tools and assessing their perceived

usefulness among rural Alabama residents. Moreover, perceived behavioral control reflects the extent to which individuals feel capable of performing the recommended behaviors. This research focuses on the perceived behavioral control of rural residents in relation to their ability to access, interpret and act on disaster warnings provided through various communication channels. It incorporates their confidence in using devices such as weather radios, as well as their perceived barriers, such as a lack of technological access or insufficient infrastructure, that could limit their response to warnings.

This framework not only facilitates a structured exploration of residents' disaster preparedness behaviors but also provides a clear foundation for identifying gaps and formulating targeted recommendations for Extension professionals.

Purposes and Objectives

The purpose of this study is to explore the communication preferences, trust levels, and perceived barriers related to weather warning systems among vulnerable rural residents in Alabama. Additionally, the study compares these preferences with the communication methods employed by Extension professionals in Florida's 2017 hurricane response, to identify gaps and opportunities for enhancing disaster preparedness outreach through more effective, community-aligned communication strategies.

The following research objectives guided the research:

1. Identify the most reliable communication methods for disaster warnings in rural areas.
2. Analyze how Alabama's communication preferences in 2019 resemble or differ from those in Florida in 2017**.**
3. Develop strategies to improve the effectiveness of Extension Services in reaching rural communities.

Methods

This study employed a quantitative and comparative research design to evaluate disaster communication preferences and the effectiveness of Extension-led preparedness outreach among rural residents in Alabama. The study used structured pre- and post-surveys to assess changes in knowledge, tool usage, and preparedness levels before and after a weather preparedness workshop. In addition, a comparative analysis was conducted using Extension communication practices from the 2017 hurricane season in Florida to contextualize the findings.

The pre and post workshop surveys were selected (within the framework of the 'HEADS-UP' project, headed by the Alabama Cooperative Extension System (ACES) and the National Weather Service). The project was approved by the Institutional Review Board (IRB) at Auburn University, which evaluated the measures to protect participants. The survey measured the level of knowledge of the participants regarding tornado warning, their access to and trust in different communication

facilities (e.g., TV, sirens, weather radio, mobile alerts), shelter information approximation, and their general feelings of preparedness.

This study incorporated a comparative review of Florida Cooperative Extension's communication efforts during the 2017 hurricane season, as reported by Mike et al. (2020). Florida Extension professionals primarily used email, phone calls, social media, and face-to-face communication. These approaches were compared with the communication tools that Alabama residents reported using and trusting most, allowing for the identification of gaps and potential improvements in communication strategies. Data analysis was performed using descriptive statistics to characterize demographic data, knowledge gain, and shifts in preparedness perceptions. Data was managed securely in the Qualtrics system, exported to Microsoft Excel, and analyzed using SPSS. A comparative analysis of Alabama's survey results and Florida's Extension practices provided insight into how different communication approaches may align, or misalign, with community preferences, particularly in vulnerable rural areas.

Findings

Figure 4.1 presents a comparison of the communication tools used by participants to receive weather alerts before and after attending the disaster preparedness workshop. Before the workshop, television was the most reported source of weather alerts, used by 35.6% of respondents. This was followed by equal usage of weather radios and cell phone apps, at 21.9%. Other sources such as social media (2.4%), scanners or other radio systems (0.7%), walking outside (0.9%), and word of mouth (3.8%) were minimally used.

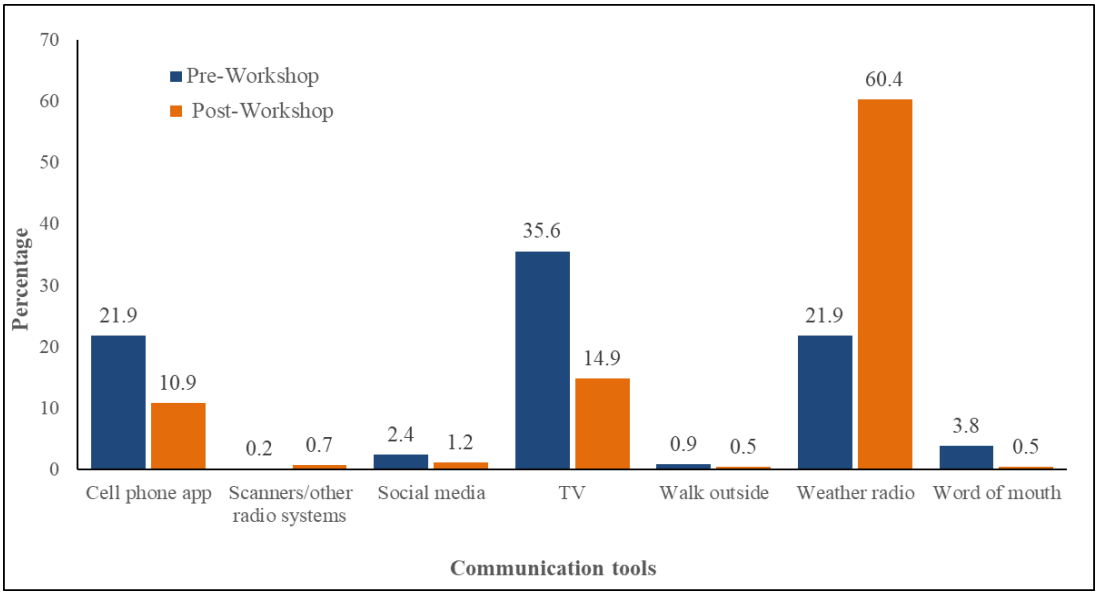

Figure 4.1 *Comparison of Communication Tools Used to Receive Weather Alerts Before and After the Workshop*

After the workshop, there was a significant shift in the communication tools preferred by participants. The most significant increase was seen in the use of weather radios, rising sharply from 21.9% to 60.4%. In contrast, reliance on television and cell phone apps declined to 14.9% and 10.9%, respectively. Use of all other

communication tools decreased slightly or remained nearly unchanged, with minimal reliance on social media (1.2%), word of mouth (0.5%), and other sources.

In response to the survey question regarding weather radio usage as shown in Table 4.1, most participants (68.4%) reported that they had never used a weather radio. An additional 23.3% indicated that they had used a weather radio in the past but were not currently using one. Only 6.8% of respondents stated that they actively use a weather radio in their home at present. These results reflect participants' baseline exposure to and engagement with this communication tool prior to the intervention.

Table 4.1

Usage of Weather Radio

Usage	*%*
Yes, but I do not use it now	23.3
Yes, and I currently use one in my home	6.8
No	68.4

Table 4.2

Communication tools that participants rely on MOST to receive severe weather warnings and similar types of weather information.

Communication tools	*%*	*n*
Television	30.8	81
Weather radio	23.2	61
Cell phone/smart phone weather apps	4.9	13
Sirens	4.6	12
Social media	5.3	14
Walk outside and check the weather myself	20.2	53

Table 4.2 shows the communication tools that participants reported relying on most to receive severe weather warnings and related information before the workshop. Among all options, television was the most frequently cited primary source, selected by 30.8% of participants (n = 81). This was followed by weather radio, used most by 23.2% of respondents (n = 61), and walking outside to check weather conditions directly, reported by 20.2% (n = 53).

Fewer participants relying primarily on cell phone or smartphone weather apps (4.9%, n = 13), social media (5.3%, n = 14), or sirens (4.6%, n = 12) as their main source of weather alerts. These results illustrate the predominance of traditional and physical observation methods in participants' information-seeking behaviors prior to any intervention.

Table 4.3

Perceived Helpfulness of a Weather Radio in Increasing Preparedness Before and After the Workshop

	Pre-Frequency	*Post-Frequency*	*Pre-Percent*	*Post-Percent*
Less prepared	2	13	0.4	3.2
More prepared	388	339	85.8	84.3
No difference	8	6	1.8	1.5
Total	452	402	100	100

Table 4.4

Usage of Social media Platforms

Social media	*n*	*%*
Facebook	241	53.8
Instagram	12	2.7
Tik Tok	6	1.3
Twitter	3	0.7
Snapchat	3	0.7
None	117	26.1

Table 4.3 summarizes participants 'perceived preparedness before and after learning about the use of a weather radio. Before the workshop, a large majority (85.8%) of respondents indicated that using a weather radio would make them feel "more prepared." This perception remained consistent following the workshop, with 84.3% of participants maintaining that belief. A small proportion of respondents perceived "no difference" in preparedness (1.8% pre-workshop and 1.5% post-workshop), while only a minimal percentage felt "less prepared" both before (0.4%) and after (3.2%) the intervention.

Table 4.4 presents participants' reported use of social media platforms. Facebook emerged as the most used platform, reported by 53.8% (n = 241) of participants. Other platforms were used to a much lesser extent, with Instagram at 2.7% (n = 12), TikTok at 1.3% (n = 6), Twitter and Snapchat both at 0.7% (n = 3). Notably, 26.1% (n = 117) of respondents did not use any social media platform for weather-related communication.

This study examined the communication preferences and perceived effectiveness of disaster warning systems among rural residents in Alabama, using survey data collected as part of the HEADS-UP project. The results revealed notable insights into

the reliance on traditional communication channels such as television, weather radios, and personal observation. Television was initially the most utilized tool for receiving weather alerts, consistent with findings by Steelman et al. (2014) indicating its widespread acceptance as a trusted information source during crises. However, the most significant finding was the substantial shift toward weather radios following targeted educational workshops, suggesting their potential as a reliable tool for emergency preparedness in rural areas.

In the 2017 hurricane season in Florida, Extension communication activities mainly involved email, in-person communication, phone calls, and Internet-based materials (Mike et al., 2020). These approaches are designed to reach various audiences efficiently within a short period. According to Florida Extension agents, the level of public awareness of disaster communication tactics was low, which implied a problem in providing information to the rural population, as they might communicate less with the digital means of interaction. This experience is aligned with the findings of Houston et al. (2014), who concluded that social media and internet-based communication tools are not effective in disaster situations affecting populations with limited technological access. Furthermore, Cheng (2016) stressed the need to consider that digital means of communication allow for the quick spreading of the message but can work well only if framed with technological infrastructure availability and audience knowledge. These tools are insufficient when used as isolated strategies in

places like Alabama, where residents of mobile homes and ageing groups have a considerable presence within the rural environment.

The people of Alabama rely on traditional media, and rural residents are significantly less likely to have internet access or believe in new technologies. The difficulties described in the Alabama setting are reminiscent of the conclusions made by Le Roux and Van Niekerk (2020), who have stressed that effective disaster communication should also be able to address the technological and infrastructural realities of the target communities. According to Alabama's experience, there is a need to retain traditional communication methods, such as weather radios and television broadcasts, despite the growing popularity of digital and social media.

According to research by Steelman et al. (2015), residents of Alabama would rely on traditional gadgets such as television and weather radios. Interest in weather radios did not decline after the workshop, in fact, usage increased on the day in question. Education becomes effective in making changes in preferences that are identified regarding trustworthy and low-tech devices. In Florida, rural populations and individuals with limited access were not receptive to digital-intensive strategies such as email and social media (Mike et al., 2020). In Alabama, there is confusion surrounding the use of sirens, as their signals are inconsistent and the population is not educated on the matter, unlike in Florida, which has a digital agenda focus (Ashby, 2021). TPB suggests actions guided by the security of devices that may be

exploited to facilitate awareness of weather radio. A hybrid approach is required (Le Roux & Van Niekerk, 2020).

The experiences of Alabama and Florida demonstrate the importance of using flexible communication tools due to the demographics of their audiences and the technologies they use. While the Florida Extension workers were more in support of social media and other digital means of contacting people, the Alabama workshop participants were very focused on broadcast-based tools. For example, the significantly higher preference for weather radio after the seminar in Alabama implies that physical instruments can be more effective among vulnerable groups. This verifies the statement of Houston et al. (2014) that communication of information should not only be concerned about how fast that information is delivered, but also how usable and familiar.

Moreover, Florida's strategy rested on human relationships in the Extension departments and the partnerships that had already been built in terms of emergencies, thus allowing the distribution of resources quickly and communication in a specific way. However, as Mike et al. (2020) showed, message reach and community feedback levels were not evaluated regularly. The model used in the Alabama survey-based study provides a more measurable way of assessing the outcome of the communication intervention because it shows the specific changes in respondents' preferences for tools before and after the intervention.

Conclusion, Implications and Recommendations

This study supports the importance of the audience-based approach to communication in increasing the rural population's preparedness against a disaster. The results of the HEADS-UP project in Alabama illustrate that conventional communication means are necessary to reach vulnerable populations, particularly those with low access to digital devices or a lack of technological experience. The visible change in weather radio use following the special workshops with the Extension demonstrates the importance of available tangible instruments combined with educational activities

In comparison to Florida's communication strategy for the 2017 hurricane season, which embraces digital measures, email, and interpersonal communication, the Alabama situation illustrates the importance of directing outreach to local conditions. The comparison helps to emphasize that there is no single model when it comes to disaster communication. Instead, hybrid strategies that combine modern technologies with trusted, low-tech methods are more likely to build preparedness and trust in underserved communities.

As natural disasters grow more frequent and severe, Cooperative Extension systems must proactively assess the specific needs, communication preferences, and infrastructural capacities. By integrating quantitative feedback, continuous education, and culturally and technologically appropriate tools, Extension professionals can play a key role in saving lives and improving community resilience. Future research should

continue to examine how audience trust, tool accessibility, and information clarity shape communication effectiveness across different regions and hazards.

The importance of traditional tools is evident in Alabama's "HEADS-UP" project, where weather radios became more relevant following the workshop. Florida's digital approach shows the necessity of individual strategies. Season Extension Services need to consider Weather Radios, regional radio relations and community-based education to increase their outreach.

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Chapter 5: Epilogue

Summary of Findings by Study

The dissertation sought to evaluate and enhance disaster preparedness methodologies in rural Alabama through a series of three papers, utilizing a three-paper model based on the HEADS-UP program (Helping Every Alabamian Develop Storm Understanding and Preparation Plans). The fundamental objective remained the same: to mitigate vulnerability and enhance the resilience of underserved groups through specially directed extension-led learning in three empirical studies.

Article 1:

An Assessment of Disaster Preparedness and Risk Perception among Rural Residents in Alabama

Explored in more detail the various weaknesses experienced by rural populations in Alabama. The consequences of this include exposure to substandard housing conditions, limited access to weather warnings, and a deficiency in familiarity with disaster terminology. The findings indicated that, despite most respondents understanding the usefulness of prepared devices, such as NOAA Weather Radios, less than 7% were using these devices at the moment. Additionally, some of the participants were confused about the distinction between a watch and a warning, and

this indicates that major obstacles are likely to exist in place when it comes to providing sufficient and early security actions.

Identify gaps in disaster readiness and barriers to information dissemination. Findings revealed reliance on traditional communication methods, primarily television (80.8%), and a significant underutilization of NOAA weather radios (16.6%), despite their proven effectiveness in severe weather situations. Barriers identified included technological unfamiliarity, limited trust, and accessibility issues.

Article 2:

An Evaluation of the Impact of a 3-Hour Disaster Preparedness Workshop on Participants' Knowledge and Behaviors

Measure changes in knowledge and confidence related to disaster preparedness immediately following the workshop. The workshop significantly increased participants' reliance on NOAA Weather Radios from 21.9% to 60.4%. It also notably enhanced immediate shelter-seeking behaviors upon receiving tornado watches and warnings, reflecting improved risk perception. Post-workshop participants demonstrated improved confidence and practical knowledge in setting up and effectively using weather radios. However, a slight decrease in perceived preparedness regarding specific preparation steps highlighted increased awareness of complexities and potential challenges in disaster preparedness.

Article 3:

An Analysis of Communication Preferences and Barriers in Delivering Weather-Related Warnings to Vulnerable Communities

Determine the most reliable forms of communication regarding disaster warnings in rural settings. Initially, television dominated as the primary source of information; however, the structured workshops shifted preferences significantly toward NOAA Weather Radios due to their reliability and effectiveness in power outage situations. A comparative analysis with Florida's 2017 hurricane season revealed that rural Alabama communities preferred tangible, low-tech communication methods, such as weather radios, rather than digital-intensive strategies. This indicates a misalignment between traditional Extension communication approaches and local preferences, emphasizing the need for a hybrid approach tailored to rural populations.

Recommendations for Future Research

Firstly, it is essential for the Cooperative Extension System to formalize and expand the HEADS-UP program, ensuring its incorporation as a permanent initiative in all counties across Alabama. The extant literature on the subject supports the notion of Extension as the optimal delivery mechanism through which to offer disaster education in rural communities. There is robust evidence, moreover, of the efficacy of the local delivery source, with its trusted outlook and grassroots model of engagement. Considering the program's success in pilot counties, it is imperative that

similar initiatives are implemented in other states susceptible to disasters, particularly in the Southeastern United States.

Secondly, it is essential that any educational program that utilizes weather radios incorporates real-time demonstrations and training. Despite their awareness of the importance of NOAA Weather Radios, respondents repeatedly expressed confusion regarding their usage and programming. The distribution of devices without the provision of adequate training is unlikely to address the existing preparedness gap. In the future, multilingual instructions and training guides that may be simplified and followed by retraining at the local agent should be provided in future programs.

Thirdly, the results indicate that a proportion of messages must be delivered to individuals residing in mobile home parks. These demographics are the most vulnerable about fatalities resulting from tornadoes, and they are generally under-represented within the conventional disaster information system. It is imperative that all educational campaigns addressing this subject focus on the specific actions that mobile home residents can undertake, emphasizing the identification of shelter locations and the dissemination of alerts in the absence of internet or mobile connectivity. The closure of these loopholes can be facilitated through collaboration with park managers, religious leaders, and local residents.

Fourth, the community needs to standardize and simplify the terminology used in weather alerts. The efficacy of early warning systems is undermined by the confusion between watches and warnings. Extension professionals working in collaboration with

the National Weather Service are tasked with the responsibility of developing visual aids and comparable illustrations that are comprehensible to both older adults and individuals with low literacy.

Lastly, since most respondents were aged 60 years and above, disaster preparedness programs should be designed to suit the requirements of elderly groups. This includes easier technology, printed documents, training of caregivers, and creating an evacuation strategy that takes into consideration mobility and sensory dysfunction.

Recommendations for Practice

This dissertation posits that the problem of vulnerability to disasters in rural Alabama can be addressed through community-based, evidence-based interventions. The scalable model introduced by HEADS-UP is based on the Extension Disaster Education Network (EDEN) model, and its implementation has been shown to result in both an increase in knowledge and significant behavioral changes. It is imperative that scholars and professionals cultivate ongoing collaborations between extension systems, emergency management agencies, and local governments to foster a culture of preparedness.

Enhance community education programs by integrating continuous hands-on training sessions to reinforce practical usage of critical tools like NOAA weather radios. Improve the accessibility and visibility of storm shelters through clear mapping, signage, and regular public education campaigns.

Provide ongoing training to Cooperative Extension agents on regional disaster risks, communication strategies, and engagement techniques tailored to diverse, underserved rural populations. Distribute free, pre-programmed NOAA weather radios broadly within vulnerable communities, accompanied by clear instructional materials available in multiple languages to accommodate diverse populations. Ensure that facilitators are comfortable with and supported in educating those with diverse language capacities and abilities to communicate (Miller, Clemons, McKibben, & Lindner, 2025; Miller, Clemons, McKibben, Cletzer, & Lindner, 2025)

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Apendixes