FINAL REPORT

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

University of Colorado Boulder

NATURAL HAZARDS CENTER

January 2024

CONTENTS

Recommended Citation:

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 was 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 that, while flexible, makes it challenging to provide consistent and accessible emergency alerts.

Finding 2. Colorado relies heavily on opt-in emergency alert systems but most localities 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. Given resource constraints, alerting authorities turn to resources that are available to provide alerts in other languages, but they may not align with best practices.

Finding 4. Many emergency response personnel are interested in incorporating systems and practices that would make alerts more inclusive, but need more guidance, funding, and personnel to adequately do so.

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 and pushback from private industry, among others.

Recommendations

Colorado has an opportunity to become a national leader in emergency alerting and save lives when inevitable emergency events occur. Based on our assessment, 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. These recommendations are meant to serve as a starting point for systemic change.

People

Hire State-Level Personnel to Address Language and Disability 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.

Develop Formal Relationships with Limited English Proficiency (LEP) and Disability Populations. More could be done to establish trusting connections between emergency response agencies, news agencies, and community groups before emergencies. Actions could include forming relationships with existing committees, establishing advisory councils, and hiring community champions or multilingual staff to assist before and during emergency events.

Practices

Adopt One Centralized Alerting System and Standardize Alerting Practices Across the State. To address the patchwork of current emergency alerts, the state should consider adopting one centralized emergency alerting system. It is also important to 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. Any statewide standards should allow for flexibility for local jurisdictions and offer consistent support through funding, resources and training.

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 humility and competency, bias-awareness, intercultural communication, community needs, translation best-practices, and technology options. The state should also work collaboratively to create shared resources such as glossaries and translated templates. Alert message templates 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 future research needs include, 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; and compiling case studies and behavioral research on public response to emergency alerts.

Secure Funding to Support Inclusive Alerts. Unfunded mandates are unpopular and unlikely to address the key issues uncovered in this assessment. As such, funding is needed to support new personnel, novel practices, and data needs. 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, the Colorado General Assembly should identify opportunities to reallocate existing funds to advance inclusive alerting across the State.

ASSESSING INCLUSIVE LANGUAGE IN EMERGENCY SITUATIONS

Introduction

Emergencies are inevitable, but how leaders respond to them is a choice. Emergency alerting[1]—the process of sending emergency information to communities rapidly—has received heightened attention in the past decade. The Grizzly and Marshall Fires in 2020 and 2021, respectively, brought to light issues with alerting systems in Colorado when protocols were not in place to translate alert messages into non-English languages [2] and many people did not receive evacuation notices through their phones leaving many to make decisions without direction from authorities [3].

These events 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: individuals who are considered LEP and people with disabilities. As Colorado becomes more diverse and climate change creates new hazard risks [4], 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.

This study was completed between August and December 2023 provides a first look at inclusive alert systems in Colorado. The research team focused on examining how emergency information is distributed to diverse audiences through alerting authorities in Colorado but recognize that additional research is needed to understand how Coloradans receive emergency messages and their knowledge of alerting systems. Though this study provides recommendations, governing bodies and authorities in Colorado will be responsible for determining adoption and implementation of recommendations.[2]

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[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.

[2] Though we reference private alerting companies in this report, the Natural Hazards Center does not endorse any specific company for use in Colorado. Funding for this study was allocated through House Bill 23-1237.

A Diverse State

Colorado is home to more than 5.8 million people who come from diverse backgrounds and circumstances, and some of whom have greater risk to disaster impacts. The two populations highlighted in this report are populations with LEP and people with disabilities, specifically people who are Deaf, blind, Deaf-Blind or hard of hearing. 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%) [5]. According to the Migration Policy Institute, more than 250,000 Coloradans have limited proficiency in English (Figure 1), meaning they have difficulty comprehending and communicating in English [5].

About one in ten adults in Colorado—more than 500,000 people—have hearing and visual disabilities [6] (Figure 2). The Centers for Disease Control and Prevention define hearing disabilities as "deafness or serious difficulty hearing" and visual disabilities as "blindness or serious difficulty seeing even when wearing glasses" [5]. We use the term 'people with disabilities' throughout the report in lieu of 'people with visual and auditory disabilities' to be concise but recognize that there are many types of disabilities not related to hearing and vision. The needs of those with disabilities and LEP are often overlooked in emergency plans and can lead these populations being underprepared and disproportionately impacted when a disaster occurs [7].

Legislation on Inclusive Alerting

The landmark 1964 Civil Rights Act [8] and other related U.S. legislation focus 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 [8]–[11]. More recent executive orders promote equity, including full participation of immigrants and refugees in civic life and eliminating language barriers [12]–[14]. Various influential federal guidance and memos require services for LEP populations and those with disabilities, including guidance issued by the U.S. Department of Transportation, Department of Justice, and Department of Health and Human Services [15]–[17]. 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" [12]. Further, the Federal Communications Commission requires that emergency information is accessible to people who are Deaf/Deaf-Blind, hard of hearing, or those who have visual or intellectual disabilities [18]–[21].

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,[3] whichever is less [22], [23]. 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.

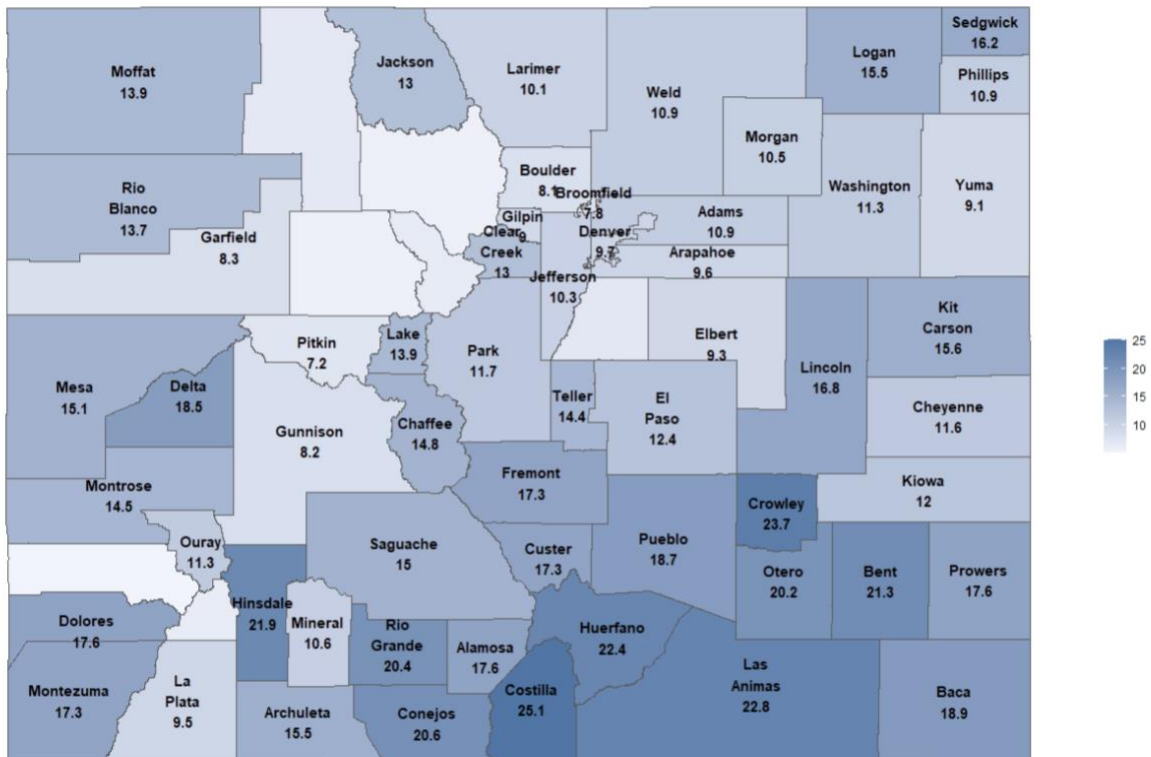[3] Languages that don't meet these criteria should still be considered in language access planning.
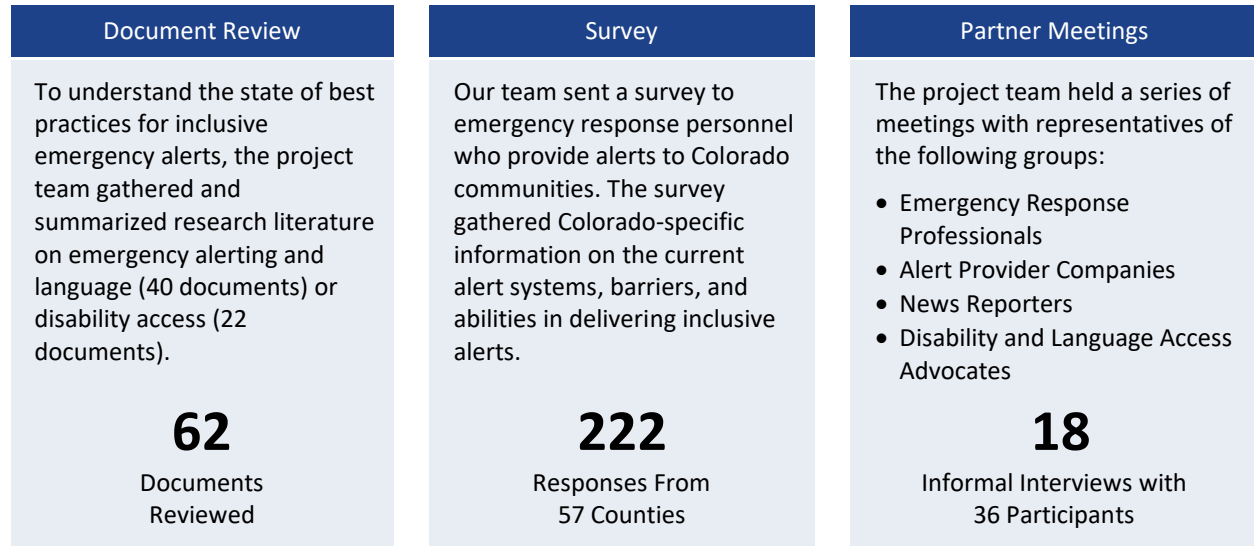
Figure 1. Percentage of Households in Which No Member 14 Years Old or Over Speaks English "Very Well," by County. *Counties with less than 0.5 percent are not labeled.* [24]
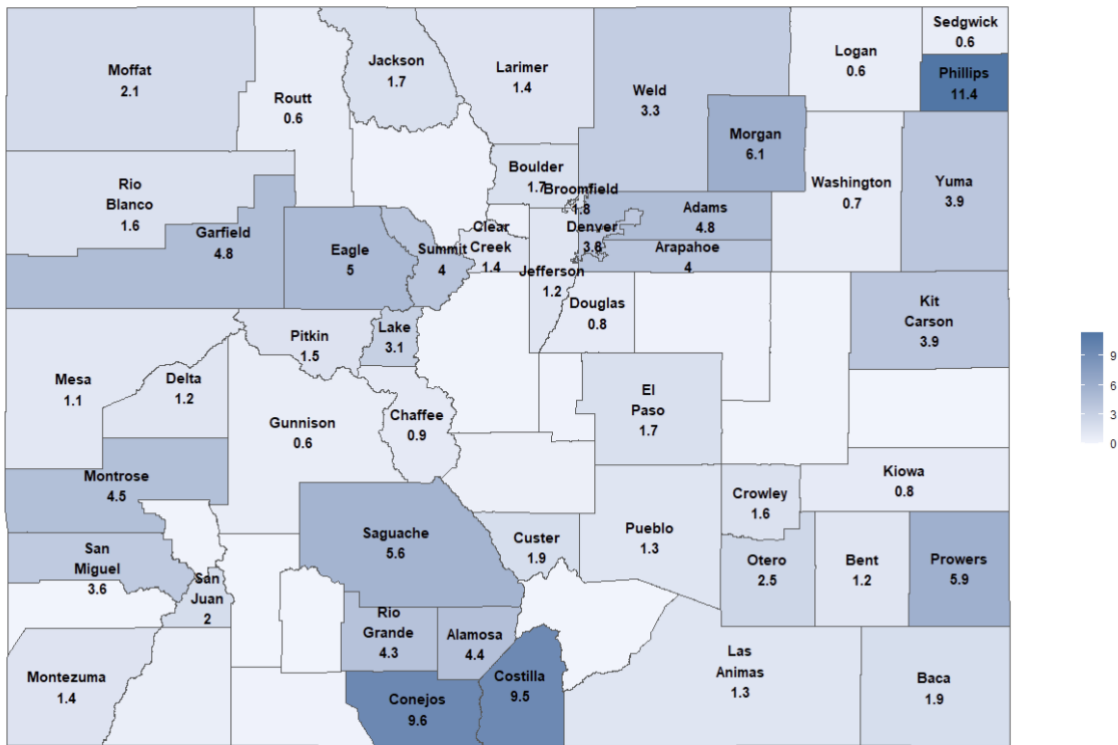
Figure 2. Percentage of People with a Disability, by County. *Counties with less than 7 percent are not labelled.* [25]
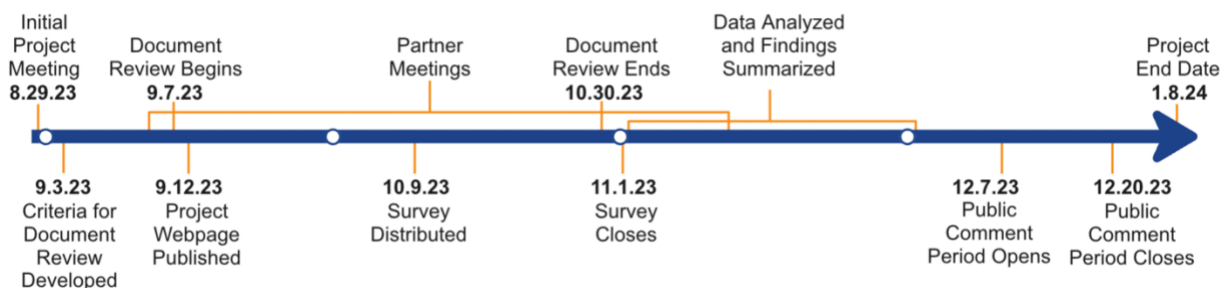
Methods Overview

Document Review	Survey	Partner Meetings
To understand the state of best practices for inclusive emergency alerts, the project team gathered and summarized research literature on emergency alerting and language (40 documents) or disability access (22 documents).	Our team sent a survey to emergency response personnel who provide alerts to Colorado communities. The survey gathered Colorado-specific information on the current alert systems, barriers, and abilities in delivering inclusive alerts.	The project team held a series of meetings with representatives of the following groups: • Emergency Response Professionals • Alert Provider Companies • News Reporters • Disability and Language Access Advocates
62 Documents Reviewed	**222** Responses From 57 Counties	**18** Informal Interviews with 36 Participants

Public Comment. The research team also sought public comment on a draft version of this report from December 7 to December 20, 2023. Interested parties had the opportunity to provide *verbal feedback* by attending one of two listening sessions held on December 14, 2023 (see Appendix E3 for attendance counts). These sessions were convened in English and offered ASL and Spanish-language interpretation. Members of the public were also invited to provide *written feedback* through a form posted on the Natural Hazards Center website. The form was open until 5:00 p.m. MST on December 20, 2023. Ninety-three people attended the online public comment sessions and we received 48 written comments via the form and direct email messages. We incorporated comments into the report where appropriate.[4]

Study Timeline

Initial Project Meeting 8.29.23 — Document Review Begins 9.7.23 — Partner Meetings — Document Review Ends 10.30.23 — Data Analyzed and Findings Summarized — Project End Date 1.8.24

9.3.23 Criteria for Document Review Developed — 9.12.23 Project Webpage Published — 10.9.23 Survey Distributed — 11.1.23 Survey Closes — 12.7.23 Public Comment Period Opens — 12.20.23 Public Comment Period Closes

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[4] Comments that were outside the scope of this report were recorded and may help guide future research-related activities.

HOW EMERGENCY ALERTS WORK

This section provides a basic summary of how emergency alerts work and context for the upcoming sections.

The **alerting process** starts when an **alerting authority** determines the need to send an alert. Next, they craft the **message** to be sent, and then that message is dispatched to the public through various **channels** using a range of **systems**. In Colorado, each step depends on the jurisdiction, so it's important to know all the parts of the process.

Alerting Authority: An organization designated to issue alerts during a disaster, emergency, or other threatening situations. Alerting authorities include county emergency management departments, 9-1-1 call centers, sheriff's offices, local police, fire departments, among other agencies.

Alert Message: This is the message sent to the public. Ideally, it includes clear information about the threat and what protective action to take. A challenge many alerting authorities face is ensuring these messages, typically composed in English, are also available to people who have LEP and those with disabilities.

Channels: Channels include all the various ways a message can be sent to the public. This can be through everyday means such as social media, news releases, radio or television broadcasts, sirens, or going door-to-door. They also include specialized, third-party systems that residents must sign up for. Channels determine the type of information, such as the number of words and character types, a message can contain.

People with disabilities sometimes subscribe to channels that deliver alerts tailored to their needs and those with LEP do the same to receive alerts in their preferred language. Jurisdictions may or may not be able to support the direct delivery of alerts through such channels.

Finally, Wireless Emergency Alerts, sometimes called WEAs, allow anyone with a cellphone in a specific
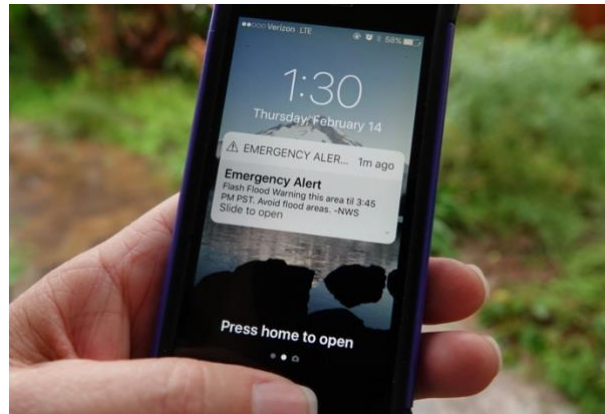
geographic area to receive an alert. These must be under 360 characters (under 90 characters for older phones) and are limited to English and Spanish.

Systems: A system is needed to issue most alerts. In most cases, alerting authorities contract with third-party alert vendors who have software systems in place to send a message through multiple channels, including different capabilities to serve people with disabilities or LEP.

Nationally, the Integrated Public Alert Warning System, or IPAWS, which is run through the Federal Emergency Management Agency (FEMA), allows authorities to send alerts directly through many channels, including the Emergency Alert System messages seen on television and radio. IPAWS must be used to issue a WEA. Alerting authorities must go through a series of steps to become designated to use IPAWS.

Given the many variables at play, alerting authorities can have challenges in reaching the general public. These issues are amplified for those with disabilities and limited-English proficiency. Careful consideration needs to be given to how messages are crafted and what channels they are sent through as many channels do not support multiple languages or other accessible formats. The systems chosen to send messages are also key, since not all systems or vendors can reach all populations.

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" [26]. 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 as well as within Colorado.

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. Authorities must have an alert vendor to send WEAs, as explained below.
Emergency Alert System (EAS)	Alerts are broadcast on 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 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 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 need (e.g., reach non-English speakers or the Deaf and Deaf-Blind). Examples include ReachWell and Deaf Link's Accessible Hazard Alert Systems (AHAS).
Written or Visual Alerting	Websites, email listservs, and texting can be used to provide emergency information to people. Often the websites of alerting authorities will include active alert notices. Additionally, social media platforms may be used to distribute alert messages.
Sound-Based Alerting	Alerts can be sent through auditory means such as sirens, phone calls, or radio or television broadcasts.
Face-to-Face	This includes in-person alerting, such going door-to-door, and may be used for hyperlocal alerting needs, such as evacuations.

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 [27] 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

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	• The name of the impending hazard type, threat, or event • Information describing the hazard • Information about the potential consequences from the hazard
Guidance on Protective Action	• Information about how people should protect themselves or the actions they should/could perform
Location of the Hazard	• Information about location, including relevant landmarks; town/city/county; road/intersection/highway or zones
Time Remaining to Take Protective Action	• When message receivers should expect hazard impact and when they should act • When the message expires
Risk Information Source	• Name of the organization providing the information

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).

Researchers built upon this work by conducting an extensive review of 90- and 360-character WEAs sent to public audiences [26], [28]. They found that many did not comply with Mileti and Sorensen's [27] 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 [29], 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. 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:

- Published 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 [30]–[34] or only shared in additional languages or modalities (e.g., American Sign Language [ASL]) if requested or in special circumstances [35], [36]. If LEP populations or people with disabilities are unable to understand a message, they may ignore the warning and not take protective action [37], or they may respond inadequately [38] because they lack critical information [32], [39]. Those in charge of distributing emergency alerts should be aware of the barriers that prevent LEP populations and people with disabilities from receiving and understanding them.

Emergency alerts may not be available in multiple languages. Not all alerting 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 [35], [40]. Agencies that have access to translations services might not use them [31] or might require residents to register for services that send alerts in their preferred language [41]. Additionally, lack of ASL interpretation impedes access to alerts for people who are Deaf and hard of hearing [39], [42]–[45]. Delays are also sometimes caused because translation in emergencies is often carried out by many different people in real time [46].

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 [32], [42], [47], [48] and delay response times [49]. Due to this delay, populations can lose a sense of urgency [39] and delay taking protective actions.

Emergency alerts may be distributed in ways that are inaccessible or undesirable. Sending alerts via the Internet [50], radio, loudspeakers, a television chyron (text which scrolls at the bottom of the television screen) [51], or text-based alerts [43] can impede access for LEP populations and those with disabilities. Knowing that not all channels are accessible means that it is best to distribute warnings through multiple means. For example, Longmont Resiliency for All [52] conducted a study after the 2013 Colorado floods and found that disseminating emergency alerts across several multimedia channels could increase access for Spanish-speakers in Longmont and Boulder Counties.

LEP populations and populations with disabilities may lack trust in government agencies, which may reduce their engagement with emergency alerts. These populations may not trust government authorities to be credible, unbiased, accurate, or balanced [53] because of perceived or real discriminatory experiences during past emergencies such as the COVID-19 Pandemic [48]. This is particularly a barrier for immigrants without documentation [48], [54]–[56]. These groups may be unwilling to respond to messages or to seek help due to fear [31]. Furthermore, research shows that people with disabilities can perceive governmental authorities as uncaring about their well-being during emergencies [42], [57].
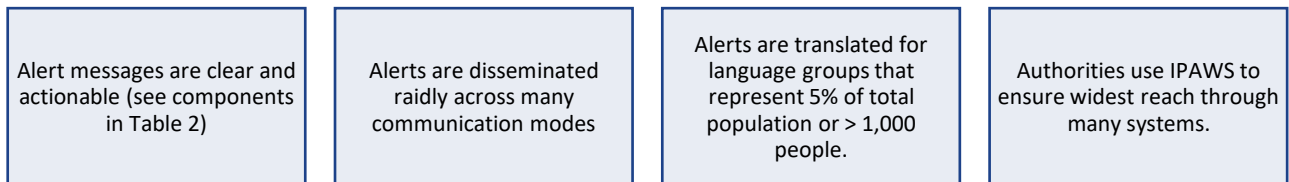
Cultural context is often missing from translated emergency alert messages. This can leave people without important information and unprepared for an emergency event [45], [58]. Word choice, connotation [39], [45], usage [59], and correct use of diacritical marks (characters above letters) [60] can greatly impact the meaning of translated messages. Therefore, 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 hazards in the United States. LEP populations include immigrants, who might not be aware of the types of hazards that occur in the U.S. [32], [37], [39], [54], [56], [61]. Furthermore, cultural beliefs can affect their willingness to take protective action [37], [61]. "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 [36] nor should LEP populations and people with disabilities be homogenized [39], [55]. Messages need to be tailored to address the unique information and cultural needs of LEP populations and people with disabilities [53].

Despite the presence of barriers outlined above, researchers and others identified best practices for inclusive emergency alerting (Figure 3). Recommendations include training personnel 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.

Figure 3. Essential Components of Inclusive Alert Systems

Alert messages are clear and actionable (see components in Table 2)	Alerts are disseminated raidly across many communication modes	Alerts are translated for language groups that represent 5% of total population or > 1,000 people.	Authorities use IPAWS to ensure widest reach through many systems.

ALERTING 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 sought information 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. Our research team held a series of informal interviews with relevant partners (see Table 3; for a full list of partners; also 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 in Colorado, 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 9-1-1 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 data.

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. Faculty and 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 9-1-1 offices and Public Safety Answering Points (PSAPs),[5] 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 an email. We sent a reminder email at the midpoint of the survey period and a second email two days before the survey closed through the same listservs.

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

The survey collected respondent information and contained questions about the designated alerting authorities; hazard events and messaging channels, frequency, and use of alerts; language and disability access capabilities and needs; and general comments. We asked survey 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.

We received 222 complete survey responses[6] representing 57 of Colorado's 64 counties (see Figure 4). Most survey respondents were emergency managers (n=65; 27.5%), followed by fire chiefs, captains, or officials (n=44; 18.6%), public safety answering point representatives (n=36; 15.3%), and police chiefs (n=30; 12.7%). Most survey respondents represented counties (n=101; 45.5%), while some represented a city or town (n=71; 32.0%). There was a high level of representation from four counties: Weld (n=12; 6.6%), Jefferson (n=11; 6.0%), El Paso (n=8; 4.9%), and Arapahoe (n=8; 4.9%). Seven counties—Archuleta, Bent, City and County of Denver,[7] Dolores, Las Animas, Lincoln, and Mineral County—were not represented in the survey.

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[6] 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.

[7] Although the City and County of Denver is not represented in survey results, their 9-1-1 Communications Center did participate in a meeting and are represented in the findings.

Figure 4. Counties Represented in the Survey with Number of Individuals who Participated
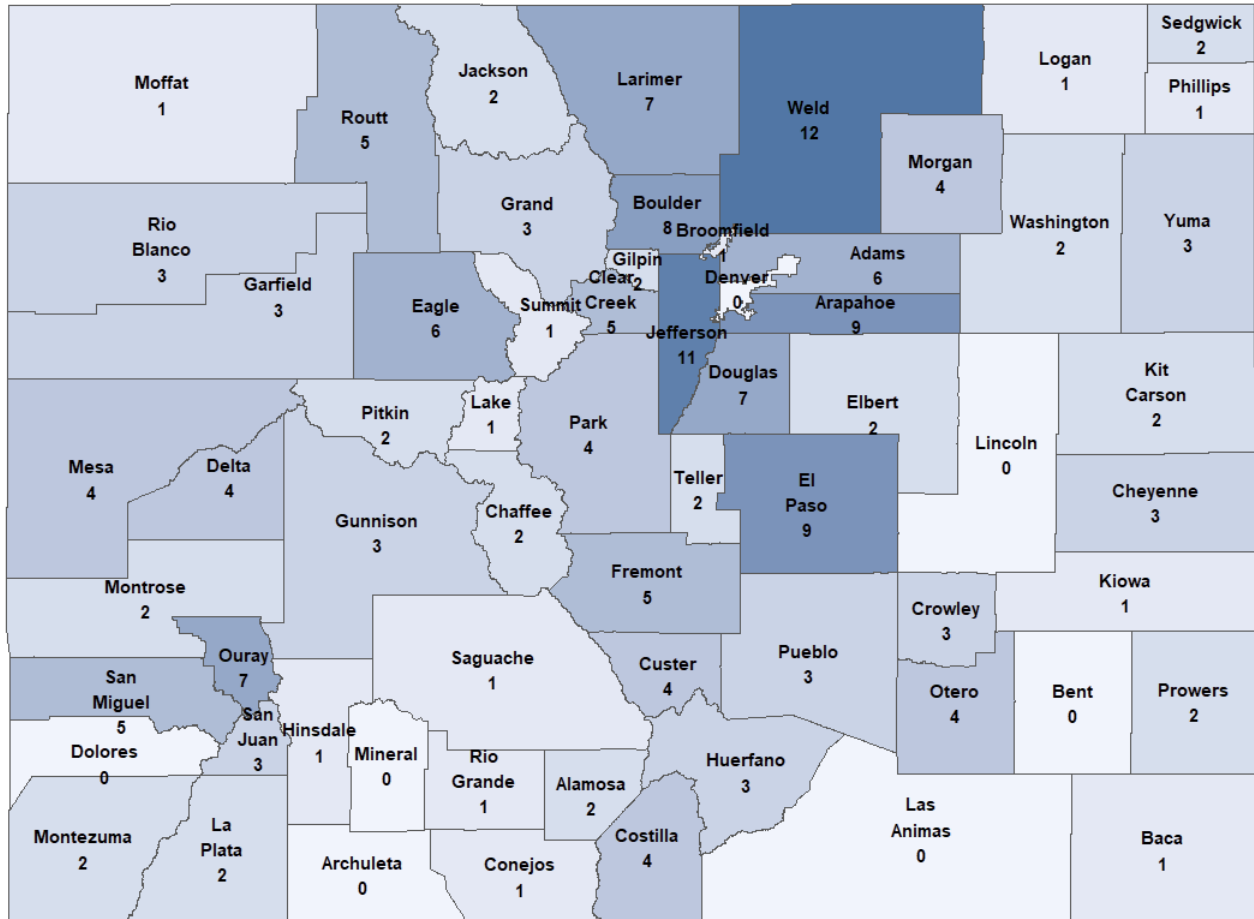
Findings for Colorado

Finding 1. Colorado's alert systems and processes are a patchwork that, while flexible, makes it challenging to provide consistent and accessible emergency alerts.

No statewide system or alerting standards exist. The agency responsible for alerting and the systems in use vary by jurisdiction (Appendices F and G1). The survey revealed that more than six authority types are responsible for sending alerts (Figure 5). The top three were emergency telephone services (9-1-1, dispatch, etc.) (n=153; 33.8%), emergency management offices (n=110; 23.4%), and sheriff's offices (n=80; 17%). Conversations with partners revealed that authorities will sometimes share alerting responsibilities within an area, such as university and city police, to pool resources or to leverage the varied strengths of each authority during emergencies. The choice of alerting systems for each authority depends on local discretion and resources (see Finding 2 for more details) but has implications for how alerts are sent and who can receive them. Partners from Larimer and Eagle counties shared that while having 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 by diverse populations [62], [63]. Resources are often more available for urban communities than rural ones, making resource sharing vital for lesser resourced areas.

**Figure 5.** Agencies Responsible for Sending Emergency Alerts
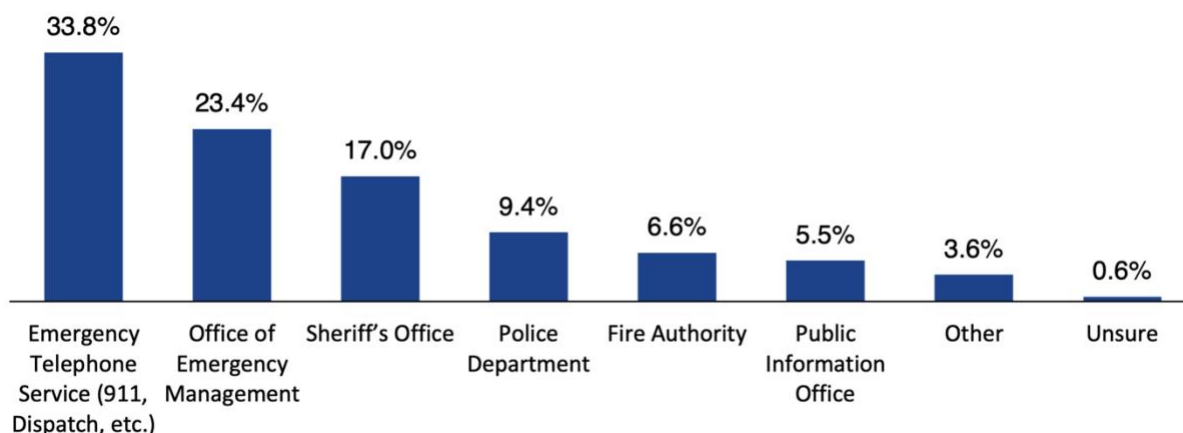
Community resources largely determine the level of access that can be provided. Fernando Almanza of Eagle County Emergency Management (October 17, 2023) and Sadie Martinez, the Colorado Office of Emergency Management Access and Functional Needs Coordinator (November 9, 2023) shared that some jurisdictions have more comprehensive alerting resources for LEP populations (e.g., ReachWell) and people with disabilities (e.g., Deaf Link), while areas with fewer resources may not be able to provide these services [62]–[64]. In a meeting with Deaf Link (November 6, 2023), we learned that this inconsistent 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 [65], highlighting that access in this current system depends on jurisdictional boundaries.

Figure 6. Alerting authority responses to, does your agency offer multilingual alerts? (n=222)
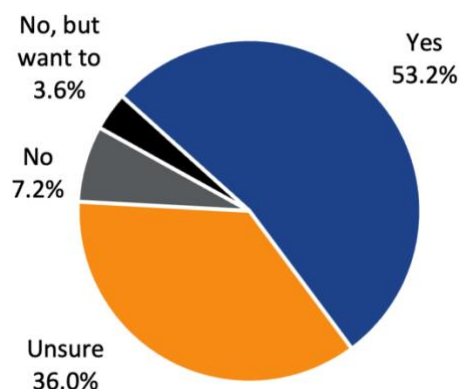
Capabilities to support multilingual translation and provide alerts in accessible formats vary. As Figure 6 shows, more than half of the survey respondents (n=118; 53.2%) stated that their current system has multilingual alerting capability and they can support a variety of languages (Figure 7). More than one-third (n=80; 36.0%) were unsure if their current system had translation capabilities. Some indicated they lacked the capability (n=16; 7.2%) or lacked it but would like to provide it (n=8; 3.6%). Just over half of survey respondents (n=112; 50.5%) were unsure if their systems have the capability to send messages to people with disabilities (see Figure 8). Large portions of respondents were unsure of alerting capabilities, which may be due in part to the many systems in use and their training in those systems. Two survey respondents have additional systems like Deaf Link that provide ASL alerts through their Accessible Hazard Alert System (AHAS)[8] 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.

Figure 7. Languages alerting authorities report having the ability to send messages in (n=118)
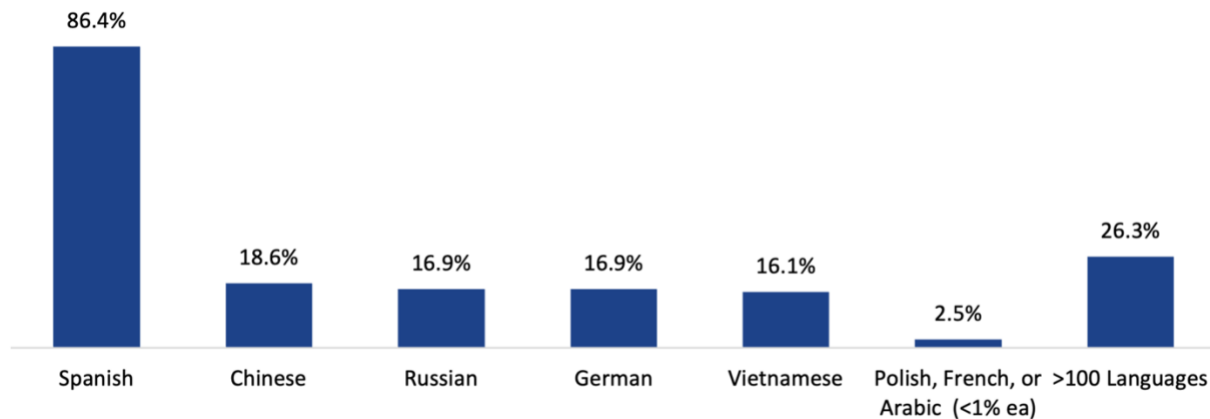
Perceptions of alerts accessibility may not meet actual needs. In meetings with partners and during public comment sessions, people shared that there are misperceptions of what resources are needed to provide accessible alerts. Of the 91 survey respondents who reported that their systems have capabilities to reach people with disabilities, 44 provided additional written insights. They shared that emergency alerts went out through texting, landline phone calls, email, text-to-voice, and teletypewriter/ telecommunications devices (TTY/TDD).[9] A Yuma County survey respondent said their 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 [65]. Others shared that emergency messages need to be compatible with the software Deaf and blind people already use and explained that TTY/TDD is an outdated technology that Deaf people have not used for over a decade. In another comment, a person who is blind shared that simple changes, such as providing alerts in plain language that screen readers can process as opposed to screenshots of text, can

Figure 8. Alerting authority responses to, does your agency offer alerts for people with disabilities?? (n=222)

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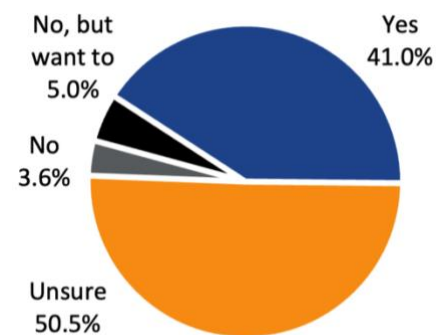
[8] AHAS alerts are developed to address and support the needs of multiple disabilities, including using live ASL and Spanish language interpreters trained in emergency management terminology.

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

greatly improve accessibility. Alerting authorities and officials sharing this information need to understand what these communities use and what is accessible, but the dispersed system makes it hard to provide consistent guidance across the state.

Statewide systems that maintain local flexibility exist. According to a representative for Everbridge (November 10, 2023), Oregon, Florida, and Connecticut have a statewide alert provider that allows municipalities to adopt the system at no cost to them [66]. 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 survey respondent said that having a uniform system would be better because then everyone could become familiar with it. 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. It would also make it easier for people who live, work, recreate, and go to school in different jurisdictions daily as they would not need to register for so many systems. For example, as one participant during the public comment session noted, she may work in one county, live in another, and take her child to school in a third location—all requiring separate opt-ins for emergency alerts. Emergency response personnel emphasized that having set standards would help to reduce resource burdens for people who cross localities and for rural alerting authorities, improve statewide alerting access, and ensure that accessibility and language access are pillars of alerting systems throughout the state. A Gunnison County survey 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 whether a statewide system has previously been discontinued nor why a statewide system has not yet been adopted.

Finding 2. Colorado relies heavily on opt-in emergency alert systems but most localities 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. A survey respondent from Delta County said,

> ...most messages [are] being sent via opt-in systems managed by the county, 9-1-1 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.

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 populations who may be wary of sharing personal information with government agencies [67]. Additionally, to register many need a phone number or email which LEP minority and low-income populations as well as people who are Deaf may not have consistently. 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. Additionally, for some systems, survey respondents noted that individuals with disabilities have to make sure they are signed up properly to receive accessible alerts. Fragmented alert systems further complicate opt-in requirements as individuals must register for each county they frequently visit. This poses problems for people who live and work in different counties and for tourists passing through multiple jurisdictions.

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 alerting authorities' best efforts to send inclusive and best practice emergency alerts, low opt-in rates result in limited reach [68]. Given that Colorado is home to nearly 6 million people and hosts tens of millions of visitors each year, 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 [69].

Of the 200 survey respondents that use an alert vendor, 114 (57%) expressed uncertainty about their service area opt-in rates. Of the 86 people that knew their rates, only 25 (12%) indicated their opt-in rates were above 50%[10] of their total population (Figure 9). Tracking opt-in rates as well as other alerting metrics would help assess the effectiveness of outreach efforts generally 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. Targeted outreach and incentives are needed to boost opt-in rates for populations with LEP and disabilities [70].

Figure 9. Opt-In Rates Reported by Survey Respondents

Social media poses challenges for use in alerting. Apart from alert vendors, we found that social media platforms were the most frequently used notification type across emergency situations, with 82% (n=183) using it for natural hazard events and 72.1% (n=160) for acts of violence (Table 4; for full list, see Appendix G2). According to Justin Singer of IPAWS (November 28, 2023), social media platforms change participant access and use policies over time, which can create issues for sending alerts [71]–[73]. Social media can pose challenges for reaching intended audiences for emergency alerts and may not be a trusted source during emergencies if there have been previous instances of misinformation through those platforms [74]. There is also limited ability to track engagement. Additionally, if agencies share images through social media, which is common, they need to also include plain and alternative or "alt" text, or they will not be accessible for people who are blind. The National Council on Disability [35] 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. Character limits on social media platforms can also limit the ability to provide emergency information in multiple languages. Despite social media being the most used alert type, alerting 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.

Outreach is needed to increase the use of opt-in services. The extensive use of opt-in systems points to a need to strengthen outreach efforts, especially for traditionally underserved populations. We asked the 200 survey respondents that have alert vendors which channels they use to distribute information about opt-in systems generally; 196 (98.0%) use social media posts to tell the public about this service; 169 (84.5%) also promote it at public events, 118 (59.0%) post flyers in public places, 81 (40.5%) share in emails, 61 (30.5%) send mailers to physical addresses, 48 (24.0%) broadcast information on the radio, and 25 (12.5%) broadcast information on local television. Thirty-five survey respondents (17.5%) said they rely on alert vendors to manage information outreach

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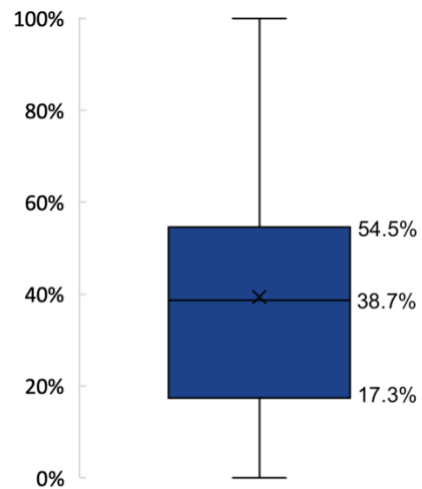
[10] We found some discrepancies in reported response rates for the same region and two people reported rates above 100 percent, which were not included in the analyses.

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

efforts. One hundred twenty reported (56.9%) doing public outreach in other languages, while another 32 (15.2%) do not but would like to. Thirty survey respondents out of the 45 who provided more information (66.7%) said their agency or organization provides materials in Spanish that explain opt-in notification systems. Other than Spanish, one group also offered outreach materials in Russian, and another offered them in French and Polish. Several said they can offer more than 60 languages by using the ReachWell Application (which translates alerts using advanced AI) and others mentioned that the alert providers they use, such as CodeRED, Genasys, and Rave, have multilingual messaging options with varied functionality. Comments from emergency managers and others suggest that statewide assistance on outreach and education about opt-in systems would be appreciated and could be distributed by news agencies, community serving organizations, schools, utility companies, and others.

Alert systems exist that do not require people to sign up, but they have their own access limitations. Wireless Emergency Alerts (WEAs) are sent to mobile phones using cellular technology within a specified geographic area and do not require people to sign up. WEAs use sound and vibration to make users aware that a text-type message has been issued. These alerts can be sent in English or Spanish.[11] Efforts are underway to expand languages supported to include the 13 most common languages spoken in the United States and ASL [75]. For users to receive messages in Spanish, alerting authorities must translate messages 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 cellular coverage can be unreliable in rural or remote areas [62]. An IPAWS Official shared (November 28, 2023) that issues with bleed over exist, but that updates to technology in 2024 should reduce that issue in the future [71]. Additionally, WEAs will not reach landlines so should be sent in conjunction through other channels. Survey results indicate WEAs are the second-highest used alerting channel for natural hazard events (n=167; 75.2%) and the fourth highest for acts of violence (n=137; 61.7%). Of the 126 survey respondents who reported on their use of WEAs to send alerts, 66 (52.4%) reported sending none in the past year. Other alert systems that do not require registration include sirens, television broadcasts, and face-to-face notifications. 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 [36].

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

Finding 3. Given resource constraints, alerting authorities turn to resources that are available to provide alerts in other languages, but they may not align with best practices.

Alerting authorities use a variety of methods for translating emergency information. We asked the 118 survey respondents who reported having the capability to send multilingual notifications to select which options they used for translating messages. The majority (n=99; 83.9%) reported using automatic translation services, with many using multilingual staff as translators (n=35; 29.7%) and some contracting with a real-time translation/interpretation service (n=21; 17.8%). Survey respondents used automatic translation either with an app that they pay to use (n=55; 46.6%), such as ReachWell, or through free translation services (n=44; 37.3%) such as Google Translate. Our survey did not ask how agencies support ASL interpretation specifically, but conversations with partners suggest that options are limited given the need for video, which doesn't work for most alerting software. Several use Deaf Link, a company that provides 24/7 ASL interpretation of emergency alerts that people sign up for separately. Translation of emergency alerts varies across jurisdictions.

Authorities shared issues they experience with sending alerts in multiple formats. A selection of 65 survey respondents elaborated on their experiences with providing translated emergency messages. The top three repeated issues were delays in disseminating messages in other languages (n=12; 18.4%), inaccurate or confusing automated translations (n=9; 13.8%), and low opt-in rates for the alert systems that offer information in multiple languages or for people with disabilities (n=8; 12.3%). Other issues included poor integration of translation options into alert software, message length and character use constraints, translation time requirements, and availability of multilingual staff. These challenges were echoed in the review of research literature and conversations with partners. Other issues survey respondents shared related to sending alerts in accessible formats included delays with the Video Relay Systems, software limitations, and difficulties with programming message templates with TTY due to glitches.[12]

Multilingual staff can assist with alerts, but do not solve translation issues. One best practice identified in the document review suggested hiring multilingual staff to help with translation. Survey respondents highlighted the benefits of having multilingual staff available to review and translate messages, such as one survey respondent who collaborated with bilingual members at the local library and county office to help translate information. However, some issues were brought up in partner meetings and in our review of literature about the risk of relying solely on multilingual staff to translate alerts. Eagle county emergency managers indicated that multilingual staff obviously were not available to help around the clock and might be off duty or otherwise unavailable during an event. Further, burnout and turnover make it difficult for alerting authorities to retain these personnel [62]. Additionally, language access professionals shared that Colorado has not standardized requirements to qualify as a multilingual employee and many people who speak more than one language may not be qualified to translate technical emergency information. Options for translation by certified translators include services like Language Line, which offers live two- and three-way calls with an interpreter. However, these services also have limitations for use in emergencies, including poor interpretation of emergency terminology or long wait times. Live interpretation by certified professionals can take five to 10 minutes depending on the message, and emergent situations—such as an active shooter situation—might last less than that, making it insufficient for all situations [62].

Automatic translation is similarly limited. Time constraints can lead alerting authorities to use automatic translation, such as Google Translate, but the outputs can result in inaccurate or confusing alerts. For example, place names may be translated literally, causing confusion, such as what happened when emergency managers tried to translate "Eagle County," which literally translated into "bird County" [62]. Receiving such a message can increase confusion and reduce trust in the alerting system. Additionally, there are limited to no opportunities for

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[12] Research 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 [21], [36], [76], [77].

individuals to provide feedback on the alerts they are receiving to assess how automatically translated messages with errors are understood. Authorities acknowledge that automatic translation is an imperfect tool that has generated poor translations and culturally incompetent messaging. A survey 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.

Additionally, most automatic translation services do not include sign language, though people have been working on this across research and startup companies (for example, https://www.signapse.ai/). Artificial intelligence researchers acknowledge there is a long way to go before automatic translation for sign language is fully automated and given the unique nature of the language, there are a number of concerns with doing so [78]. Despite the advances in automatic translation, best practices suggest that certified interpreters should review emergency alert messages in advance.

Planning for translation of alerts can help. One avenue for addressing time constraints found in the literature [36], [60] and shared by survey respondents included developing pre-translated message templates. Sedgwick County reported they "started creating pe-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." Our document review found that New York City has also used translated templates to effectively send messages quickly in multiple languages [70]. The IPAWS Conference (September 27, 2023) showcased new tools that can help with this, such as the Message Design Dashboard (MDD),[13] that aims to help authorities create complete messages based on research best practices [80]. These tools can be employed to ensure English messages are complete before they are translated, ensuring English and non-English speaking audiences are getting accurate and actionable information.

Finding 4. Many emergency response personnel are interested in incorporating systems and practices that would make alerts more inclusive, but need more guidance, funding, and personnel to adequately do so.

Limited opportunities for training hinder inclusive alert improvement. Many alerting authorities stated they have limited funding, personnel, and training, that make sustaining all their operations a challenge—including providing inclusive alerts. For example, agencies may want to send emergency information across many channels simultaneously in an effort to get alerts to LEP populations and those with disabilities. However, to use the IPAWS software that allows for this, they must become an IPAWS-designated authority through required trainings and additional steps[14] (Table 1). Some survey respondents (n=48; 21.6%) noted that their alerting authority was not IPAWS-designated because they have limited staff capacity (n=6; 12.5%), time (n=4; 8.3%), or funding to procure an alert vendor required to use IPAWS (n=3;6.9%). Additionally, alerting authorities, such as 9-1-1 and sheriff's offices, have responsibilities outside of issuing alerts, making finding the time to learn new alerting technology with improved accessibility features a challenge. Some alerting authorities feel that the expectations for getting emergency alerts out in multiple languages including ASL are not feasible with current systems. A survey respondent from Gunnison County shared that, despite new capabilities for access and functional needs offered through their vendor,

> 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

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[13] Sutton and FEMA are developing a Message Design Dashboard (MDD) to assist in developing complete messages. See [79].

[14] See steps required here: https://www.fema.gov/emergency-managers/practitioners/integrated-public-alert-warning-system/public-safety-officials/sign-up

situation, an alert really needs to go out in [about] five minutes and the reality is… due to technology and resource constraints, it is not possible to do that AND make sure it hits every single population demographic in our county.

Without proper support, these barriers will prevent inclusive practices from being adopted.

Funding was the top barrier to implementing inclusive alerts. The majority (n=142; 64.0%) of survey respondents said they lacked enough funds to make alerts more inclusive. This was followed by personnel (n=112; 50.5%) and training in technology (n=104; 46.8%) (Figure 10). Partner meetings revealed fears that recommendations from this report would lead to unfunded mandates for improvements to emergency alert systems. 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. To update alerting practices to be more inclusive, alerting agencies need financial resources to support personnel and software upgrades. A public information officer from a special district acknowledged that, "everything has a cost, and we cannot afford to implement… [inclusive alerting] to the degree that it needs. Our money goes to keeping the doors open." Although funding was the top choice for resources needed, it should be emphasized that funding, personnel, technology, and outreach are all connected. For example, outreach cannot be conducted without funding and technology cannot be used without personnel.

Figure 10. Top Resource Needs (n=222)
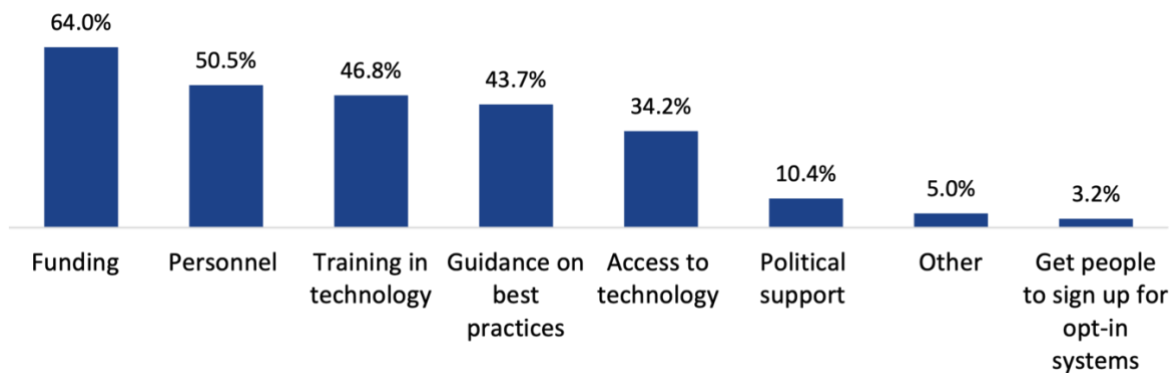
Basic alerting capacity—as well as inclusive alerting—is limited by lack of staff. Many survey respondents and partners shared that they would need to be staffed 24/7 to achieve the level of alerting that could support inclusivity. They do not have the personnel available, however, nor are there funds to hire more people. More than half of survey respondents (n=112; 50.5%) highlighted personnel as the top resource needed to reach all people in their community through emergency 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 [62]. Similarly, a Delta County representative shared,

> With limited staff, dispatchers must answer 9-1-1 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 survey respondent made the point that the expectations of personnel and alerting systems don't align with the realities of rural jurisdictions. Partners shared that the budgets and personnel in rural communities makes it very difficult to distribute alerts at all, before considering how to translate alerts into other languages or provide them it multiple formats. This presents a unique challenge for people with LEP and disabilities in these rural areas.

Limited capacity and training make using best practices difficult. Guidance and training are needed on which alert systems and communication modes to use, recommended verbiage in English and other languages,[15] and protocols for translation and disability access. 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" [65], [81]. For emergencies, the Colorado State 9-1-1 Program Manager Jennifer Kirkland (September 7, 2023) shared that 9-1-1 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 [82]. Researcher Jeannette Sutton stated (September, 19, 2023),

> 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.

Consistent guidance and training are needed to promote inclusive alerting options. Michael Willis, Director of the State Office of Emergency Management (OEM), and Micki Trost, Strategic Communications Director for OEM (September 25, 2023), along with several County Commissioners (September 28, 2023) pointed out that regular training is needed in technology use, message development, best practices for inclusive alerts, and information on how to access to technology. These points were further reiterated in other partner meetings [83], [84]. 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 [64]. 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 populations and people with disabilities getting integrated into alert training and planning processes. This will help ensure best practices are being adopted and diverse needs are consistently being met throughout the State.

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 and pushback from private industry, among others.

Advances to alerting technology are slow and uneven. Alerting authorities are limited by available technology in terms of the emergency alerts they can provide. Message length, character types, language options, and supported file formats vary depending on the alerting software and platforms alerting agencies use. Increasing the pace of technological improvements will likely require federal policy change and enforcement. Currently, each cellphone company has different approaches to supporting alerts, feeding into the patchwork of alerting systems in Colorado and across the United States. Furthermore, commercial mobile services are not mandated to participate in sending WEAs, although most larger companies do so as in recognition of their corporate social responsibility [26]. These differences create hiccups in WEAs delivery depending on cellphone type and mobile service and have implications for language and disability access. For example, a national test of the WEA system on October 4, 2023, highlighted

language issues when the language preference set by many users did not align with the alert message language, showcasing how cellphone type and mobile service interact with sending alerts. Mobile companies do not profit from providing alerting services, so while they comply with regulations, they often petition against upgrades due to costs to change their systems, severely limiting advances. According to Jeannette Sutton (September 19, 2023), the Federal Communications Commission has proposed several updates to the WEA and EAS systems to make

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[15] For example, New York City developed a glossary of emergency terms translated into their top 13 languages for alerting authorities to use [70].

them more inclusive, but has received pushback from private industry that limits the recommendations from being realized [85].

Limitations to existing systems 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 agency capacities, and varied planning processes have implications for emergency alerting for every Coloradan and the tens of millions of visitors to the state. Agencies learned from previous emergency events and have made significant changes to improve access on local levels, 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].

Recommendations

Colorado has an opportunity to become a national leader in emergency alerting and save lives when inevitable emergency events occur. Based on the findings, we recommend that the State of Colorado adopt a series of actions that fall under three pillars: people, practices, and 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 and Disability 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, as well as consult with community-based organizations to determine most effective modes of communication for particular populations.

Develop Formal Relationships with LEP and Disability Populations
More could be done to establish trusting connections between emergency response agencies, news agencies, and community groups before emergencies. This may involve developing memorandums of understanding between relevant parties to ensure that interpretation and other types of assistance can be provided during events. Actions could include forming relationships with existing committees, establishing advisory councils, and hiring community champions or multilingual staff to assist before and during emergency events. Alerting authorities should also partner with community-based organizations that have established trusted relationships with LEP populations and people with disabilities.

Practices

Adopt One Centralized Alerting System and Standardize Alerting Practices Across the State
To address the patchwork of current emergency alerts, the state should consider adopting one centralized emergency alerting system. It is also important to 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. Any statewide standards should allow for flexibility for local jurisdictions and offer consistent support through funding, resources and training.

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 humility and competency, bias-awareness, intercultural communication, community needs, translation best-practices, and technology options. The state should also work collaboratively to create shared resources such as glossaries and translated templates. Alert message templates need to be developed based on input from linguistically diverse communities and populations with disabilities and alerting authorities and research best practices.
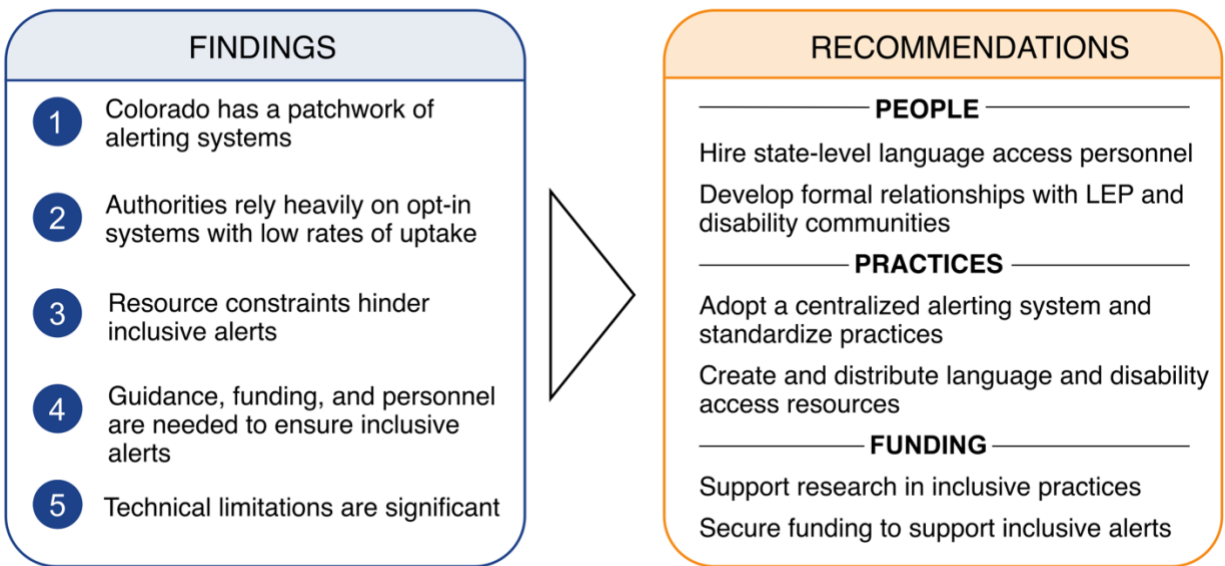
Data and Funding

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 future research needs include, 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; identifying areas where LEP populations make up 5% of the service area or 1000 people; assessing and ranking policy changes for language and disability access; assessing funding implementation needs (e.g., grant writers, funding list, etc.) and processes; and compiling case studies and behavioral research on public response to emergency alerts.

Secure Funding to Support Inclusive Alerts

Unfunded mandates are unpopular and unlikely to address the key issues uncovered in this assessment. As such, funding is needed to support new personnel, novel practices, and data needs. 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 [21], [35], [76], [86], [87], the Colorado General Assembly should identify opportunities to reallocate existing funds to advance inclusive alerting across the State.

FINDINGS	RECOMMENDATIONS
1. Colorado has a patchwork of alerting systems	**PEOPLE**
2. Authorities rely heavily on opt-in systems with low rates of uptake	Hire state-level language access personnel
	Develop formal relationships with LEP and disability communities
3. Resource constraints hinder inclusive alerts	**PRACTICES**
4. Guidance, funding, and personnel are needed to ensure inclusive alerts	Adopt a centralized alerting system and standardize practices
	Create and distribute language and disability access resources
5. Technical limitations are significant	**FUNDING**
	Support research in inclusive practices
	Secure funding to support inclusive alerts

Implementation. These recommendations may be realized through a number of avenues that include expanding existing authorities and offices, passing new legislation, or pursuing additional research. Appendix B provides a list of funding sources to advance many of the recommendations.

CONCLUSIONS AND NEXT STEPS

Throughout this study, it was clear that emergency officials, alert providers, and community representatives share a united vision to provide lifesaving emergency information to those who need it. It is this shared commitment that will push policy and actions 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 [35], [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

ACKNOWLEDGEMENTS

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APPENDICES

Appendix A: Glossary of Terms

Alerting Authority: "... a jurisdiction with the designated authority to alert and warn the public when there is an impending natural or human-made disaster, threat, or dangerous or missing person" (FEMA, https://www.fema.gov/emergency-managers/practitioners/integrated-public-alert-warning-system/public-safety-officials/alerting-authorities).

Disability: "...any condition of the body or mind that makes it more difficult for a person with the condition to do certain activities and interact with the world around them" (CDC, https://www.cdc.gov/ncbddd/disabilityandhealth/disability.html).

Emergency: "...events that cause huge losses to persons and/or property and require communities to respond with routine procedures and resources" (Sadiq et al., 2023).

Emergency Alert (or Warning): "...provide[s] about [an] emergency, such as emergency type, when it will manifest, and the forms of protective action that should be taken...to capture the attention of the public in preparation for a subsequent warning message" (Sutton and Kuligowski, 2019).

Emergency Alert System: "...a national public warning system commonly used by state and local authorities to deliver important emergency information, such as weather and AMBER alerts, to affected communities. EAS Participants – radio and television broadcasters, cable systems, satellite radio and television providers, and wireline video providers – deliver local alerts on a voluntary basis, but they are required to provide the capability for the President to address the public during a national emergency" (Federal Communications Commission, https://www.fcc.gov/emergency-alert-system).

Emergency Notification System: "...facilitates the real-time, one-way dissemination or broadcast of messages to one or many groups of people at a site/facility/activity. Examples of an ENS include intelligible voice communications, a distributed recipient mass notification system such as text messaging, email, or Reverse 9-1-1, and/or common siren systems that are used to alert for tornadoes, tsunamis, and air-raids" (Department of Energy, https://www.directives.doe.gov/terms_definitions/emergency-notification-system-ens).

Equity: "... the consistent and systematic fair, just, and impartial treatment of all individuals, including individuals who belong to underserved communities that have been denied such treatment, such as Black, Latino, and Indigenous and Native American persons, Asian Americans and Pacific Islanders and other persons of color; members of religious minorities; lesbian, gay, bisexual, transgender, and queer (LGBTQ+) persons; persons with disabilities; persons who live in rural areas; and persons otherwise adversely affected by persistent poverty or inequality" (U.S. Office of Personnel Management, https://www.opm.gov/about-us/our-mission-role-history/agency-equity-action-plan/equity-action-plan-overview/).

Inclusion: "... the active, intentional and ongoing engagement with diversity—in decision-making, sense-making, curriculum, in the co-curriculum, and in communities (intellectual, social, cultural and geographical) with which individuals might connect—in ways that increase awareness, content knowledge, cognitive sophistication and empathic understanding of the complex ways individuals interact within systems and institutions" (University of Colorado Boulder DEI Office, https://www.colorado.edu/dei/resources/definitions-citations-campus-guide-dei-terms).

Integrated Public Alert & Warning System (IPAWS): "...FEMA's national system for local alerting that provides authenticated emergency and life-saving information to the public through mobile phones using Wireless Emergency Alerts, to radio and television via the Emergency Alert System, and on the National Oceanic and Atmospheric Administration's Weather Radio" (FEMA, https://www.fema.gov/emergency-managers/practitioners/integrated-public-alert-warning-system).

Language Access: "providing Limited English Proficient (LEP) people with reasonable access to the same services as English-speaking individuals" (migrationpolicy.org, https://www.migrationpolicy.org/print/4074)

Limited English Proficiency: "Individuals who do not speak English as their primary language and who have a limited ability to read, speak, write, or understand English can be limited English proficient..." (lep.gov, https://www.lep.gov/sites/lep/files/media/document/2020-03/042511_QA_LEP_General_0.pdf).

Opt-In Alert Systems: Systems that require individuals to sign up, register, or subscribe to receive an emergency alert.

Opt-Out Systems: Systems that individuals receive without having to sign up, register, or subscribe. Examples include Wireless Emergency Alerts (WEAs) that provides alerts to cellphones in a specific region and the Emergency Alert System (EAS) that broadcasts alerts through radio and television networks.

Appendix B: Funding Opportunities List

The Natural Hazards Center team developed a list of grant and funding opportunities that could support data and funding recommendations.

Department of Homeland Security/FEMA Grant Programs:

IPAWS Authorized Equipment List: The Authorized Equipment List (AEL) is a list of approved equipment types allowed under FEMA's preparedness grant programs. Under this list, systems that are used to alert the public to take protective measures during an emergency are included under this list. This includes the Emergency Alert System (EAS), Integrated Public Alert and Warning System (IPAWS), and Wireless Emergency Alerts (WEA). However, fees related to systems supporting telecommunications are still the responsibility of an alerting jurisdiction and are not allowed to be covered under these grants. Visit this website to learn more: https://www.fema.gov/authorized-equipment-list-item/04ap-09-alrt.

Emergency Management Performance Grant (EMPG) Program (FY23 Funding Total: $355.1 million)
Provides state, local, tribal and territorial emergency management agencies with the resources required for implementation of the National Preparedness System and works toward the National Preparedness Goal of a secure and resilient nation. The EMPG's allowable costs support efforts to build and sustain core capabilities across the prevention, protection, mitigation, response and recovery mission areas. These awards are transferred directly from FEMA to eligible State and territorial governments or state emergency management agencies. The grant is for 36 months. https://www.fema.gov/grants/preparedness/emergency-management-performance

Nonprofit Security Grant Program (NSGP) (FY23 Funding Total: $305 million)
Provides funding support for target hardening and other physical security enhancements and activities to nonprofit organizations that are at high risk of terrorist attack. The intent is to integrate nonprofit preparedness activities with broader state and local preparedness efforts. It is also designed to promote coordination and collaboration in emergency preparedness activities among public and private community representatives, as well as state and local government agencies. https://www.fema.gov/grants/preparedness/nonprofit-security

State Homeland Security Program (SHSP) (FY23 Funding Total: $1.12 billion)
The Homeland Security Grant includes a suite of risk-based grants to assist state, local, tribal and territorial efforts in preventing, protecting against, mitigating, responding to and recovering from acts of terrorism and other threats. This grant provides grantees with the resources required for implementation of the National Preparedness System and working toward the National Preparedness Goal of a secure and resilient nation. https://www.fema.gov/grants/preparedness/homeland-security

Tribal Homeland Security Grant Program (THSGP) (FY23 Funding Total: $15 Million)
The Tribal Homeland Security Grant Program (THSGP) plays an important role in the implementation of the National Preparedness System by supporting the building, sustaining and delivery of core capabilities essential to achieving the National Preparedness Goal of a secure and resilient nation. Funding is awarded directly to eligible tribes with a performance period of 36 months. https://www.fema.gov/grants/preparedness/tribal-homeland-security

Urban Areas Security Initiative Program (UASI) (FY23 Funding Total: $615 Million)
This program provides funding to enhance regional preparedness and capabilities in designated high-threat, high-density areas. 36 urban areas are eligible for funding under the UASI program, including the Denver Area. https://www.fema.gov/grants/preparedness/homeland-security

The Next Generation Warning System Grant Program (NGWSGP) (FY23 Funding Total: $56 Million)
Supports investments that improve the resilience and security of public broadcasting networks and systems. The grant will: enable (1) public television broadcasters to upgrade to the Advanced Television Systems Committee

broadcast standard (ATSC 3.0) (2) public radio stations to upgrade to digital capabilities to enable broadcast of IPAWS alerts. (3) the capability to alert, warn and provide equivalent information to individuals with disabilities, individuals with access and functional needs, and individuals with limited-English proficiency (4) alerts and warnings based on geographic location as well as those projects that improve the ability of remote rural areas to receive alerts and warnings. https://www.fema.gov/emergency-managers/practitioners/integrated-public-alert-warning-system/broadcasters-wireless/ngwsp

Building Resilient Infrastructure and Communities (BRIC) (FY23 Funding Total: $1 Billion)

Supports states, local communities, tribes and territories as they undertake hazard mitigation projects, reducing the risks they face from disasters and natural hazards. The program's guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large infrastructure projects; maintaining flexibility; and providing consistency. https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities/about

Other Grants

The United States Cybersecurity and Infrastructure Security Agency compiled a list of Federal Financial Assistance Programs Funding Emergency Communications (https://www.cisa.gov/safecom/emergency-comms-grants-list), which provides many financial assistance programs that support emergency communication investments in state and local governments. This list is updated periodically, with tables divided by department and agencies who provide those grants. As noted on the website, "While the federal programs included may not focus primarily on emergency communications, the program goals, objectives, and allowable costs may support activities to further the emergency communications mission. This list aims to identify programs that may otherwise be overlooked by state, local, tribal, and territorial government applicants." (https://www.cisa.gov/safecom/emergency-comms-grants-list).

National Science Foundation Research Awards Programs

Humans, Disasters, and the Built Environment (HDBE)

Supports fundamental research on the interactions between humans and the built environment within and among communities exposed to natural, technological and other types of hazards and disasters. Supports fundamental, convergent research on how human activities and behaviors interact with the built environment to reduce or exacerbate the effects of natural hazards and disasters. The program foci are ongoing and emerging hazards to populations (individuals, households, businesses, organizations, and agencies) and built environments (critical infrastructures, physical and cyber spaces, and buildings). https://new.nsf.gov/funding/opportunities/humans-disasters-built-environment-hdbe

Decision, Risk and Management Sciences (DRMS)

Supports research that increases understanding of how individuals, organizations and societies make decisions. Areas include judgment, decision analysis and aids, risk analysis and communication, public policy decision making and management science. https://new.nsf.gov/funding/opportunities/decision-risk-management-sciences-drms

Technology, Innovation and Partnerships (TIP)

The Directorate for TIP, advances use-inspired and translational research in all fields of science and engineering, giving rise to new industries and engaging all Americans — regardless of background or location — in the pursuit of new, high-wage jobs in science, technology, engineering and math (STEM). TIP brings together teams of researchers, practitioners and users to shape research directions, catalyze iterative co-design and co-creation, develop game-changing technologies and solutions to address the nation's societal and economic challenges, and grow the future workforce. https://new.nsf.gov/tip/latest

Appendix C: Best Practices for Alerting Populations with Limited English Proficiency and People with Disabilities

Our review of the literature identified recommendations for best practices to overcome the barriers mentioned above and better reach linguistically diverse populations and people with disabilities.

Best Practice 1: Emergency response professionals should regularly be trained in cultural competency and how to communicate with diverse audiences. Traditional training for emergency response professionals may not include planning for LEP populations and people with disabilities. If personnel are expected to develop inclusive practices and procedures for emergency alerts, they need trainings that focus on cultural competency, how to work with an interpreter, identifying people who may be at higher risk during an emergency, and engaging effectively through continual and lasting communication and relationship building with LEP populations and people with disabilities. Training should be tailored to diverse community members—including their involvement in developing and implementing trainings—to ensure cultural competence and trust. See [22], [31], [35], [36], [40], [55], [57], [90]–[92].

Best Practice 2: Actively involve partners in the process of alert dissemination. There are several different avenues for involving different partners in the alerting planning and dissemination process. These relationships can include news outlets, local organizations, interpreters, government agencies, among others. Partner engagement can include:

- Alert originators developing relationships with relevant news outlets to improve communication;
- Establishing agreements (such as memorandums of understanding) *before* emergencies so departments to reach out for language assistance from experts *during* them;
- For language translation, training interpreters to appropriate terminology in emergency situations;
- Co-creating disaster information campaigns with linguists and other language experts;
- Government agencies sharing communication strategies and resources with those who also have a stake in emergency response;
- Including diverse populations and communities as a part of the development of policies and procedures.

See citations [21], [31], [35], [36], [44], [45], [48], [54], [60], [76], [86], [92], [93].

Best Practice 3: Tailor communication to diverse populations and communities. Government agencies could use task forces or other guiding bodies to better understand language access needs and community disaster preparedness and response, including how communities prefer to receive information. Additionally, community organizations should be consulted in research needs assessments. Educational campaigns—which should be tracked, assessed, and regularly conducted—could explain disaster terminology, how to opt-in for alerts, emergency procedures, and where to find shelter and resources. These can be supported with the help of community leaders, who can be trained in how to disseminate emergency information knowledge to their communities. The goal would be to build a habit of preparedness in communities by teaching them the importance of accessing and knowing alerts. These community leaders and other forms of communication can be built into a stepwise process for understanding what language to use and how to conduct an alert. These can include diagrams and guides for alerting agencies deciding what channel and messaging to use in different times and situations. See Appendix D for examples of how to approach these efforts. See citations [20], [31], [32], [36], [37], [39], [44], [45], [48], [49], [54], [55], [58], [59], [61], [77], [86], [88]–[90], [92], [94]–[99].

Best Practice 4: Ensure alerts are accurate and culturally competent. This can include working with linguists to use clear and plain language, having plenty of graphics, and avoiding jargon and culturally insensitive words—ideally, taking these actions will translate more than words—they'll translate meaning. Agencies can also develop message templates and only use artificial intelligence (including Google Translate) when it can be reviewed and corrected before dissemination. Additionally, there should be Deaf awareness training for emergency responders.

See Appendix D for tools and examples of initiatives that can be used for these efforts. See citations [20]–[22], [31], [35], [36], [38], [48], [53], [54], [58], [60], [88], [92]–[96], [100]–[104].

Best Practice 5: Distribute alerts in multiple modes. Different modes could include, for example, sending alerts via Spanish language television, adding scrolling text to the chyron at the bottom of English television broadcasts in multiple languages, and engaging in face-to-face strategies. For the Deaf/hard of hearing community, closed captioning should be used alongside a video of an ASL interpreter. It is critical to ensure consistency in alerts being issued across modes and that if an alert is issued in one mode, an "all clear" alert is also issued using the same mode. Additionally, a network of partner agencies can help to translate and disseminate emergency information. Other best practices include disseminating information via non-English social media, making sure interpreters are present at public meetings and events, establishing telephone voicemail menus with language assistance, translating information and posting it online for free, and ensuring alerts are routed through devices that will notify people through their preferred mode (e.g., vibration, visual cues, etc.). See citations [20], [22], [31]–[33], [35], [35], [36], [39], [40], [42]–[44], [48], [49], [51], [52], [57], [91], [91], [93], [96], [102], [103], [105].

Best Practice 6: Disseminate alerts via well-informed, trusted sources and incorporate participation of diverse populations and communities. Government agencies can develop relationships with and compensate nonprofit organizations, interpretation agencies, and community leaders to develop plans for disaster communication. Additionally, hiring multilingual staff and staff with disabilities should be prioritized. These positions should be permanent, with incentives for multilingual staff to get certified. Language access plans that provide explicit guidance for agencies engaging with people with disabilities and LEP populations during disasters is critical. This guidance should be specific and translated into multiple languages. See citations, [20]–[22], [31], [35], [36], [41], [44], [52]–[58], [61], [70], [76], [76], [86], [87], [90], [93], [94], [97], [97], [100], [102], [104] .

Appendix D: Examples of Tools and Initiatives to Facilitate Implementation of Best Practices

Best Practice	Example
#1: Regularly attend training on cultural competency and best practices for communication with diverse audiences.	FEMA/IPAWS previously had annual roundtables with the office of Disability Integration and Coordination to discuss disability-related concerns. The roundtables included leading organizations representing people with disabilities and were designed to provide periodic updates to industry and federal partners [19].
#2 Actively involve all stakeholders in the process of alert dissemination	Kimiko and Mathew [106] shared an example following the 1994 Northridge Earthquake in California where "One nonprofit emergency provider had a LEP strategy which involved working with the city and faith-based institutions in order to target minorities and special needs populations. Within the Latino community, such collaborations have resulted in the distribution of education materials by ethnic organizations heavily involved in the community and the development of forums to present preparedness information. It also helped establish a network of organizations advocating for and providing services to the Latino community. The provider has worked with this network of organizations to plan how to deal with LEP people and make them feel comfortable in the event of an emergency."
#3: Tailor communication to diverse populations and communities.	Roseville, Minnesota doesn't offer multilingual text or email alerts. The City conducted research with property managers to identify best communication channels to utilize with tenants. Based on their input, the City created door hangers in multiple languages and work with property management staff to keep residents informed [30].
	In Colorado Springs, CO notifications for the Deaf and Hard of Hearing community were improved between the Waldo Canyon Fire in 2012 and the Black Forest Fire in 2013. Captioning and scroll bar notifications were provided on TV and ASL interpreters were on-site. Post-incident meetings resulted in recommendations to collaborate more effectively with the Colorado Broadcasters Association (CBA) to allow Public Information Officers and CBA to work together to maximize notification and communication details to the general public. Just recently, we've started an Emergency Response Interpreter program. Currently ASL is offered but they have plans to add more languages in the future [Shared by Billy Allen from the Center for Independence during public comment]
#5: Ensure alerts are accurate and culturally competent.	Message Design Dashboard (MDD)[79] : This tool gives alert originators an opportunity to design effective and complete warning messages by utilizing templates that are compliant with Mileti and Sorensen's [27] model of message completeness.
	ReadyPhiladelphia Platform: Users are able to sign up for emergency alerts in one of 10 languages; messages are pre-translated to fit dozens of different emergency situations that could occur [47]. https://www.phila.gov/departments/oem/programs/readyphiladelphia/
	Notify NYC: New York City's official emergency communications program that sends multilingual messages spanning a variety of emergency situations. Subscribers have access to messages in 13 different languages, audio format, and ASL. The program also has two non-English Twitter (X) accounts: @NNYCSpanish and @NNYCChinese [70]. https://portal.311.nyc.gov/article/?kanumber=KA-01082
#6: Disseminate alerts via well-informed, trusted sources and incorporate participation of diverse populations and communities.	The National Council on Disability [35] found that some disabled individuals develop and provide pocket-sized guidebooks to first responders, which include tips on communicating with people with disabilities and picture manuals to allow the person to communicate by showing a picture that corresponds to their current problem.

Appendix E: Partner Meeting and Survey Distribution

E1. Partner Meeting Attendees

Name		Position and Organization
1. Emergency Response Officials		
Almanza	Fernando	Deputy Emergency Manager, Eagle County, Colorado
Barron	Birch	Director of Emergency Management, Eagle County, Colorado
Blick	Brian	9-1-1 Quality Improvement Manager, City & County of Denver
Branson	Daryl	State of Colorado Telecom Programs Section Chief
Briese	Garry	Executive Director, Colorado State Fire Chiefs
Culp	Kimberly	CEO, Larimer Emergency Telephone Authority 9-1-1 and Chairperson of the Colorado 9-1-1 Association
Kirkland	Jennifer	State of Colorado 9-1-1 Program Manager and Colorado Department of Regulatory Agencies
Martinez	Sadie	Access and Functional Needs Coordinator, Colorado Office of Emergency Management
Slate	Jodie M	9-1-1 Communications Center, City & County of Denver
Trost	Micki	Strategic Communications Director, Colorado Division of Homeland Security and Emergency Management (DHSEM)
Willis	Mike	Director of the Colorado Office of Emergency Management, DHSEM
2. Alert and Warning Service Providers		
Bastani	Zuben	CEO, ReachWell
Chiodo	Kay	CEO, Deaf Link
Heller	Dan	President, Deaf Link
Kigin	Dan	Partner, ReachWell
Shell	Glenn	COO, Deaf Link
Singer	Justin	Program Analyst, IPAWS, National Continuity Programs
Toolan	Brian	Vice President of Global Public Safety, Everbridge Alerting Software
Voleppe	Sunita	Senior Solution Marketing Manager for Public Safety, Everbridge
3. Community Serving Partners (community organizations, news agencies)		
Allen	Jared	Compliance and Resettlement Supervisor, Office of New Americans
Bergum	Samantha	Senior Producer, 9NEWS, Reported on emergency alerts in Colorado
Garcia	Shirl	Disability Rights Advocate and Co-Chair of Colorado 9-1-1 Equal Access Committee
Greuel	Kate	Policy Advocate, Spring Institute
Kogeman	Adam	Main Administrator, Office of New Americans
Schriefer	Paula	President and CEO, Spring Institute
Scriven	Dee Daniels	Director, Office of New Americans
Soto	Alexandra	Program Manager, The Interpreter Network
Staeger	Steve	Investigative Reporter, 9NEWS, Reported on emergency alerts in Colorado
4. Alert and Warning Researchers		
LaForce	Salimah	Research Scientist II, Center for Advanced Communications Policy, Georgia Institute of Technology
Sutton	Jeannette	Associate Professor, University at Albany, SUNY, expert in emergency alerts
5. Politicians		
Velasco	Elizabeth	Representative for District 57, State of Colorado
County Commissioners		During a 1-hour listening session with county commissioners (all were welcome to attend) those from Douglas, El Paso, Fremont, Phillips, and Weld Counties attended as well as Katie First, Legislative and Policy Advocate, Colorado Counties Inc.

E2. Survey Distribution Contacts and Audience

Survey Distribution Partner	Listserv Audience (All in Colorado)
Gary Briese, Executive Director, Colorado State Fire Chiefs	Fire Officials
Jennifer Kirkland, Colorado State 9-1-1 Program Manager	9-1-1 Offices and Public Safety Answering Points
Micki Trost, Strategic Communications Director, Colorado Division of Homeland Security and Emergency Management	Emergency Managers Sheriffs, Public Information Officers, and Police Chiefs and Officials

E3. Public Comment Attendance

Public Comment Meeting	Attendance
Session 1: 12:00 p.m. – 1:15 p.m. MST	62 Attendees
Session 2: 6:00 p.m. – 7:15 p.m. MST*	31 Attendees
Total	**93 Attendees**

*See link to recording of Session 2 in English, Spanish, and American Sign Language.

Appendix F: Alerting Authorities Reported in Survey by County/Region

County	Alerting Authority	Coverage
Adams	Fire Authority, Municipal Fire Department, or Fire Protection District	Adams County Fire Protection District (Unincorporated Area)
	Local 9-1-1 Center	County
	Local 9-1-1 Center	Brighton (City/Town)
	Office of Emergency Management; Local 9-1-1 Center	Thornton (City/Town)
	Local 9-1-1 Center	Thornton (City/Town)
	Police Department; Local 9-1-1 Center	Federal Heights (City/Town)
Alamosa	Office of Emergency Management; Public Information Office	County
	Office of Emergency Management	County
Arapahoe	Office of Emergency Management; Local 9-1-1 Center	County
	Office of Emergency Management; Sheriff's Office	County
	Office of Emergency Management; Public Information Office	County
	Police Department; Fire Authority, Municipal Fire Department, or Fire Protection District	Glendale (City/Town)
	Local 9-1-1 Center	Littleton (City/Town)
	Police Department	Aurora (City/Town)
	Police Department; Local 9-1-1 Center	Glendale (City/Town)
Archuleta	*No data from survey*	
Baca	Office of Emergency Management; Sheriff's Office; Local 9-1-1 Center	County
Bent	*No data from survey*	
Boulder	Local 9-1-1 Center	County
	Sheriff's Office; Police Department	County
	Sheriff's Office	County
	Sheriff's Office; Police Department; Local 9-1-1 Center	Louisville (City/Town)
	Local 9-1-1 Center	Louisville (City/Town)
	Police Department; Fire Authority, Municipal Fire Department, or Fire Protection District	Lafayette (City/Town)
	Office of Emergency Management; Sheriff's Office; Local 9-1-1 Center	Longmont (City/Town)
	Office of Emergency Management; Local 9-1-1 Center	Boulder (City/Town)
Chaffee	Office of Emergency Management; Sheriff's Office; Local 9-1-1 Center	County
	Sheriff's Office	County
Cheyenne	Local 9-1-1 Center	County
	Office of Emergency Management; Sheriff's Office; Police Department; Local 9-1-1 Center; National Weather Service Goodland	County
City & County of Broomfield	Office of Emergency Management; Police Department; Fire Authority, Municipal Fire Department, or Fire Protection District; Local 9-1-1 Center; Public Information Office	County
City & County of Denver	*No data from survey*	
Clear Creek	Sheriff's Office; Local 9-1-1 Center	County
	Local 9-1-1 Center	County
	Sheriff's Office	County
	Office of Emergency Management; Sheriff's Office; Local 9-1-1 Center; Public Information Office	County
	Sheriff's Office	Idaho Springs (City/Town)
Conejos	Office of Emergency Management; Sheriff's Office; Local 9-1-1 Center; Public Information Office; Land Use Administration	County
Costilla	Local 9-1-1 Center	County
	Office of Emergency Management; Sheriff's Office; Local 9-1-1 Center	County

County	Alerting Authority	Coverage
	Office of Emergency Management	County
Crowley	Office of Emergency Management; Sheriff's Office; Local 9-1-1 Center	County
	Sheriff's Office; Local 9-1-1 Center	Ordway (City/Town)
Custer	Unsure	County
Delta	Office of Emergency Management; Local 9-1-1 Center	County
Dolores	*No data from survey*	
Douglas	Office of Emergency Management; Sheriff's Office	Teller and Douglas County Unincorporated Area (Unincorporated Area)
	Sheriff's Office; Local 9-1-1 Center	County
	Local 9-1-1 Center	County
	Sheriff's Office	Lone Tree (City/Town)
	Local 9-1-1 Center	Town of Castle Rock (City/Town)
	Fire Authority, Municipal Fire Department, or Fire Protection District	Castle Rock (City/Town)
	Police Department	Parker and Lone Tree (City/Town)
Eagle	Local 9-1-1 Center	County
	Local 9-1-1 Center	Vail (City/Town)
	Local 9-1-1 Center	Eagle (City/Town)
	Office of Emergency Management; Local 9-1-1 Center	Vail (City/Town)
El Paso	Office of Emergency Management; Fire Authority, Municipal Fire Department, or Fire Protection District; Local 9-1-1 Center	Cimarron Hills Fire Protection District (Unincorporated Area)
	Office of Emergency Management; Sheriff's Office; Police Department; Fire Authority, Municipal Fire Department, or Fire Protection District; Local 9-1-1 Center	County
	Sheriff's Office; Police Department; Local 9-1-1 Center; Public Information Office	County
	Local 9-1-1 Center	County
	Office of Emergency Management; Police Department; Fire Authority, Municipal Fire Department, or Fire Protection District; Local 9-1-1 Center	Colorado Springs (City/Town)
	Office of Emergency Management; Sheriff's Office; Police Department; Fire Authority, Municipal Fire Department, or Fire Protection District; Local 9-1-1 Center	Colorado Springs (City/Town)
	Local 9-1-1 Center	Colorado Springs (City/Town)
	Police Department	Colorado Springs (City/Town)
Elbert	Office of Emergency Management; Sheriff's Office; Local 9-1-1 Center; Public Information Office	County
	Sherriff's Office (Elbert and Douglas Counties - Shared)	Elizabeth (City/Town)
Fremont	Office of Emergency Management; Local 9-1-1 Center; Public Information Office	County
	Office of Emergency Management; Local 9-1-1 Center	County
	Office of Emergency Management; Sheriff's Office; Local 9-1-1 Center	County
	Local 9-1-1 Center	County
	Office of Emergency Management; Sheriff's Office; Local 9-1-1 Center; Public Information Office	County
Garfield	Local 9-1-1 Center	County
	Office of Emergency Management; Sheriff's Office; Local 9-1-1 Center	County
	Local 9-1-1 Center; Incident Command	Glenwood Springs (City/Town)
Gilpin	Office of Emergency Management; Local 9-1-1 Center	County
	Office of Emergency Management; Sheriff's Office; Police Department; Fire Authority, Municipal Fire Department, or Fire Protection District; Local 9-1-1 Center	Black Hawk (City/Town)
Grand	Sheriff's Office	County

County	Alerting Authority	Coverage
	Office of Emergency Management; Sheriff's Office	County
	Office of Emergency Management	Granby (City/Town)
Gunnison	Office of Emergency Management; Local 9-1-1 Center	County
	Office of Emergency Management; Local 9-1-1 Center	Crested Butte (City/Town)
Hinsdale	Office of Emergency Management; Sheriff's Office; Public Information Office	County
Huerfano	Local 9-1-1 Center	County
	Office of Emergency Management; Local 9-1-1 Center	County
Jackson	Sheriff's Office	County
	Sheriff's Office; Local 9-1-1 Center	County
Jefferson	Fire Authority, Municipal Fire Department, or Fire Protection District	Unincorporated Jefferson County (Unincorporated Area)
	Local 9-1-1 Center	Evergreen (Unincorporated Area)
	Local 9-1-1 Center	County
	Local 9-1-1 Center	Morrison (City/Town)
	Sheriff's Office; Police Department; Local 9-1-1 Center	Edgewater (City/Town)
	Office of Emergency Management; Police Department; Fire Authority, Municipal Fire Department, or Fire Protection District; Local 9-1-1 Center; Public Information Office	Arvada (City/Town)
	Local 9-1-1 Center	Golden (City/Town)
	Local 9-1-1 Center	Lakewood (City/Town)
	Office of Emergency Management; Local 9-1-1 Center	Arvada (City/Town)
	Local 9-1-1 Center	Westminster (City/Town)
Kiowa	Office of Emergency Management; Sheriff's Office; Bent County Dispatch	County
Kit Carson	Local 9-1-1 Center	County
	Office of Emergency Management; Sheriff's Office; Police Department; Local 9-1-1 Center; National Weather Service Goodland	County
La Plata	Office of Emergency Management; Local 9-1-1 Center	County
	Office of Emergency Management; Local 9-1-1 Center	Ignacio (City/Town)
Lake	Local 9-1-1 Center	County
Larimer	Office of Emergency Management; Sheriff's Office	Poudre Canyon Fire Protection District (Unincorporated Area)
	Office of Emergency Management; Sheriff's Office; Fire Authority, Municipal Fire Department, or Fire Protection District	Crystal Lakes Fire Protection District (Unincorporated Area)
	Larimer Emergency Telephone Authority	County
	Office of Emergency Management; Local 9-1-1 Center; Health Department	County
	Office of Emergency Management; Sheriff's Office; Police Department; Fire Authority, Municipal Fire Department, or Fire Protection District; Local 9-1-1 Center	County
	Office of Emergency Management; Local 9-1-1 Center; Public Information Office; Larimer Emergency Telephone Authority	City of Loveland (City/Town)
Las Animas	*No data from survey*	
Lincoln	*No data from survey*	
Logan	Office of Emergency Management; Sheriff's Office; Police Department; Fire Authority, Municipal Fire Department, or Fire Protection District; Local 9-1-1 Center	Sterling (City/Town)
Mesa	Office of Emergency Management	County
	Local 9-1-1 Center	County
	Local 9-1-1 Center	Fruita (City/Town)
	Office of Emergency Management; Sheriff's Office; Police Department	Grand Junction (City/Town)
Mineral	*No data from survey*	
Moffat	Office of Emergency Management	Craig (City/Town)
Montezuma	Office of Emergency Management; Sheriff's Office; Local 9-1-1 Center; Public Information Office	County

County	Alerting Authority	Coverage
	Office of Emergency Management; Sheriff's Office	County
Montrose	Office of Emergency Management; Local 9-1-1 Center	County
	Office of Emergency Management; Local 9-1-1 Center; Public Information Office	County
Morgan	Office of Emergency Management; Sheriff's Office; Police Department	County
	Office of Emergency Management	Brush (City/Town)
	Office of Emergency Management; Sheriff's Office; Police Department; Fire Authority, Municipal Fire Department, or Fire Protection District	Fort Morgan (City/Town)
Otero	Local 9-1-1 Center	County
	Office of Emergency Management; Sheriff's Office; Police Department; Local 9-1-1 Center	Cheraw (City/Town)
	Local 9-1-1 Center	La Junta (City/Town)
Ouray	Fire Authority, Municipal Fire Department, or Fire Protection District; Local 9-1-1 Center	Log Hill Village (Unincorporated Area)
	Office of Emergency Management; Sheriff's Office; Police Department; Local 9-1-1 Center; Public Information Office; Coroner's Office; Emergency Medical Services	County
	Office of Emergency Management; Sheriff's Office; Public Information Office	County
	Office of Emergency Management	County
	Public Information Office	Ridgeway (City/Town)
	Office of Emergency Management; Local 9-1-1 Center; Public Information Office	County
Park	Office of Emergency Management; Local 9-1-1 Center	Hartsel (Unincorporated Area)
	Local 9-1-1 Center	County
Phillips	Local 9-1-1 Center	County
Pitkin	Local 9-1-1 Center	County
	Local 9-1-1 Center	Aspen (City/Town)
Prowers	Local 9-1-1 Center	County
	Local 9-1-1 Center	Lamar (City/Town)
Pueblo	Office of Emergency Management; Sheriff's Office; Local 9-1-1 Center	County
	Office of Emergency Management; Sheriff's Office; Local 9-1-1 Center; Public Information Office	County
	Sheriff's Office; Police Department	County
Rio Blanco	Local 9-1-1 Center	County
	Local 9-1-1 Center	Rangely (City/Town)
	Police Department	Rangely (City/Town)
Rio Grande	Local 9-1-1 Center	Monte Vista (City/Town)
Routt	Local 9-1-1 Center	County
	Office of Emergency Management; Sheriff's Office; Police Department; Fire Authority, Municipal Fire Department, or Fire Protection District; Local 9-1-1 Center	County
	Office of Emergency Management; Sheriff's Office; Police Department; Fire Authority, Municipal Fire Department, or Fire Protection District; Local 9-1-1 Center	City of Steamboat Springs (City/Town)
	Office of Emergency Management; Local 9-1-1 Center	Oak Creek (City/Town)
	Local 9-1-1 Center	City of Steamboat Springs (City/Town)
Saguache	Local 9-1-1 Center	County
San Juan	Sheriff's Office	County
	Office of Emergency Management	County
	Office of Emergency Management	Silverton (City/Town)
San Miguel	Sheriff's Office; Public Information Office	County
	Sheriff's Office	County

County	Alerting Authority	Coverage
	Office of Emergency Management; Sheriff's Office; Local 9-1-1 Center; Public Information Office	County
	Office of Emergency Management; Sheriff's Office; Local 9-1-1 Center	Mountain Village (City/Town)
	Office of Emergency Management; Local 9-1-1 Center; Public Information Office	County
Sedgwick	Local 9-1-1 Center	County
	Office of Emergency Management; Local 9-1-1 Center	County
Summit	Office of Emergency Management	County
Teller	Local 9-1-1 Center	County
	Sheriff's Office	Florissant (City/Town)
Washington	Local 9-1-1 Center	County
	Office of Emergency Management; Local 9-1-1 Center	County
Weld	Local 9-1-1 Center	County
	Larimer Emergency Telephone Authority	Windsor (City/Town)
	Office of Emergency Management; Sheriff's Office; Police Department; Fire Authority, Municipal Fire Department, or Fire Protection District; Local 9-1-1 Center; Public Information Office	Mead (City/Town)
	Local 9-1-1 Center	Windsor (City/Town)
	Local 9-1-1 Center	Severane (City/Town)
	Sheriff's Office; Police Department; Fire Authority, Municipal Fire Department, or Fire Protection District; Local 9-1-1 Center	Keenesburg (City/Town)
	Police Department; Local 9-1-1 Center	LaSalle (City/Town)
	Office of Emergency Management; Public Information Office	Frederick (City/Town)
	Office of Emergency Management; Sheriff's Office; Police Department; Local 9-1-1 Center	Hudson (City/Town)
	Office of Emergency Management; Sheriff's Office; Police Department; Fire Authority, Municipal Fire Department, or Fire Protection District; Public Information Office	Firestone (City/Town)
	Office of Emergency Management; Public Information Office; Larimer Emergency Telephone Authority (LETA NOCO)	Windsor (City/Town)
	Office of Emergency Management; Sheriff's Office; Police Department; Fire Authority, Municipal Fire Department, or Fire Protection District; Local 9-1-1 Center	Greeley (City/Town)
Yuma	Office of Emergency Management; Sheriff's Office; Local 9-1-1 Center	County
	Office of Emergency Management; Local 9-1-1 Center	County

Jurisdiction	Alerting Authority	Coverage
State of Colorado	Office of Emergency Management	State
	Local 9-1-1 Center	State
Southern Ute Indian Tribe	Office of Emergency Management; Police Department	Southern Ute Indian Tribe
Buckley Space Force Base	Command Post	Base
Northwest Region Colorado	Sheriff's Office	Region
San Luis Valley	Office of Emergency Management; Sheriff's Office; Police Department; Fire Authority, Municipal Fire Department, or Fire Protection District; Local 9-1-1 Center	Region

Appendix G: Additional Survey Results

G1. Most popular service providers as reported in statewide survey

Service Provider	Count	Percent
CodeRED	81	36.5%
Everbridge	79	35.6%
Genasys	15	6.8%
LookoutAlert	10	4.5%
RAVE	5	2.3%
WENS	5	2.3%
Hyper-Reach	4	1.8%
Nixle	3	1.4%
Swift9-1-1	2	0.9%
Multiple services	2	0.9%
Other	5	2.3%
Unsure if we have a system or unsure what provider we use	7	3.2%
We do not have an emergency notification service provider	4	1.8%

G2. Expanded table of alert channels used by emergency event type as reported in statewide survey

Alerting Channel	Event Type				
	Natural hazard	Technological hazard	Act of violence	Public health emergency	Transportation issues
Social media	82.4%	71.2%	72.1%	75.2%	73.4%
Wireless Emergency Alert (WEA)	75.2%	54.5%	61.7%	46.4%	29.3%
Text messaging (non-WEA)	70.7%	59.9%	67.1%	58.6%	46.8%
Automated phone call	69.4%	53.2%	64.9%	52.3%	28.8%
Email	52.7%	13.5%	15.3%	13.1%	6.3%
Face-to-face	49.1%	20.7%	22.5%	14.4%	5.4%
General notification from alert vendor (third-party provider)	46.8%	39.6%	42.3%	40.1%	31.1%
Broadcast TV and radio	35.1%	26.1%	26.1%	24.8%	16.7%
Outside siren	30.2%	2.3%	2.3%	0.9%	0.9%