



FINAL REPORT

Inclusive Emergency Alerts for Colorado: An Assessment and Recommendations for Language and Disability Considerations



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Recommended Report Citation:

MacPherson-Krutzky, C., Painter, M. A., and Villarreal, M. 2023. Inclusive Emergency Alerts for Colorado: An Assessment and Recommendations for Language and Disability Considerations. Natural Hazards Center, University of Colorado Boulder.

Executive Summary

This report presents findings and recommendations from research conducted by the Natural Hazards Center at the University of Colorado Boulder in accordance with House Bill 23-1237 [1]. The purpose of this study is to identify best practices for inclusive alerting and offer recommendations to improve current alert systems in Colorado that address language and access needs. This project collected information using three methods: a **document review** (62 documents) of research literature, a **statewide survey** of emergency response personnel (222 responses), and **meetings with key partners** (37 people). Findings based on analyses of these materials are summarized below. Please see **Appendix A** for a glossary of terms used in this report.

Findings for Colorado

Finding 1. Colorado’s alert systems and processes are a patchwork of different practices that, while flexible, can also hinder consistent, inclusive alerts.

Finding 2. Colorado relies heavily on opt-in emergency alert systems but most report opt-in rates below 40%. These systems create barriers for everyone, but especially those who don’t speak English or who have disabilities. Tracking alert subscribers and measuring the efficacy of alerts is a challenge.

Finding 3. Many emergency response personnel are interested in incorporating systems and practices that would make alerts more inclusive, but need more guidance, funds, and personnel to adequately do so.

Finding 4. Implementation for language and disability access are varied and inconsistent across the state. Some alert authorities are not aware of options for making alerting more accessible or face issues with existing systems – as a result they rely on practices that may not meet community needs. Others are making great strides but still face challenges.

Finding 5. The technical and practical limitations of emergency alerts that hinder most people compound the challenges faced by those with disabilities or linguistic considerations. These include delays in technology upgrades, limited awareness of systems, pushback from private industry, among others.

Recommendations

Based on the best practices established in the research literature and our survey and interview findings, we recommend that the State of Colorado adopt a series of actions that fall under three pillars: (1) people, (2) practices, and (3) data and funding. Creating inclusive emergency alerts requires an enduring commitment to equity, inclusion, and access for all. We hope that these recommendations can serve as a starting point.

People

Hire State-Level Personnel to Address Language and Disability Access Needs

Hiring personnel to focus on language and disability access needs could ensure consistent support for local inclusive alerting efforts. Responsibilities might include assessing local needs; developing plans, resources, and training; tracking metrics; promoting the adoption of inclusive practices across Colorado; and seeking funding to support these activities. Staff could coordinate with the existing Colorado Office of Emergency Management access and functional needs team.

Develop Formal Relationships with Limited English Proficiency (LEP) and Disability Communities

More could be done to establish trusting connections between emergency response agencies and community groups before emergencies. Actions could include developing steering committees, forming advisory councils, and hiring community champions or multilingual staff.

Practices

Standardize Alerting Practices Across the State

Develop statewide alert standards to ensure consistent language and disability access and reduce barriers for local authorities. Actions may include standardizing alert vendor use, designating alerting authorities, sharing inclusive access materials, and tracking opt-in alerting system registration or subscription.

Create and Distribute Language and Disability Access Resources

Provide guidance, training, and shared resources for language and disability access across jurisdictions. Actions can include conducting regular training on cultural competency, community needs, technology options, and creating shared resources such as glossaries and translated templates. Alert message templates for Colorado would need to be developed based on input from LEP communities, populations with disabilities, alerting authorities, and research best practices.

Data and Funding

Support Research to Fill Information Gaps to Support Inclusive Practices

This study uncovered areas where more qualitative and quantitative data is needed to fully understand the gaps that exist and to offer evidence-based recommendations for implementing practical changes.

Secure Funding to Support Inclusive Alerts

Unfunded mandates are unpopular and unlikely to address findings. As such, funding is needed to support people, practice, and data recommendations outlined above (see **Appendix B**).

Assessing Inclusive Language in Emergency Situations

Introduction

Emergencies are inevitable, but how we respond to them is a choice. Emergency alerting¹—the process of sending emergency information to communities rapidly—has received heightened attention in the past decade. The Marshall Fire in 2021 brought to light issues with alerting systems in Colorado when many people did not receive evacuation notices through their phones and had to determine what steps to take without direction from authorities [2].

The Marshall Fire highlighted the need to examine Colorado alert systems and identify best practices and areas of improvement for some of Colorado’s most at-risk populations: communities that are considered Limited English Proficient (LEP) and people with disabilities. As Colorado becomes more diverse and climate change creates new hazard risks [3], it is necessary to ensure practices and systems align with the needs of the public.

Study Purpose

House Bill 23-1237 directed this study to advance three main objectives:

1. Assess the state of emergency communications in Colorado and identify gaps in current systems as they relate to access and inclusion;
2. Identify best practices for developing and distributing inclusive emergency alerts;
3. Provide tangible and actionable recommendations to improve emergency communications systems that serve everyone, particularly those who are LEP and people with disabilities.

A Diverse State

Colorado is home to people from diverse backgrounds and circumstances, some of whom have greater risk to disaster impacts. The two populations highlighted in this report are LEP communities and people with disabilities. Almost 900,000 Coloradans speak a language other than English, with the top five languages being Spanish (10.9%), Chinese (0.5%), Vietnamese (0.4%), German (0.4%), and Russian (0.4%) [4]. According to the Migration Policy Institute, more than 250,000 Coloradans are reported to have limited English proficiency (**Figure 1**), meaning they have difficulty comprehending and communicating in English [4]. Additionally, about one in four adults in Colorado—more than one million people—have some type of disability [5] (**Figure 2**), which the Centers for Disease Control and Prevention defines as “any condition of the body or mind that makes it more difficult for a person to do certain activities and interact with the world around them” [6]. Types of disabilities include hearing, vision, cognitive, ambulatory, self-care, and the ability to live independently [7]. The needs of those with disabilities and limited English proficiency are often overlooked in emergency plans and can lead them to suffer disproportionately [8].

Legislation on Inclusive Alerting

Since the 1965 Civil Rights Act [9], U.S. legislation focused on expanding and providing all Americans with inclusive access to spaces, services, and information. Several laws and executive orders call for access to services or prohibit discrimination in public operations [9]–[12]. More recent executive orders promote equity, including full participation of immigrants and refugees in civic life and eliminating language barriers [13]–[15]. Various influential federal guidance and memos require services for LEP populations and those with disabilities, including guidance

¹ We use the term “emergency alert” here to represent any notification, message, or warning that is intended to provide emergency information to individuals at risk. We developed a glossary of relevant terms for reference. See Appendix A.

Figure 1. Percentage of Household in Which No Member 14 Years Old or Over Speaks English “Very Well” by County. *Counties with less than 0.5 percent are not labeled.* [16]

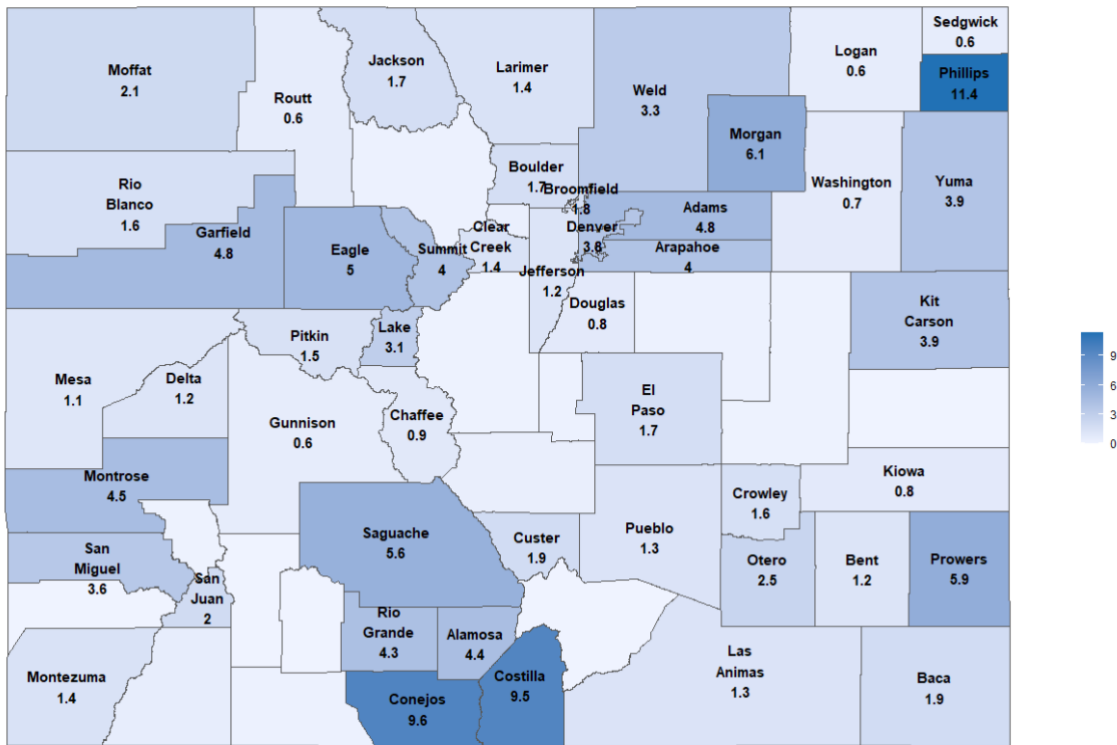
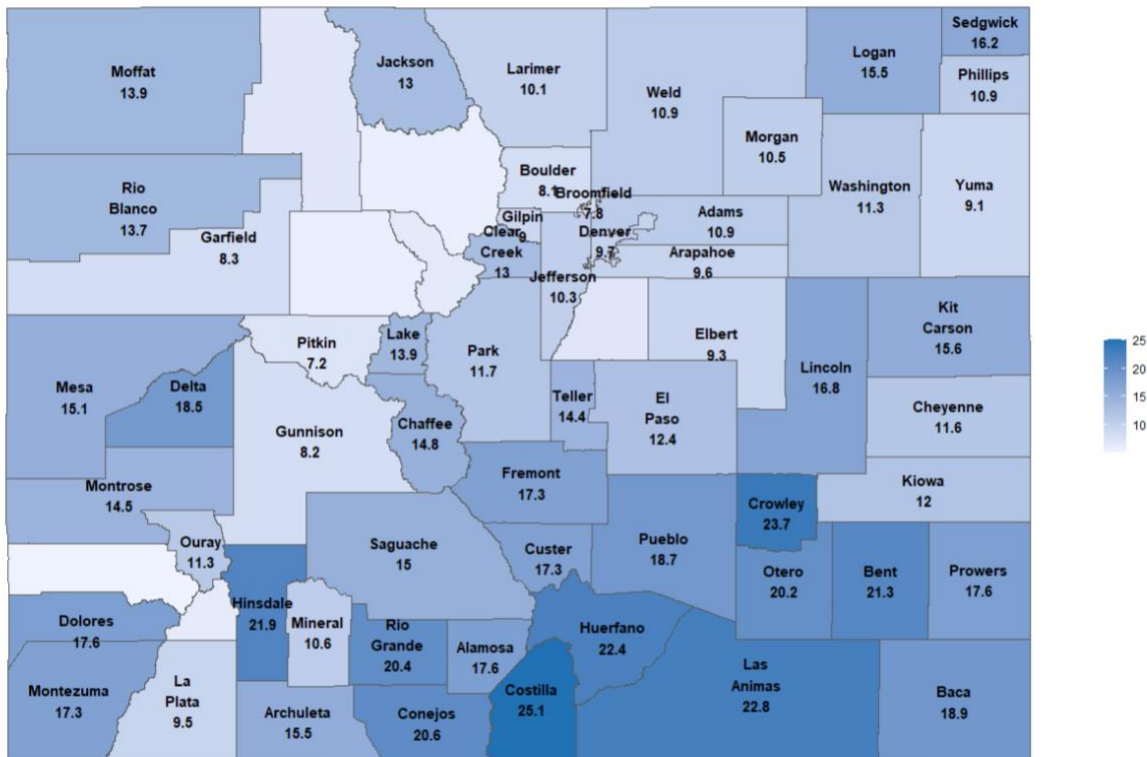


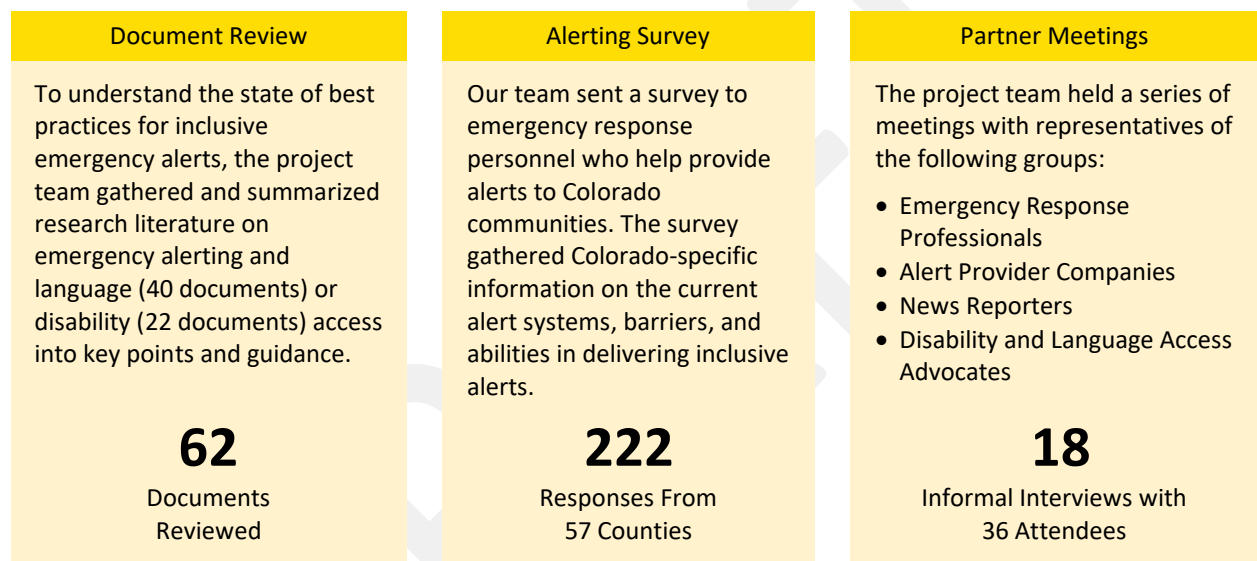
Figure 2. Percentage of People with a Disability by County. *Counties with less than 7 percent are not labelled.* [17]



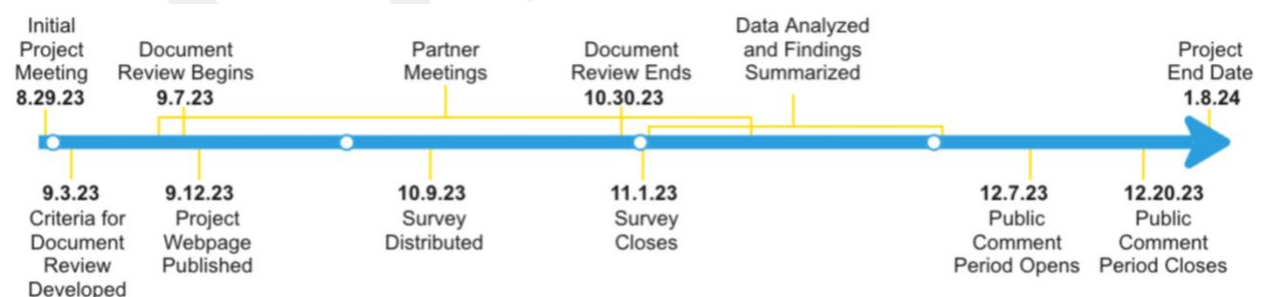
issued by the U.S. Department of Transportation, Department of Justice, and Department of Health and Human Services [18]–[20]. In 2006, Executive Order 13407 specifically focused on inclusive access to emergency alerts and called for a public system that can warn “all Americans, including those with disabilities and those without an understanding of the English language” [13]. Further, the Federal Communications Commission (FCC) requires that emergency information is accessible to people who are Deaf/Deaf-Blind, hard of hearing, or those who have visual or intellectual disabilities [21]–[24].

Related policies and guidance in Colorado followed suit, with the Colorado Department of Transportation issuing policies directing access for persons with disabilities and LEP, further suggesting that there should be written translation of vital messages for each language group that constitutes 5% of the population an agency serves or 1,000 people, whichever is less [25], [26]. With precedence for making alerting more inclusive nationally and in Colorado, this study represents a next step in expanding inclusion by assessing the state of emergency alerting and outlining specific best practices for Colorado.

Methods Overview



Study Timeline



Document Review Summary: Alerting Systems in the United States

As of 2023, there are no U.S. mandates for emergency alert communication. Instead, message creators (alerting authorities) often rely on “intuition and hope that the message they pose delivers the right information to prompt quick and effective protective action” [27]. Additionally, systems and channels vary, with many existing pathways, mechanisms, and procedures being used to reach people rapidly when an emergency occurs (**Table 1**). Often, local jurisdictions determine their own protocols, which creates a patchwork of systems across the United States.

Table 1. Emergency Alerting System and Channel Options

Alert Options	Description
Wireless Emergency Alerts (WEA)	A system that uses cellular towers to send messages of 360 characters or less to cell phones in a distinct geographic area. Everyone physically in that area receives an alert unless they have opted out of receiving them. (Must have alert vendor to send WEAs, see below)
Emergency Alert System (EAS)	Broadcast through radio and television, this technological system has been in place since 1997. Includes National Oceanic and Atmospheric Administration weather alerts, used most frequently for imminent and dangerous weather conditions.
Integrated Public Alert and Warning System (IPAWS)	Since 2012, the Federal Emergency Management Agency (FEMA)-provided system that allows alerting authorities to send emergency alerts through many channels at once including text, phone, WEA, EAS, and others. Alerting authorities must complete activities and trainings to become an authorized IPAWS user.
Alert Vendors	Third-party systems and software that support alerting across several channels that include proprietary services and the Integrated Public Alert and Warning System (IPAWS). Alerting authorities use these services on a contract basis. Examples include Everbridge and CodeRED.
Specialized Providers	Software, systems, and applications that can integrate into alert vendor platforms or be used alongside them. These are typically intended to fill a certain audience gap (e.g., reach non-English speakers or the Deaf and Deaf-Blind). Examples include ReachWell and Deaf Link Accessible Hazard Alert Systems(AHAZ).
Written or Visual Alerting	Websites, email listservs, and texting can be used to provide emergency information to people. Often the websites of alert authorities will include active alert notices. Additionally, social media platforms can also be used to distribute alert messages.
Sound-Based Alerting	Alerts can be sent through auditory means such as sirens, phone calls, radio or television broadcasts.
Face-to-Face	This includes in-person alerting, such as going door-to-door and may be used for hyperlocal alerting needs, such as evacuations.

Despite the lack of alerting policy, social science disaster researchers have been studying multi-hazard warning systems for decades and have produced numerous recommendations for effective messaging and community engagement. For example Mileti and Sorensen [28] reviewed 200 publications on multi-hazard warning systems and found that variations in the warning message, the population being warned, and the alert method impact how the public responds. This foundational research revealed five crucial elements of multi-hazard emergency alert messages that promote understanding and trust in a message and inspire protective action: (1) the nature of the hazard, (2) guidance on the protective action to take, (3) location of the hazard, (4) time remaining to take protective action, and (5) the risk information source (**Table 2**).

Table 2. Components of Emergency Alert Message Completeness

Mileti and Sorensen’s (1990) Model	Components Identified by Kuligowski et al. (2023)
Nature of the Hazard	<ul style="list-style-type: none"> • The name of the impending type, threat, or event • Information describing the hazard • Information about the potential consequences from the hazard
Guidance on Protective Action	<ul style="list-style-type: none"> • Information about how people should protect themselves or the actions they should/could perform
Location of the Hazard	<ul style="list-style-type: none"> • Information about location, including relevant landmarks; town/city/county; road/intersection/highway or zones
Time Remaining to Take Protective Action	<ul style="list-style-type: none"> • When message receivers should expect hazard impact and when they should act • When the message expires
Risk Information Source	<ul style="list-style-type: none"> • Name of the organization providing the information

Researchers [27], [29] built upon this work by conducting an extensive review of 90- and 360-character WEAs sent to public audiences. They found that many did not comply with Mileti and Sorensen’s [28] guidance. This suggests that more work is needed to ensure research is translated into practice and emergency alerts contain essential information. In the past few decades, disaster researchers have developed additional best practices for emergency alerting [30], but more work is needed to address issues and identify barriers for specific audiences. The following section summarizes barriers and associated best practices from research specifically for inclusive alert systems for LEP populations and people with disabilities.

Document Review Methods

To conduct a review of the research literature, we used databases such as Web of Science, EBSCOhost, and ProQuest and web resources such as Google Scholar and agency websites. This provided us with relevant journal articles, agency reports, dissertations, master’s theses, and news articles. The search strategy involved a combination of key words related to hazards and disasters, emergency alert systems, and language and disabilities. We considered research and documents that were:

- in English
- focused on the United States
- published in between 2003-2023
- focused on development and distribution of emergency alerts, specifically for LEP populations and those with disabilities
- emphasized how people access, receive, and respond to emergency alerts rather than the technical aspects of those systems
- peer-reviewed articles, dissertations, theses, conference papers, agency reports, news articles, or literature reviews

The following sections summarize what we learned from reviewing this key literature.

Barriers to Issuing and Receiving Inclusive Alerts

Emergency alerts are not always accessible to LEP populations and people with disabilities. Emergency alerts are often only distributed in English [31]–[35] or only shared in additional languages or modalities (e.g., American Sign Language [ASL]) if requested or in special circumstances [36], [37]. If LEP populations or people with disabilities are unable to understand a message, they may ignore the warning and not take protective action [38], or they may respond inadequately [39] because they lack critical information [33], [40]. Those in charge of distributing emergency alerts should be aware of the barriers that prevent LEP populations and communities with disabilities from receiving and understanding them. These can include issues such as:

Emergency alerts might not be available in multiple languages. Not all alert authorities have the capacity to send non-English alerts, especially those without the funding to support communication and staff who are dedicated to

producing inclusive emergency alerts [36], [41]. Agencies that do have access to translations services might not use them [32] or might require residents to register for services that send alerts in their preferred language [42]. Additionally, lack of ASL interpretation impedes access to alerts for the Deaf and hard of hearing [40], [43]–[46]. Delays are also sometimes caused because translation in emergencies is often carried out by many different people in real time [47].

The distribution of emergency alerts in languages other than English is often delayed, leaving populations to seek out other sources of information. LEP populations and people with disabilities must seek out emergency information from other sources that may be informal or unreliable [33], [43], [48], [49] and delay response times [50]. Due to this delay, populations can lose a sense of urgency [40] and delay protective actions.

Emergency alerts might be distributed in ways that are inaccessible or undesirable. Sending alerts via the Internet [51], radio, loudspeakers, a television chyron (text which scrolls at the bottom of the television screen) [52], or text-based alerts [44] can impede access for LEP populations and those with disabilities. Knowing that not all channels are accessible means that it's best to distribute warnings through multiple means. Longmont Resiliency for All [53], for example, conducted a study after the Colorado 2013 flood and found that disseminating emergency alerts across several multimedia channels could increase access for Spanish-speakers in Longmont and Boulder County.

Trust in government agencies can be lacking among LEP populations and populations with disabilities, which may reduce their engagement with emergency alerts. This is particularly a barrier for immigrants without documentation [49], [54]–[56]. These groups may be unwilling to respond to messages or to seek help due to fear [32]. They may not trust government authorities to be credible, unbiased, accurate, or balanced [57] because of perceived or real discriminatory experiences during past emergencies such as the COVID-19 Pandemic [49]. Furthermore, research shows that people with disabilities can perceive governmental authorities as uncaring about their well-being during emergencies [43], [58].

Important cultural context can be missing from translated emergency alert messages. This can leave people without important information and unprepared for an emergency event [46], [59]. Word choice, connotation [40], [46], usage [60], and correct use of diacritical marks (characters above letters) [61] can greatly impact the meaning of translated messages. Therefore, poor and inaccurately translated messages can limit understanding and credibility. Additionally, the use of unfamiliar disaster terminology in emergency alerts can cause confusion for all audiences [40], [47], [50].

Many LEP populations may be unfamiliar with U.S. hazards. LEP populations include immigrants, who might not be aware of the types of hazards that occur in the U.S. [33], [38], [40], [54], [56], [62]. Furthermore, cultural beliefs can affect their willingness to take protective action [38], [62]. “One-size-fits all” suggestions for alerts and warning systems are not likely to be effective, as those in charge of distributing messages must be aware of local demographics—local nuances must not be ignored [37] nor should LEP communities and people with disabilities be homogenized [40], [55]. Messages need to be tailored to address the unique information and cultural needs of LEP communities and people with disabilities [57].

Despite the presence of barriers outlined above, researchers and others identified best practices for inclusive emergency alerting. Recommendations include personnel getting training in cultural competency, involving LEP populations and people with disabilities in response planning, and developing inclusive messaging. For a full list of best practices, see **Appendix C**.

Warning Systems in Colorado: An Assessment

To learn more about the state’s specific challenges and opportunities with inclusive alerting, we held a series of informal interviews and conducted a statewide survey of emergency response personnel. We heard directly from those who are responsible for alerts, as well as those who work with LEP populations and people with disabilities. This allowed us to assess the state of inclusive alerts in Colorado and identify relevant recommendations.

Partner Meetings. The research team held a series of meetings with relevant partners (see **Table 3**; for a full list of partners, see **Appendix E1**) to learn about the overall landscape of emergency alert systems in the state, identify language and disability access issues and successes, and assess what strategies might help improve current or future systems. To identify partners to meet with, we used a snowball sampling method—we asked existing contacts for recommendations on who is knowledgeable, especially in Colorado, about emergency alert systems, LEP populations, and populations with disabilities. We used these partner meetings to help us understand how emergency alert systems operate, how alerts are sent out, and the language used in the emergency alert field. Some meetings informed the development and distribution of the survey. Our team also attended a Colorado 911 Equal Access Committee Meeting, an IPAWS Conference, a Federal Communications Commission hearing on alerts and warnings, and a Colorado Language Access Coalition meeting to gather additional information.

Table 3. Meetings Summary

Partner Type	Number of Meetings	Number of Partners
Colorado Emergency Response Officials	8	11
Emergency Alert Vendors/Companies (private industry)	3	7
Community Partners (community-serving organizations, news agencies)	3	9
Emergency Alert Researchers	2	2
Policymakers (State Representative and County Commissioners)	2	7
Total	18	36

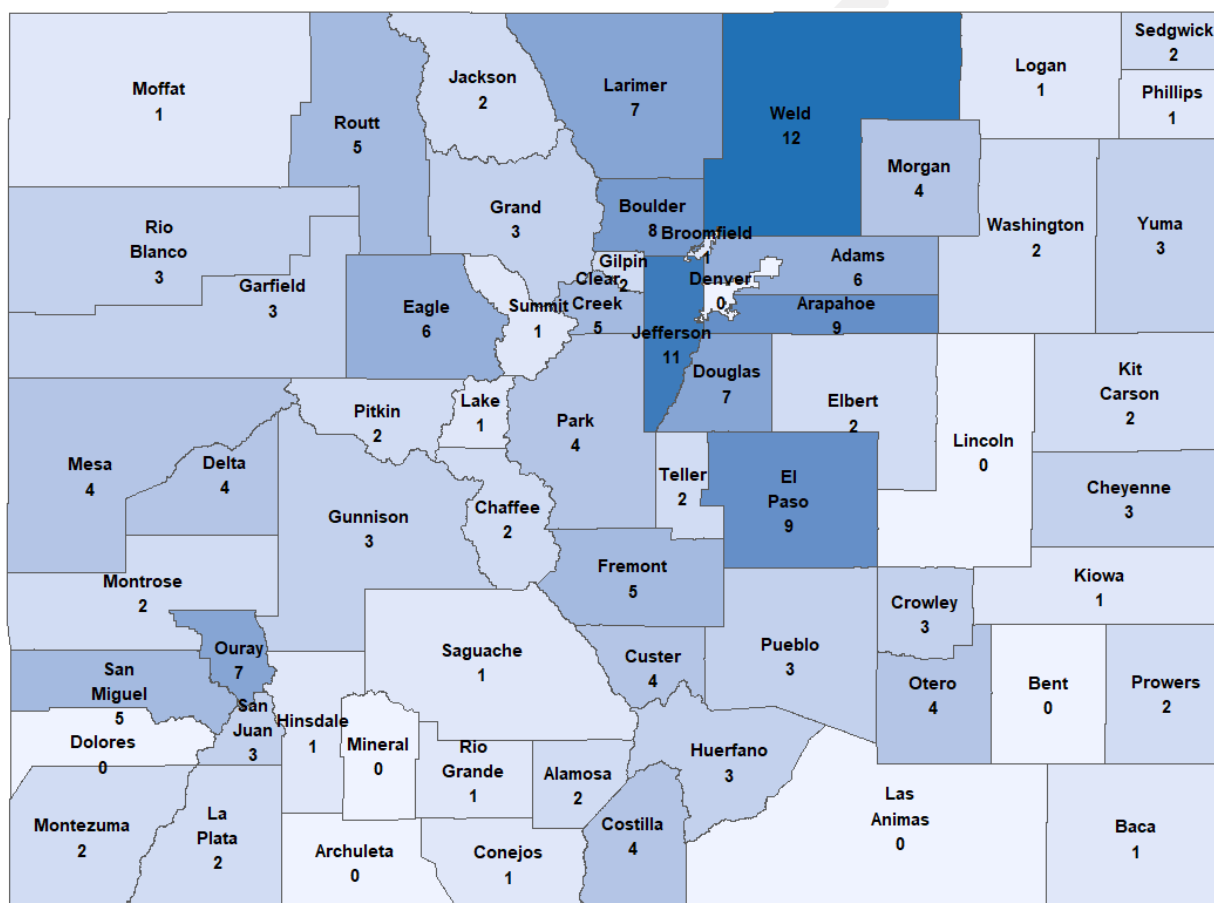
Survey. We developed an online survey to assess emergency alert systems in Colorado. To ensure we were collecting novel and relevant information, we sought out and received input from Colorado alerting professionals via our partner meetings about the content and phrasing of survey questions. Disaster researchers at the Natural Hazards Center also reviewed the survey and announcement materials for clarity. We identified dissemination avenues for the survey through key partners, which included email listservs for emergency response personnel in Colorado such as 911 offices and Public Safety Answering Points (PSAP)², emergency managers, sheriffs, public information officers, police chiefs/officials, and fire officials (see **Appendix E2**). We then sent survey announcement emails through partner listservs inviting individuals involved in disseminating emergency alerts to participate in the survey by clicking a URL in the email. We followed up with two reminder emails halfway through the survey and again right before the survey closed through the same listservs.

The survey collected respondent information and contained questions about the alerting authority in their service area; hazard events and messaging channels, frequency, and use of alerts; language and disability access capabilities and needs; and general comments. We asked respondents to provide their professional position and county but did not request other identifying information. For closed-ended questions, we assessed response percentages and counts. For open-ended questions, we reviewed responses and identified themes and supporting quotes that are incorporated into our findings.

² PSAPs are facilities designated to receive emergency calls and route them to emergency service personnel (e.g., 9-1-1).

We received 222 complete survey responses³ representing 57 of Colorado's 64 counties (see **Figure 3**). Most respondents were emergency managers (27.5%), followed by fire chiefs, captains, or officials (18.6%), public safety answering point representatives (15.3%), and police chiefs (12.7%). Most respondents represented counties (45.5%), while some represented a city or town (32.0%). There was a high level of representation from four counties—Weld (6.6%), Jefferson (6.0%), El Paso (4.9%), and Arapahoe (4.9%). Seven counties were not represented in the survey: Archuleta, Bent, City and County of Denver⁴, Dolores, Las Animas, Lincoln, and Mineral County.

Figure 3. Counties Represented in the Survey with Number of Individuals who Participated



³ As of the survey close on November 1, 2023, there were 103 additional responses representing people who began, but did not complete the survey. These are not included in the analyses.

⁴ Although the City and County of Denver is not represented in survey results, their 911 Communications Center did participate in a meeting and are represented in the findings.

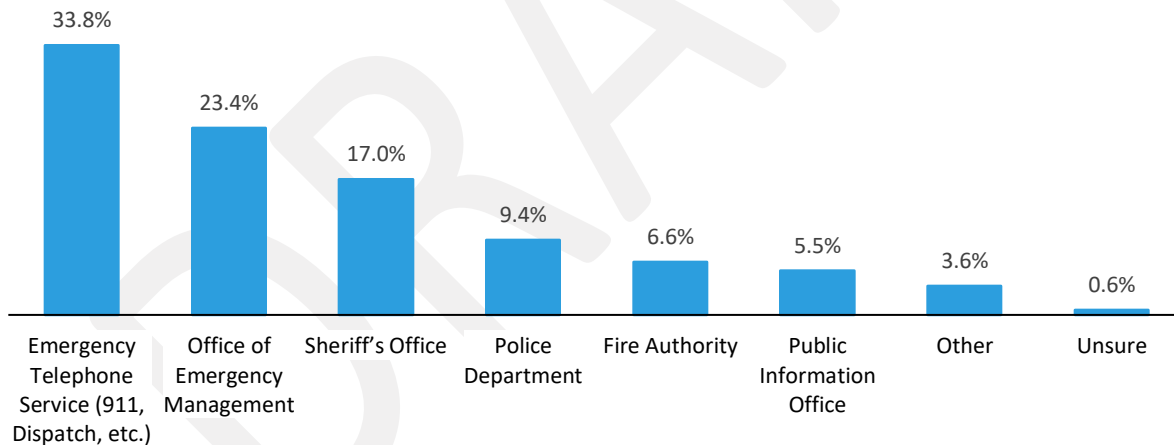
Findings for Colorado

Finding 1. Colorado’s alert systems and processes are a patchwork of different practices that, while flexible, can also hinder consistent, inclusive alerts.

No statewide alerting standards exist. Alerting authorities and systems vary by jurisdiction (**Appendix F**). The choice of alerting systems depends on local discretion and resources (see **Finding 2** for more details). While a non-standardized system allows communities to tailor practices to their own community needs, it also introduces inconsistencies in how alerts are distributed and received. In a meeting with Colorado’s Office of New Americans (November 7, 2023), they emphasized the importance of being responsive to diverse language needs throughout the state [63] and emergency managers from Eagle and Larimer Counties acknowledged that there are both benefits, such as the ability to select systems that do not rely cell coverage for mountainous areas, and challenges, such as not being able to share resources across jurisdictions, to the current approach [64], [65].

Certain alerting authorities issue alerts more than others. The survey revealed that emergency telephone services (911, dispatch, etc.), who have around-the-clock staffing, were most frequently selected as the source of alerts (33.8%), followed by local offices of emergency management (23.4%) (see **Figure 4**). However, sometimes responsibility is shared across alerting authorities depending on hazard type and coverage or due to varied alerting abilities (e.g., IPAWS capability). According to Eagle County Emergency managers, inconsistencies in who issues alerts could leave the public confused about where to find information during times of emergency [64].

Figure 4. Agencies Responsible for Sending Emergency Alerts



Community resources largely determine the level of access that can be provided. Numerous factors, such as funding, personnel, capacity, and technology determine what services are available. Fernando Almanza of Eagle County Emergency Management (October 17, 2023) and the Colorado Access and Functional Needs Coordinator Sadie Martinez (November 9, 2023) shared that some jurisdictions have more comprehensive alerting resources for LEP communities (e.g., ReachWell) and people with disabilities (e.g., Deaf Link), while areas with less resources may not be able to provide these services [64]–[66]. Additionally, alert vendors that authorities contract with (**Appendix G1**) have varied access capabilities and can limit options. Respondents also commented that, in general, alert vendor systems are not compatible with one another, making resource sharing a challenge. Some have in-house translation options, while others do not, resulting in varied practices and protocols across vendors. In our partner meeting with Deaf Link (November 6, 2023), we learned that this distribution system results in cases where one Deaf sibling living on one side of a county line may receive an emergency alert in ASL while their Deaf

sibling living on the other does not [67], highlighting that access in this current system depends on jurisdictional boundaries.

Statewide systems that maintain local flexibility exist. According to a representative for Everbridge (November 10, 2023), Oregon, Florida, and Connecticut, among others, have a statewide alert provider that allows municipalities to adopt the system at no cost to them [68]. Alternatively, other states use their bargaining power to create purchasing agreements, allowing jurisdictions to secure vendors directly without a competitive process. Both options require state-level coordination with alert vendors. Interviewees and survey respondents supported some level of statewide standardization. A Garfield County representative suggested that “it would be better if there was uniformity and a statewide system that everyone was familiar with.”

A statewide system would allow resource sharing to create better access for language and disability services by developing consistent formats, templates, and training that can be deployed throughout the state. Emergency response personnel emphasized that having set standards would help to reduce resource burdens for smaller communities, improve statewide alerting access, and ensure that accessibility and language access are pillars of alerting systems throughout the state. A Gunnison County respondent supported this idea by saying, “Recognizing that each county is unique and has its own strengths and needs, there should be some baseline standards for emergency alerts in Colorado.” The survey responses and partner conversations did not reveal why a statewide system has not yet been adopted.

Finding 2. Colorado relies heavily on opt-in emergency alert systems but most report opt-in rates below 40%. These systems create barriers for everyone, but especially those who don’t speak English or who have disabilities. Tracking alert subscribers and measuring the efficacy of alerts is a challenge.

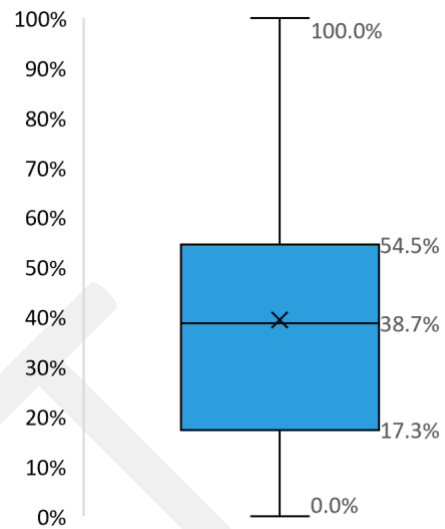
Most alert systems that are widely used in Colorado require individuals to sign up. With these systems, individuals need to register for an account, download a phone app, or follow alerting authorities on social media to receive alerts. In our meeting with Office for New Americans (November 7, 2023), we found that knowing about these systems and how to sign up is a barrier for most people, but especially for LEP communities who may be wary of sharing personal information with government agencies [63]. While specialized providers, like ReachWell, address some language barriers with apps that translate alerts into multiple languages without requiring personal information, they still rely on individuals knowing they need to sign up and how. Fragmented alert systems further complicate matters, requiring individuals to register for each county system they want to receive alerts from. A respondent from Delta County said, “...most messages [are] being sent via opt-in systems managed by the county, 911 system, etc. Vendors such as CodeRed, Everbridge, Genasys, Rapid Reach... The success of these systems in an emergency relies on the community actively signing up for alerts.”

Low opt-in rates limit the reach of alerts. According to Garry Briese, Executive Director of the Colorado State Fire Chiefs (September 14, 2023), despite alert authorities’ best efforts to send inclusive and best practice emergency alerts, low opt-in rates result in limited reach [69]. He shared that, “an alert warning and notification system which reaches a very small percentage of residents and visitors is an ineffective and dangerous gesture for meeting government’s responsibility for emergency notification” [70]. Of the 200 survey respondents that use an alert vendor, 57% expressed uncertainty about their service area opt-in rates. Of those that knew their rates, only 12% indicated their opt-in rates were above 50%⁵ of their total population (**Figure 5**).

⁵ We found some discrepancies in reported response rates for the same region and two people reported rates above 100 percent, which were not included in the analyses.

Apart from alert vendors, we found that social media platforms were the most frequently used notification type across emergency situations, with 82% using it for natural hazard events and 72.1% for acts of violence (Table 4; for full list, see Appendix G2). According to Justin Singer of IPAWS National (November 28, 2023), social media platforms change participant access and use policies over time, which can create issues for sending alerts [71]–[73]. There is also limited ability to track engagement. The National Council on Disability [36] recommends enforcing federal access laws, such as the Americans with Disabilities Act (ADA) and the Rehabilitation Act, by increasing monitoring of social media sites and websites to respond to people commenting or posting about emergencies. Despite social media being the most used alert type, alert authorities shared that most alerts are sent through multiple channels (e.g., alert vendors, websites, etc.), which increases the potential reach and aligns with best practices. Tracking opt-in rates would help assess the effectiveness of outreach efforts and monitor the potential reach of systems. Tracking may be happening on a local level, but no shared or regularly updated statewide database appears to exist.

Figure 5. Opt-In Rates Reported by Survey Respondents



If opt-in alert providers are used, outreach is important to get more people to sign up, especially populations who are traditionally underserved. Of respondents that have alert vendors (200), 25.3% use social media posts to tell the public about this service. They also use public events (21.8%), flyers posted in public places (15.2%), emails (10.5%), mailers sent to physical addresses (7.9%), broadcast radio (6.2%), and local television (3.2%), with 4.5% of respondents relying on efforts managed by alert vendors. Of respondents who use an alert vendor, 56.9% do public outreach in other languages, while another 15.2% do not but would like to. Thirty respondents said they provided translated materials on opt-in notification systems in Spanish. Beyond Spanish, one group also offered Russian, and another offered French and Polish. Several offer 60+ languages through the ReachWell Application (translated using advanced AI), with others mentioning alert providers like CodeRED, Genasys, and Rave that have multilingual messaging options with varied functionality.

Table 4. Use of Notification Channels by Emergency Type

Notification Channels	Emergency Type	
	Natural hazard (%)	Act of violence (%)
Social media (opt-in)	82.4	72.1
Text messaging (opt-in unless through WEA)	70.7	67.1
Automated phone call (opt-in)	69.4	64.9
Email (opt-in)	52.7	15.3
General notification from alert vendor (opt-in)	46.8	42.3
Wireless Emergency Alerts (WEAs) (opt-out)	75.2	61.7
Face-to-face	49.1	22.5
Broadcast TV and radio (receive when on)	35.1	26.1
Outside siren (hear when nearby)	30.2	2.3

Opt-out systems exist but have their own limitations. Wireless Emergency Alerts (WEAs) are an opt-out system where messages are sent to mobile phones within a specified area with sound and vibration. These alerts can be sent in English or Spanish⁶ with planned future expansion to the U.S.'s 13 most common languages [74]. To receive translated messages, alerting authorities must pre-translate messages⁷ and individuals must have their preferred language set on their phone. Emergency officials from Eagle County (October 17, 2023) expressed concerns with WEAs noting that people outside specified alert areas sometimes receive alerts, and mobile coverage can be unreliable in certain areas [64]; Updates to technology in 2024 should reduce these issues in the future according to IPAWS national (November 28, 2023) [71]. Survey results indicate WEAs are the second-highest used alerting channel for natural hazard events (75.2%) and the fourth highest for acts of violence (61.7%). However, despite their widespread consideration, respondents reported limited usage, with 52.4% stating zero uses in the past year. Other opt-out systems exist, such as sirens, television broadcasts, and face-to-face notifications, but these channels have their own opportunities and challenges for language and disability access. Best practices recommend use of many communication modes to relay emergency alerts and standardizing language, colors and symbols to provide consistent messaging across platforms [37].

Finding 3. Many emergency response personnel are interested in incorporating systems and practices that would make alerts more inclusive, but need more guidance, funds, and personnel to adequately do so.

Limited guidance and training hinder inclusive alert improvement and reach. Despite a desire to provide services, many alerting authorities stated that they face shortages of personnel, lack training, and other resources that make sustaining all their operations a challenge—including inclusive alerts. For example, some respondents noted that their alerting authority was not IPAWS-authorized⁸, meaning they could not use FEMA's software to send alerts across many modes at once to reach diverse audiences. This was because they didn't know how to become authorized (10.7%), had limited staff capacity (10.7%), had too little time (7.1%), or the cost to use the system was too high (5.4%). Additionally, alerting authorities, such as 911 and sheriff's offices, have additional responsibilities aside from issuing alerts. Without proper support, these barriers will prevent inclusive practices from being adopted.

Funding was the top barrier to implementing inclusive alerts. Sixty-four percent of respondents said they didn't have enough funds allocated to make alerts more inclusive. This was followed by personnel and training in technology (Figure 6). Partner meetings revealed fears that recommendations from this report would lead to unfunded mandates. This anticipated outcome was extremely unpopular given the already high demands on alerting authorities and the lack of resources for some to maintain daily operations. The costs of additional services, such as Deaf Link or ReachWell, are reasonable for some jurisdictions but not others. This highlights that budget constraints are limiting improvement to inclusive alerting practices. A public information officer from a special district acknowledged that, "everything has a cost, and we cannot afford to implement this to the degree that it needs. Our money goes to keeping the doors open."

Basic alerting capacity—not to mention inclusive alerting—is limited by lack of staff. Many respondents and partners shared that they would need to be staffed 24/7 to achieve the level of alerting that could support inclusivity. They do not have the personnel available nor are there funds to hire more people. Fifty percent of survey respondents (112 people) highlighted personnel as the top resource needed to provide inclusive alerts. However, Fernando Almanza and Birch Barron of Eagle County Emergency Management also expressed challenges with turnover because of burnout, especially for multilingual and multicultural staff [64]. A Delta County representative shared,

⁶ Certain characters, such as tildes, are not supported and must be removed before an alert can be sent.

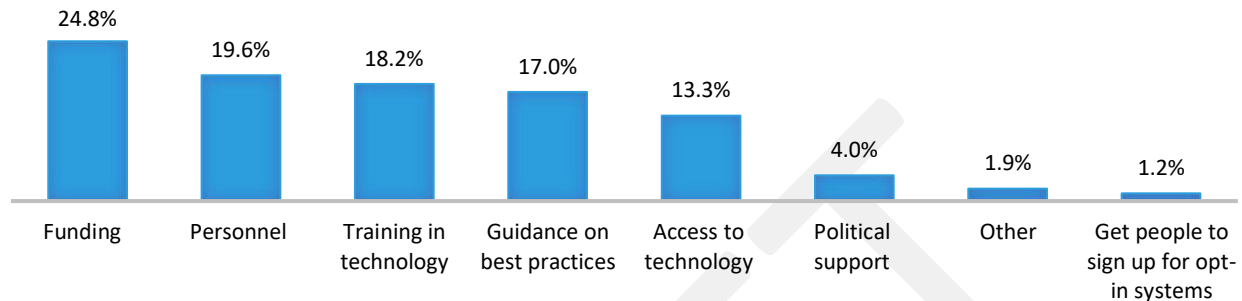
⁷ A national test of the WEA system on October 4, 2023, highlighted language issues when instances of set language preference did not align with the alert message language.

⁸ See more on requirement for IPAWS: <https://www.fema.gov/emergency-managers/practitioners/integrated-public-alert-warning-system/public-safety-officials/sign-up>

With limited staff, dispatchers must answer 911 and non-emergency lines, manage the radio, provide EMD [Emergency Medical Dispatch] instructions and keep track of the incident, as well as send emergency alerts if afterhours, which is too much for one person.

A Gunnison County respondent made a similar point saying that the expectations for alerting do not align with existing software, systems, and capabilities, especially in rural jurisdictions.

Figure 6. Top Resource Needs



Alert authorities use available resources to translate alerts, but each has limitations. More than half of survey respondents (57.9%) reported using AI to translate messages compared with 20.5% who use multilingual staff and 12.3% who use live translation services like Language Line, which offers two- and three-way calls with an interpreter. Others were unsure (4.7%) or used another system (4.6%) for translation. Of those who use AI services for translations, over half (55.6%) use apps such as ReachWell that they pay to use, while the rest use free translation services (25.7%) such as Google Translate. Those that use ReachWell felt that the app works well and provides better and more customizable translation than other automated translation services. Despite the advancements in AI translation, best practices suggest that human interpreters should review emergency alert messages.

However, live interpretation also has limitations, including the potential for poor interpretation of emergency terminology or long wait times. Conversations with Eagle County Emergency Management revealed that translation by multilingual staff and Language Line interpreters can take 5 to 10 minutes depending on the message and emergent situations. With some events, such as an active shooter situation that might last less than that, make these options insufficient for certain emergencies [64]. Despite these issues, respondents highlighted the benefits of having multilingual staff available to review and translate messages, such as one respondent who collaborated with bilingual members at the local library and county office to help translate emergency materials.

Authorities recognize issues with AI but need resources and support to adjust practices. Alerting authorities acknowledge that AI is an imperfect tool that has led to poor translations or messaging that is not culturally competent. Inaccurate translation can create confusion for message recipients and reduce their trust in the alerting system. Some alerting authorities feel that the expectations of emergency alerts do not correspond with what is feasible. A respondent from Gunnison County shared,

[Despite new vendor capabilities for access and functional needs], we simply do not have the resources (both financial and people) to deploy all of these systems. Not to mention more systems = more complexity. Particularly in an immediate life safety situation, an alert really needs to go out in ~5 minutes, and the reality is right now due to technology and resource constraints, it is just not possible to do that AND make sure it hits every single population demographic in our County.

To make inclusive alerting possible, there needs to be support from the state of Colorado for all counties. Beyond funding and capacity, Michael Willis, Director of the State Office of Emergency Management (OEM), and Mick Trost, Strategic Communications Director for OEM (September 25, 2023), along with several County Commissioners (September 28, 2023) pointed out that other important needs included training in technology use and message development, guidance on best practices for inclusive alerts, as well as access to technology. These were further reiterated in other partner meetings [75], [76].

Finding 4. Implementation for language and disability access are varied and inconsistent across the state. Some alert authorities are not aware of options for making alerting more accessible or face issues with existing systems – as a result they rely on practices that may not meet community needs. Others are making great strides but still face challenges.

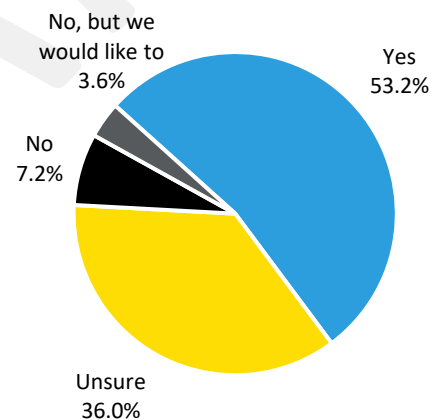
Some local alerting authorities are unsure on how they provide accessible alerts or shared significant limitations in reaching diverse audiences. More than half of the survey respondents (53.2%) stated that their current system has multilingual alerting capability, but more than one-third were unsure (36.0%) (Figure 7). A few indicated they lacked this capability (7.2%) or lacked it but would like to provide it (3.6%). Among those with multilingual alerting capabilities, the largest percentage provide alerts in Spanish (45.9%), followed by Chinese (9.9%), Russian (9.0%), German (9.0%), and Vietnamese (8.6%). Several respondents indicated the ability to translate into any language (11.3%). However, given resource constraints, many shared that having language capabilities does not always result in use.

Some respondents elaborated on challenges they face when providing translated emergency messages. Three issues were repeated across these responses. Twelve shared issues with delays in disseminating messages in other languages, nine found automated translations to be inaccurate or confusing, and eight shared concerns about opt-in rates for LEP populations across alert systems. These challenges were echoed in the review of literature. Other issues included poor integration of translation options into alerting software (3 people), message length and character use constraints (3 people), translation time requirements (4 people), and availability of multilingual staff (e.g., off-duty during event) (1 person). Many mentioned using Google Translate, but this process was time-consuming and often produced poor translations, such as place names being translated literally, causing confusion, such as what happened when emergency managers tried to translate “Eagle County,” which literally translated into “bird County” [64]. Some respondents had access to multilingual staff or to real-time translation services but found those avenues too time-consuming to use during an event where every second counts. A respondent from San Miguel County said,

...we usually resort to online translation services, but they are rarely correct. It's a catch-22 when we are expected to get warnings out as quickly as possible in every language possible, but doing so isn't possible in a timely manner.

One avenue for addressing time constraints shared by two respondents included developing message templates that were pre-translated. To address these issues, Sedgwick County, “started creating pre-drafted messages that can be created in advance of the most likely incidents according to our regional hazard mitigation plan. This allows us to have the message 90% ready for dissemination before an incident.” At the IPAWS Conference (September 27, 2023), we found that new tools are being developed to help with message creation and generation and can be

Figure 7. Capability to Send Multilingual Alerts



employed to ensure English messages are complete before they are translated, ensuring English and non-English speaking audiences are getting accurate and actionable information [77]⁹.

Respondents are often unclear whether the systems have capabilities for disability access or report technical issues. Just over half of survey respondents (50.5%) were unsure if their systems have the capability to send messages to people with disabilities (**Figure 8**). Of the 91 respondents whose systems had these capabilities, 44 provided additional insights. Some shared that messages went out in a variety of ways that provide access for people with disabilities including texting, landline phone calls, email, text to voice, and teletypewriter/telecommunications devices (TTY/TDD)¹⁰. A Yuma County respondent said, “[the alert system] has text for people who can't hear. It has Spanish for people who don't speak or read English. It has phone call for people who are blind.” However, Kay Chiodo, CEO of Deaf Link, shared that because ASL is not English, members of the Deaf community have varied levels of English comprehension, making English text alone insufficient for emergency communication [67]. Respondents also noted that individuals have to make sure they are signed up properly to receive accessible alerts. Regarding TTY, a respondent from Gunnison County said, “I do not think it is very effective because the person has to know to sign up for the TTY channel when registering. We include this information on instructional videos/flyers, but [I] imagine it is easy to miss.”

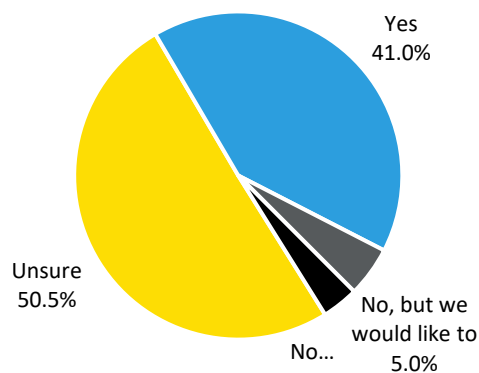
Two respondents have additional systems like Deaf Link that provide ASL alerts through their Accessible Hazard Alert System (AHAZ) and shared positive experiences. However, these systems can be expensive and may not be feasible for places with limited budgets, reiterating the need for resource sharing across jurisdictions. Other issues respondents shared include delays with the Video Relay Systems (VRS), software limitations, and difficulties with programming message templates with TTY due to glitches¹¹. A person from San Miguel County said, “One problem we have noticed is that if we select the TTY channel when sending a message and none of our contacts have TTY, the entire message will fail.”

There is a lack of consistent guidance for inclusive alerting options or recommendations. Sadie Martinez, the Access and Functional Needs (AFN) Coordinator for the Colorado Office of Emergency Management, shared that traditional emergency response training does not typically include training on AFN or language access [66]. However, emergency response personnel are willing to adopt more inclusive practices but need guidance and support. Additionally, given the high turnover rates, regular training is needed to ensure inclusive practices are developed and maintained, with LEP communities and populations with disabilities getting integrated into alert training and planning processes. This will ensure diverse needs are being met and processes are comprehensive.

Finding 5. Technical and practical limitations of emergency alerts hinder most people and compound the challenges faced by those with disabilities and populations with LEP. These include delays in technology upgrades, limited awareness of systems, pushback from private industry, among others.

Our findings brought up limitations to existing systems that stymie access to alerts for everyone. Even though this study focuses on LEP populations and those with disabilities, the patchwork of alert systems, low opt-in rates, limited alerting

Figure 8. Reported Capability to Send Alerts to People with Disabilities



⁹ Sutton and FEMA are developing a Message Design Dashboard (MDD) to assist in developing complete messages. See [78].

¹⁰ TTY and TDD are both types of assistive technology that allow blind, Deaf, and Deaf-Blind individuals to access information.

¹¹ Literature recommends texting and text-to-speech capabilities be implemented into systems, such as N-1-1 and 9-1-1 systems and smart alert devices in homes and cars [24], [37], [79], [80].

agency capacities, and varied planning processes have implications for emergency alerting for every Coloradan and visitor to the state. Agencies learned from previous emergency events and have made significant changes, but more work is needed. Garry Briese, (September 14, 2023) shared that if there were excellence in emergency alerts and warnings systems, the media would have already found them. But excellence is not being done anywhere [Paraphrased: 87].

Advances to alerting technology are disappointingly slow. Federal policy change and enforcement are needed to address it. Each cellphone company has different approaches to supporting alerts, feeding into the patchwork of alerting systems. Further, commercial mobile services are not mandated to participate in sending WEAs (although most larger companies do as part of their corporate social responsibility) [27]. These differences create hiccups in WEAs delivery depending on cellphone type and mobile service. These companies do not profit from providing alerting services, so they agree but often petition against changes, severely limiting advances. According to Jeannette Sutton, professor in the College of Emergency Preparedness, Homeland Security, and Cybersecurity at the University of Albany, the FCC has proposed several updates to the WEA and EAS systems to make them more inclusive, but has received pushback from private industry that limits recommendations from being realized [81].

Statewide support and approaches are needed to address these issues with opt-in systems. Most alert types require people to opt-in in some way, such as through an alert vendor or social media. With the public and visitors having limited awareness of alerting systems and hazards [70], tremendous outreach and incentives are needed to boost opt-in rates [82]. The patchwork of alerting further contributes to issues as people must be aware of which system is relevant for them based on where they are located at the time. Visitors and new residents are even more unlikely to be aware of these systems or the need to sign up. Given the limited capacities of alerting authorities shared in conversations and survey responses, the responsibility to inform residents and visitors of alerting systems cannot fall solely on alerting authority personnel. More could be done to meet people where they are and develop cultures of preparedness [83].

The lack of statewide guidance on alerting results in confusion for both alerting authorities and for the public. Guidance and training are needed on which alert systems and communication modes to use, recommended verbiage in English and other languages¹², and protocols for translation and disability access and will help standardize practices. Jeannette Sutton shared that,

The emergency managers that I talk to are not using it [WEAs] because they are scared of it – if they use it wrong, they are making a huge mistake. The alerting software is so complicated to learn how to use, if the one person who is trained leaves, the memory of that is gone [81].

According to representatives from Deaf Link and Steve Staeger and Sam Bergum of 9NEWS Colorado, without guidance and training, inappropriate alerting channels may be used, and messages may leave out important content or use terminology that is not widely understood such as “shelter in place” or “level-1 evacuation” [67], [84]. For emergencies, the Colorado State 911 Program Manager Jennifer Kirkland (September 7, 2023) shared that 911 operators are often the first point of contact but may not have training or familiarity with a specific event and must take on the difficult task of gathering and distributing information as they receive it [85]. Support and training across alerting agencies will help ensure best practices are adopted during emergencies. Having space for communities to create systems that fit their needs is essential, however, the State can provide resources and best practice informed guidance to help jurisdictions improve their local systems.

¹² New York City developed a glossary of emergency terms translated into their top 13 languages for alerting authorities to use [82].

Recommendations

Based on these findings, the report recommends that the State of Colorado adopt a series of actions that fall under three pillars: (1) people, (2) practices, and (3) data and funding. These recommendations serve as a starting point, but creating inclusive emergency alerts requires an enduring commitment to equity, inclusion, and access for all.

People

Hire State-Level Personnel to Address Language Access Needs

Hiring personnel to focus on language access needs could ensure consistent support for local inclusive alerting efforts. Responsibilities might include assessing local needs; developing plans, resources, and training; tracking metrics, and promoting the adoption of inclusive practices across Colorado and seeking funding to support these activities. Staff could coordinate with the existing Colorado Office of Emergency Management access and functional needs team.

Develop Formal Relationships with Limited English Proficiency (LEP) and Disability Communities

More could be done to establish trusting connections between emergency response agencies and community groups before emergencies. Actions could include developing steering committees, forming advisory councils, and hiring community champions or multilingual staff.

Practices

Standardize Alerting Practices Across the State

Develop statewide alert standards to ensure consistent language and disability access and reduce barriers for local authorities. Actions may include standardizing alert vendor use, designating alerting authorities, sharing inclusive access materials, and tracking opt-in alerting system registration or subscription.

Create and Distribute Language and Disability Access Resources

Provide guidance, training, and shared resources for language and disability access across jurisdictions. Actions can include conducting regular training on cultural competency, community needs, technology options, and creating shared resources such as glossaries and translated templates. Alert message templates for Colorado would need to be developed based on input from linguistically diverse communities and populations with disabilities and alerting authorities and research best practices.

Data and Funding

Support Research to Fill Information Gaps to Support Inclusive Practices

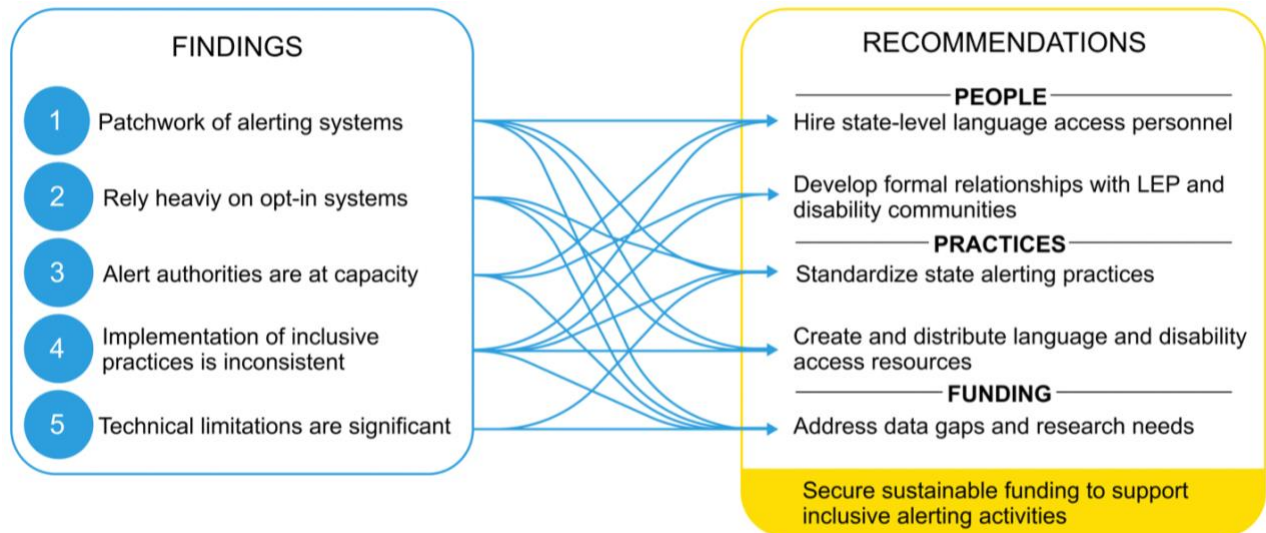
This study uncovered areas where more qualitative and quantitative data are needed to offer evidence-based recommendations for implementing practical changes. Examples of research objectives include, identifying areas where LEP populations make up 5% of the service area or 1000 people; surveying the public, LEP, and people with disabilities on opt-in alert systems awareness and use; summarizing practical guidance for developing formal working agreements with community organizations and individuals; assessing funding implementation needs (e.g., grant writers, funding list, etc.) and processes; Assessing and ranking policy changes for language and disability access; Compiling case studies and guidance on implementing inclusive alerting practices.

Secure Funding to Support Inclusive Alerts

Unfunded mandates are unpopular and unlikely to address findings. As such, funding is needed to support people, practice, and data recommendations outlined above. Given capacity issues, grant writing assistance may be needed to ensure that Colorado communities can access and use funds to improve their systems (see Appendix B for list of potential funding opportunities). Additionally, since funding is critical to inclusivity [24], [36], [79], [86],

[87], the Colorado General Assembly should identify opportunities to reallocate existing funds to advance inclusive alerting across the State.

Figure 9. Findings Mapped to Recommendations



Conclusions and Next Steps

Throughout this study, it was clear that emergency officials, alert providers, and community representatives share a united vision: provide lifesaving emergency information to those who need it. It is this shared commitment that pushes policy forward to create more inclusive emergency alerting in Colorado. Despite the technological challenges that persist, there are tremendous opportunities to learn from one another and implement systems that work for each community. We also know that by addressing the barriers to receiving and responding to emergency alerts for diverse communities, especially people with LEP and disabilities, it will also address issues for the broader population [36], [88], [89]. It is evident that no single solution exists, but rather, many solutions and opportunities that can be shared and built upon. Like pieces of fabric being stitched together to form a strong and cohesive quilt, the current patchwork of alerting in Colorado can be strengthened through collective action to ensure that all people, regardless of language or ability status, receive lifesaving emergency information.

*“To not know and do nothing is forgivable,
to know and do something is admirable,
to know and do nothing is unforgivable.”*

*-Life motto shared by Sadie Martinez,
AFN Coordinator, State Office of Emergency Management*

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Acknowledgements

Thank you to the dozens of individuals who made this research possible. Special thanks to Representative Velasco, Micki Trost, Jennifer Kirkland, Garry Briese, and Shirl Garcia who provided project support and guidance; the Natural Hazards Center staff for providing review and assistance throughout; the emergency response personnel of Colorado who gave their limited time to respond to our survey and have spent their lives in service to their communities.