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Wireless Emergency Alerts and Organizational Response: Instructing and Adjusting Information in Alerts

Short Title: Instructing & Adjusting Information in Alerts

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Abstract

In the United States, alerting authorities are authorized by the Federal Emergency Management Agency (FEMA) to notify the public of imminent hazards and threats by sending Wireless Emergency Alerts (WEAs) through the Integrated Public Alert and Warning System (IPAWS). Although recent efforts have been made to examine historical WEA compliance with frameworks such as Mileti and Sorenson's (1990) Warning Response Model, less attention has been paid to information included in WEAs that is not prescribed by message design frameworks from risk communication scholarship. This paper explores the presence of Situational Crisis Communication Theory's (SCCT) instructing and adjusting information in terse mobile alerts. The authors conducted a content analysis of 4,777 WEAs sent between 2019 and 2022 to determine how often and in which contexts (i.e., hazard types, 90- or 360-character messages) these strategies are used. We find that the limited definition of adjusting information used in prior research (e.g., direction to mental health resources) is rarely included in WEAs. Additionally, we identify differences in use by message length (90- vs. 360-characters) and hazard type. We conclude that adjusting information in WEAs most frequently takes the form of organizational response information, thereby amending prior definitions of adjusting information to more closely align with the objectives and goals of warning message design.

Keywords. Alerts and warnings, risk communication, crisis communication, Situational Crisis Communication Theory

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Wireless Emergency Alerts and Organizational Response: Instructing and Adjusting Information in Alerts

In the United States, there are over 1,600 alerting authorities (AAs) authorized by the Federal Emergency Management Agency (FEMA) to issue alerts and warnings for imminent threats through the Integrated Public Alert and Warning System (IPAWS; FEMA, 2020). Since 2012, AAs have had the capability to notify the public of imminent threats through IPAWS using Wireless Emergency Alerts (WEAs), which are short messages sent to mobile devices in at-risk areas using geotargeted broadcast technology (FEMA, 2020). When reading through these messages, those familiar with WEAs will recognize some hallmark terms of risk messaging: "take shelter now," "mandatory evacuation," "shelter in place," etc. Closer inspection, though, shows other phrases exist in WEAs that are not prescribed by Mileti and Sorensen's (1990) Warning Response Model (WRM), the pre-eminent framework for warning message design and evaluation (e.g., Kuligowski et al., 2023; Sutton et al., 2020). For example, residents in Garysburg, North Carolina, received a WEA from their county emergency management office stating: "There is a water main break […] We have crews working to repair the problem" (Public Broadcasting Service Warning, Alert, & Response Network [PBS WARN], 2022), indicating that the local jurisdiction is actively responding to the event. Another sent to residents of Grundy County, Illinois, states "Grundy County Sheriff is issuing a law enforcement emergency due to an officer involved shooting" (PBS WARN, 2021b), strategically placing the sheriff as the issuing authority for the emergency. These details do not provide specifics about where exactly the incidents are, when they occurred, how severe they are, or what residents should do to protect themselves, which are commonly cited elements from the WRM. Instead, they draw attention to the fact that there is an ongoing official response to the hazard in question and describe efforts to

address the hazard and its impacts—or what we define as "organizational response information." We observe that organizational response information is present in WEAs but is not prescribed by the WRM. Several questions arise from these observations: why do AAs include this information? Are they attempting to reassure publics that the situation is under control? What are the effects of this information on warning outcomes? Are there conditional (i.e., hazard-specific) benefits of including it in WEAs? Before answering these questions, however, it is important to understand how frequently these contents are included in WEAs and the types of official responses they describe.

The main objective of this study is to document and quantify organizational response information in WEAs by drawing from theories of both risk and crisis communication to help conceptualize this information in alerts and warnings. Although risk and crisis communication theories generally have distinct approaches to studying communication pertaining to hazards and crises, each has produced theories to guide risk or crisis messaging and predict outcomes related to such messages. Some theories/frameworks share similar constructs: for example, Mileti and Sorensen's (1990) WRM and Coombs's (2007) Situational Crisis Communication Theory (SCCT) both recommend that officials provide protective action guidance, or "instructing information," to help publics physically cope with and protect themselves from threats. Despite these similarities, the applications for these frameworks in extant literature are quite distinct. The WRM is oriented toward disaster risk messaging to facilitate protective actions, whereas SCCT takes a more organizationally focused approach to crisis response, with reputation as a primary outcome of interest. Thus, the application of recommendations from SCCT (namely, to provide "adjusting information" such as emotional coping advice or details of corrective actions to help receivers psychologically cope with the crisis) has not been extensively studied in the context of

alert and warning messages such as WEAs. As a result, it is unknown if the more organizationally oriented messaging strategies derived from SCCT are used, or have positive effects, in terse messaging spaces. However, crisis communication theories like SCCT may help to explain why AAs would include information that falls outside the scope of the WRM.

With this in mind, we conduct a deductive content analysis of 4,777 WEAs sent by state and local AAs in the United States from 2019 to 2022 to determine how frequently instructing and adjusting information are included in these WEAs. Our analyses also assess how the inclusion of organizational response information differs (a) between messages of different lengths (WEAs can be 90- or 360-characters), and (b) across different hazard types (i.e., natural, technological, human-induced). In doing so, we begin to identify the practices that have been enacted by AAs that communicate about the organization in addition to public safety. In the next section, we review the relevant literature on alerts, warnings, and crisis communication to identify the contents that are recommended for messages to effectively communicate about imminent threats and organizational response efforts.

Literature Review

Alerts and Warnings

WEAs, issued through FEMA's Integrated Public Alert and Warning System, were first introduced in 2012 as a means for AAs at the federal, state, local, tribal, and territorial levels to quickly notify the public of impending threats using text-based, geotargeted messages that are not affected by cellular network congestion like Short Messaging Service (SMS) messages (FEMA, 2020). Unlike other public alerting channels, WEA does not require the message receiver to opt-in (e.g., signing up through an app) or seek out information (e.g., through television or internet) to receive an alert. WEAs were originally limited to 90 characters but were

expanded in 2019 to include 360 characters (FEMA, 2020; National Weather Service, 2022). This allows WEAs to shift from serving as alerts, which serve to attract attention and promote further information seeking, to warnings, which serve to provide details about the hazard and recommended protective actions (Bean et al., 2019). Thus, the addition of 270 more characters enables AAs to potentially make their messages more specific and to also include all the contents recommended in the WRM.

Within the disaster and risk communication research space, the WRM is the pre-eminent model informing the design of effective alerts and warnings for the purpose of motivating publics to take protective actions. The contents included in the WRM were initially identified by Mileti and Sorensen (1990) following a review of empirical studies on behavioral outcomes for disasters. They identified five key contents that, when included, increase the likelihood of timely and appropriate behavioral response by reducing the likelihood of additional information seeking, or milling (Mileti & Sorensen, 1990; Wood et al., 2018). These contents are (a) the name of the message source (i.e., who is sending the message, such as "Central City Sheriff"), (b) a description of the hazard and its expected impacts (such as "hazardous material spill: exposure to chemicals could cause difficulty breathing"), (c) guidance for protective actions (such as "take shelter in an interior room at the lowest point in the building"), (d) timing information, such as the time of hazard impact, when protective action should take place, and/or when the message expires, and (e) the location(s) affected by the hazard (i.e., "at the intersection of Main and 1st" or "near the Central Public Library"; Mileti & Sorensen, 1990; Mileti, 2018).

The WRM also offers guidelines for warning message *style*, that is, how an effective message should be composed. Warnings that are specific (i.e., providing details about the location and timing of the event), consistent (i.e., indicating the same hazard and the same

actions as warnings issued in parallel over other channels), accurate (i.e., representing the conditions correctly, so that they correspond with what is occurring), certain (i.e., using language that is not hedging or containing likelihoods or probabilities), and clear (i.e., using language that is unambiguous and directive) lead to better message understanding, personalizing, believing, and ability to decide to act, preventing information seeking that delays a protective action response (Mileti & Sorensen, 1990; Wood et al., 2018). Alert and warning message contents and style have also been shown to improve message receivers' trust in the message, which positively affects behavioral intention (Burgeno & Joslyn, 2020; Weyrich et al., 2019). Additional research employing the WRM articulates the requisite order of contents for WEA messages (see Wood et al., 2015).

The WRM has been used to inform message design and evaluation for imminent threat hazards including wildfires (Kuligowski et al., 2023), earthquakes (Sutton et al., 2020, 2023), tornadoes (Sutton et al., 2021), tsunamis (Sutton et al., 2018), and snow squalls and dust storms (Fischer et al., 2023), as well as human-induced threats such as radiological and active shooter events (Wood et al., 2015). However, AAs are not bound by FEMA to specific messaging rules such as those articulated in the WRM. Furthermore, AAs can issue a WEA for nearly any threat, event, or public safety issue they deem relevant to their population at risk. Therefore, WEA contents and design differ by hazard and location, as well as AA practices and policies. Recent efforts have been made to examine how WEAs conform to the WRM contents overall (Olson et al., 2023) and to determine message completeness and language consistency for a single hazard type (e.g., Kuligowski et al., 2023). Recognizing that the WRM focuses solely on outcomes related to protective action response, the inclusion of content in WEAs that is *not* prescribed by the WRM (such as the recommended contents from SCCT) has yet to be investigated in this

space. We now turn to frameworks from crisis communication scholarship to help contextualize such contents.

Crisis Communication

Theories and frameworks from risk communication such as the WRM center around "persuading individuals to take action to limit risk, whereas crisis communication focuses on responding to immediate public needs for information" in order to reduce uncertainty, thereby ensuring that stakeholders can understand and respond to the crisis (Veil et al., 2008, p. 28). Thus, theories and models of crisis communication typically focus on organizational outcomes such as reputation, or overall impressions of the organization's favorability (Coombs, 2010). However, crises can come with additional or associated risks that require timely and effective messages to motivate protective action (Veil et al., 2008), introducing an element of public safety and related behavioral outcomes (e.g., protective action behavior) that are traditionally the focus of *warning* communication. Importantly, crisis communication and warning communication scholars alike have found that reputational factors, in addition to the message content and style elements identified in the WRM, can influence protective action behaviors in high-risk situations (DeYoung et al., 2019). From qualitative research with residents of Hawaii who received a false alert for an incoming intercontinental ballistic missile, DeYoung et al. (2019) found that many participants sought to confirm the alert with other sources due to lack of trust in the original message. Additionally, message receivers expressed decreased trust in the organization and increased concerns about the legitimacy of future messages, should another alert be issued (DeYoung et al., 2019).

One crisis communication theory that provides messaging recommendations for all types of organizations facing crises, including public safety organizations, is SCCT (Coombs, 2007).

SCCT is a prescriptive framework that can guide crisis response by considering the amount of responsibility the public is likely to attribute to the responding organization during a crisis event (Fediuk et al., 2010). The theory includes response strategies for a variety of crises, including those where the organization is a victim of the crisis (e.g., natural disasters, rumors), accidents (e.g., technical errors), and intentional incidents (e.g., organizational misdeeds, human error; Coombs, 2007). SCCT states that the levels of responsibility attributed to an organization will depend on if the organization is a victim of the crisis—or suffers losses and was not responsible for causing the crisis—as well as its prior crisis history (i.e., past or recurring organizational misdeeds) and reputation (Ulmer et al., 2018). SCCT also argues that organizations can effectively influence stakeholder perceptions of a crisis and their attributions of responsibility by creating effective messages in response to the crisis.

Response message strategies should consider the level of organizational responsibility for the crisis and its prior crisis history. However, regardless of organizational responsibility or prior history, SCCT recommends that crisis communicators include a base response consisting of instructing and adjusting information to help the public cope physically and psychologically, respectively, as they manage their response and recovery (Coombs, 2007; Sturges, 1994; Zhang & Zhou, 2020). In other words, officials should address the primary informational needs of those at risk by providing information that tells people how to protect themselves (i.e., instructing information) and helps them to cope with the emotional stress and uncertainty of a crisis (i.e., adjusting information). Importantly, Coombs (2007) explains that these types of information should be provided as soon as possible after a crisis occurs and *before* any reputation repair efforts, such as denying responsibility, attacking accusers, or apologizing. Providing “a complete overview of relevant instructing and adjusting information” during a crisis can reduce anxiety

and uncertainty for message receivers and increase their trust in the source, thereby protecting reputation without engaging in explicit reputation repair efforts (Claeys et al., 2022, p. 360). By providing instructing and adjusting information as part of the initial organizational response, organizations demonstrate that they are actively helping victims of a crisis, which can help to minimize reputational damage for the organization (Coombs, 2015). Next, we describe instructing and adjusting information in greater detail.

Instructing Information

Instructing information focuses on information directing people to physically protect themselves from a crisis (Coombs, 2015). This concept closely aligns with Mileti and Sorensen's (1990) definition of protective action guidance from the WRM and includes public safety-oriented calls to action (Coombs, 2015) such as "shelter in place," "avoid the area," or "leave now." Although instructing information should be provided as soon as possible during a crisis (Sturges, 1994), the SCCT literature lacks specific message design recommendations regarding the contents and style of instructing information beyond providing highly instructive information (Claeys et al., 2022) that directs physical response to a crisis, including descriptions of who could be affected, how to get to safety, and how to protect oneself (Page, 2020).

Adjusting Information

Adjusting information focuses on information that can help people cope with the emotional stress and uncertainty of a crisis. According to Coombs (2007), "a crisis creates a need for information. The uncertainty of a crisis produces stress for stakeholders. To cope with this psychological stress, stakeholders need information about what had just happened" (p. 165). Adjusting information is important for psychological coping and stakeholder well-being, but

some scholars have also indicated that it should be provided immediately *after*, rather than during, the crisis (Sturges, 1994; Page, 2020).

Adjusting information can take several forms such as expressions of concern, solidarity, and sympathy for victims of the crisis (Coombs, 2010); information about mental health resources available to victims and their family members (Liu et al., 2020); and details of corrective actions being taken by the organization (e.g., actions being taken to prevent a repeat of the event; Coombs, 2010; Page, 2020). Page (2020), however, expanded upon the definition of adjusting information, arguing that "providing an explanation of the causes and resolution of a crisis" (p. 3) can also serve as adjusting information. Page (2020) conducted a series of interviews evaluating the extent to which explanations and resolution affected public perceptions of organizational reputation for a fictitious company facing a reputational crisis. They found that interviewees preferred messages explaining what had happened during the crisis, with particular emphasis on how the crisis was resolved. This kind of adjusting information assured message receivers that they were safe and that the organization cared for their well-being (Page, 2020). Indeed, many crisis communication scholars have found that adjusting information that provides details about the organizational response or corrective actions can reduce psychological stress and uncertainty by assuring the public that the organization is in control of the situation and cares about their well-being, thereby protecting the organization's reputation (Kim & Sung, 2014; Page, 2020; Sellnow et al., 1998; Zhang & Zhou, 2020).

However, SCCT prescribes strategies for responding to crises broadly, as it was developed for crisis response strategies, not alert and warning communication. Importantly, the character limitations for WEAs may prevent the inclusion of detailed descriptions of corrective actions and other forms of adjusting information. In fact, results from a study assessing the

inclusion and use of instructing and adjusting information in government Twitter, Instagram, Facebook, and official website posts found that only 26.5% of posts included information about organizational efforts to minimize harm (i.e., corrective actions; Liu et al., 2020). Although this study coded corrective actions separately from adjusting information, these contents do fit the definition of adjusting information provided by Coombs (2010) and Page (2020). This information was less likely to appear on Twitter, which limits messages to 280 characters, in comparison with channels that do not place limitations on content length such as Facebook (Liu et al., 2020).

Furthermore, crisis communication scholarship, such as SCCT, emphasizes the importance of instructing information for messages shared with victims during the crisis, especially "during health crises, product recalls, natural disasters, and other events that threaten public safety and well-being" (Kim et al., 2011, p. 185). However, the nature of the hazard (including whether there are victims) and level of human intervention required to resolve the hazard (e.g., officers needing to apprehend a suspect) may result in varied use of adjusting information between different hazard types.

Summary

In summary, the WRM model prescribes the inclusion of five contents: source, hazard, location, guidance, and time. The inclusion of organizational response information, which we argue is a form of adjusting information, does not align with the WRM. Although instructing information is similar to protective action guidance found in the WRM, there is no equivalent for adjusting information in the existing WRM framework. We have observed both instructing and adjusting information (namely, organizational response information) in previously sent WEAs (see PBS WARN 2021b, 2022); however, it remains unknown how frequently this content is

included, whether these contents are more prevalent in longer or shorter WEAs, and whether their inclusion differs by hazard type. Given the dearth of research on the use of crisis communication strategies in alert and warning messages, we pose the following research questions:

RQ1: How frequently is instructing information and adjusting information included in WEAs?

RQ2: What types of adjusting information are included in WEAs?

RQ3: How does instructing and adjusting information inclusion differ by WEA length (90 or 360 characters)?

RQ4: How does instructing and adjusting information use differ by hazard type?

Methods

We conducted a quantitative content analysis of 4,777 WEAs obtained from FEMA-IPAWS sent between 2019 and 2022. WEAs were manually coded for completeness (i.e., inclusion of the five contents identified in the WRM; where content on guidance is equivalent to instructing information), their inclusion of adjusting information (including organizational response information), and hazard type. Descriptive analyses and/or chi-square tests were conducted to illustrate differences in use of instructing and adjusting information between 90- and 360-character messages and between WEAs for various hazard types.

Sample

The sampling frame for this study includes the historical record of WEAs sent by state, local, tribal, and territorial AAs from 2012 to 2022 (n = 7,645). For this analysis, we narrowed this sample to include WEAs sent between December 18, 2019, and April 13, 2022 (n = 6,252). The start of this timeframe coincides with the introduction of 360-character WEAs. We do not

include messages from federal sources such as the National Weather Service or the National Center for Missing and Exploited Children. Additionally, duplicate messages (i.e., identical messages sent as both 90- and 360-character WEAs, n = 1,104) and post-alert or cancellation messages (n = 445) were excluded from the content analysis, yielding a sample of 4,777 messages. Only the content of the messages themselves was coded; any information linked through URLs was not included in the analysis.

Coding Scheme

All WEAs in the sample were coded for completeness (i.e., containing source, hazard, location, protective action guidance/instructing information, and time information; Mileti & Sorensen, 1990). WEAs were also coded for presence or absence of content that represented adjusting information. Adjusting information was defined as information related to psychological coping advice or resources (Liu et al., 2020) and/or details of official organizational response efforts. Inclusion of adjusting information as psychological coping advice was indicated by content directing readers to mental health resources. Inclusion of organizational response information was indicated by language that described official actions to directly address the hazard or hazard impacts in question before, during, or after the initial event. Our coding criteria are detailed in the following paragraphs and summarized in Table 1 with italics added to emphasize contents that qualified messages for inclusion.

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Table 1

Examples of Adjusting Information Coding Criteria.

Decision	Example message	Explanation
Included	*Spokane County Fire District 4 is keeping Level 2 evacuations in place for the Nelson Creek Fire*. Residents from East Bridges S to E Nelson Rd and N Madison East to N Jackson Rd should still stay prepared and monitor your phones.	This message positions the fire district as making an official decision regarding evacuation status. This action aims to mitigate the wildfire threat.
	Law enforcement is in the area along Hwy 71 between County Roads Y and Z looking for a suspected armed suspect. Stay inside and lock doors. Remove Keys from outside vehicles. Call 911 if you observe anyone suspicious.	This message includes detail that law enforcement personnel are actively looking for the suspect.
	Northampton Public Works is currently working to repair a watermain break in your area	This message demonstrates a strategic choice in language to depict Public Works as actively working to repair an issue.
Excluded	Santa Maria PD *Requesting* resident shelter in place at this time due to police activity.	This message positions Santa Maria PD as the source of a request to shelter in place, but "requesting" does not hold the same legal significance as terms like "issuing" or "ordering."
	The water system in Avon has been repaired. Boil water for human use until 6.14.21 @ 3 PM.	This message does not identify who repaired the water system, and the reader cannot assume that an official source is responsible.

The coding scheme was developed via inductive content analysis. We extracted and recorded language used to describe organizational response efforts to build a lexicon of response types (e.g., issuing, working, ordering, etc.). From this lexicon, two main categories of response emerged: *actions*, that is, organizational physical response activities, and *orders*, or enforceable

statements designed to initiate public response. We then identified content describing an organization's active response to a named hazardous event as a form of adjusting information. For example: "crews have restored services" following a water main break points to (a) an organization ("crews") and (b) physical response ("restored services") to manage and/or resolve a hazard during or following the hazard event. Therefore, the passive version (e.g., "service has been restored") would not be coded as adjusting information, as the role of an organization in reaching that resolution is unclear.

Second, we include actions such as "issuing," "advising," and "warning" as organizational response information when the organization is positioned as "doing" the action (e.g., "The Shasta County Sheriff's Office has issued an evacuation warning due to the Fawn fire"; PBS WARN, 2021a). These messages reflect strategic choices in phrasing to identify who is responsible for a warning and position the organization as playing a direct role in addressing a hazard or attempting to mitigate hazard impacts but do not clearly direct individuals to take a specific protective action. By identifying themselves as the source of an evacuation, order, or warning, organizations demonstrate that they are exercising due diligence to warn of an impending threat and potentially fulfill legal obligations to provide timely warnings and effective protective guidance. However, terms such as "urging," "asking," "reporting," and "reminding" were not included in our conceptualization of organizational response information, as such phrasing primarily serves to identify the source of the advisory and does not hold the same legal implication as terms like "ordering" or "issuing."

Additionally, inclusion of organizational response information was coded only when response activities were distinct from the hazard itself. For example, several law enforcement-related hazards such as "police activity" imply official action to address some hazard (e.g.,

"Avoid area at and near Southlake Mall on US 30 - Police Activity"; PBS WARN, 2021c). This statement implies an official response to some hazard; however, if the hazard was not explicitly named in the message, these WEAs were not coded as including organizational response information because "police activity" is presumed to be the hazard. Another example is a 90-character WEA that states "Xcel will be conducting rolling blackouts" (PBS WARN, 2021d). The 360-character version of this message specifies that the blackouts were intentional to mitigate threats from a nearby wildfire, but without that knowledge the blackouts *are* the hazard instead of a *response* to address or mitigate the hazard.

Three other pieces of information were considered in this analysis: inclusion of instructing information or guidance, message length, and hazard type. Instructing information or guidance was coded as present when WEAs contained explicit instruction to receivers to take action in response to the hazard (e.g., "take shelter," "check local media," "call 9-1-1 if spotted"). Message length (90- or 360-characters) was included in the dataset as metadata for each WEA; hazard type was coded manually to align with categories from Sutton et al. (2023; see Table 2).

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Table 2

List of Hazard Categories and Sub-Categories Adapted from Sutton et al. (2023).

Hazard Category	Hazards		
Atmospheric	Blizzard	Dust storm	Extreme cold
	Extreme heat	Flash flood	Fog
	Hail	Heavy rain	Heavy snow
	High wind	Hurricane/tropical storm/tropical cyclone	Ice
	Severe thunderstorm	Snow squall	Storm surge
	Tornado	Tsunami	Winter storm
Geophysical	Avalanche	Earthquake	Landslide
	Mud/debris flow	Rock fall	Sinkhole
	Volcano		
Law enforcement	Active shooter	Bomb threat	Civil disturbance
	Hostage taking		
Public health	Air quality	Bio-hazard	Infectious disease/novel pandemic
Public safety	Blackout/brownout	Water service disruption	911 telephone outage
Technological	Bridge collapse	Building collapse	Building fire
	Chemical release	Dam/levee failure	Explosion
	Hazardous materials release	Industrial plant fire	Radiological release/accident
	Toxic fumes		
Wildfire			

Coding Process

Contents were manually coded using Excel spreadsheets. Each message was read as a single unit of observation. The WRM contents and adjusting and instructing information were coded dichotomously as present or absent in each message. Intercoder reliability for protective

action guidance (i.e., instructing information) was performed by the first author and a research assistant on the entire WEA dataset provided by FEMA (n = 7,645). We used 300 messages that were randomly selected for intercoder reliability (Lombard et al., 2005), including 50 messages used for pilot coding (Neuendorf, 2017). Reliability was calculated using ReCal2 (Freelon, 2013) and was high (α = .96); the research assistant coded the remainder of the sample.

Intercoder reliability for adjusting information was performed later in a separate process, looking solely at messages sent between 2019 and 2022 (n = 4,777), but followed a similar procedure. The first and second authors first reviewed and refined the inclusion and exclusion criteria for organizational response information before conducting two rounds of pilot coding with 50 messages each. Agreement was satisfactory after the second round of pilot coding. The coders proceeded to code 300 messages (Lombard et al., 2002), including the 50 messages from the second round of pilot coding; Neuendorf, 2017) and reached high reliability (α = .96) calculated using ReCal2 (Freelon, 2013). The first author coded the remainder of the sample, referring to the second coder for a second opinion when necessary.

Data Analysis

Descriptive statistics were used to identify differences in the inclusion of instructing and adjusting information, between 90- and 360-character messages, and between hazard categories. We conducted additional chi-square tests to determine if differences in use were statistically significant.

Results

Use and Types of Adjusting Information

Instructing information was included in 72.2% of WEAs (n = 3,450). Adjusting information was included in 13.7% (n = 656) of WEAs. Additionally, 8.8% of the sample (n =

419) included both instructing and adjusting information. Three categories of adjusting information were included: mental health resources, official orders, and official actions. The first category, mental health resources, includes the conceptualization of adjusting information as emotional coping and mental health resource information (e.g., Liu et al., 2020), and was observed in 0.1% of the sample (n = 4). The content of these four messages was nearly identical and were all sent by the same AA for the same hazard.

The second and third categories represent two forms of organizational response efforts: orders and actions. Language that described an official organization as issuing an order or advisory was observed in 9.0% (n = 432) of WEAs. Language that described an official organization's physical response to the hazard was observed in 4.6% (n = 221) of WEAs. One message in our sample included details of both an organizational order and action. Examples of messages from each of these three categories are provided in Table 3.

Table 3

Categories of Adjusting Information and Example Messages

Type	Example
Emotional coping	Dealing with challenging emotions or situations in these times? Reach out, you're not alone! *Call our 24hr @ 915-779-1800 or go to emergencehealthnetwork.org*
Organizational order	*UCPD ordering a shelter in place for those within a 1/2 mile of 1589 South Garnet Mine Road due to active shooter*. If you are not in the area do not return to your home.
Organizational action	*City of Centerville is repairing a water main*. Residents boil water until further notice.

Differences by Message Length

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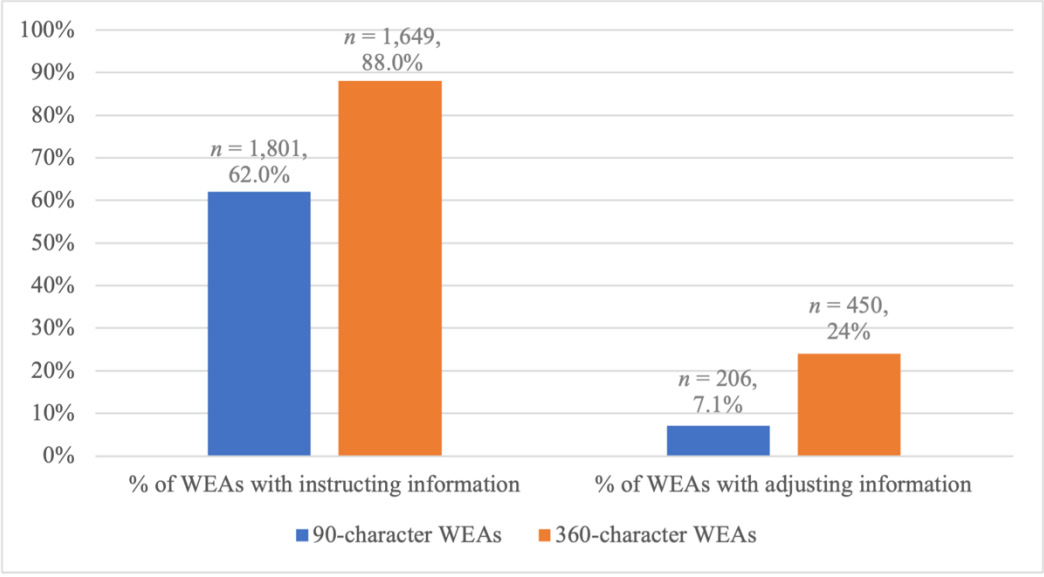
Of the total sample (*N* = 4,777), 60.8% (*n* = 2,904) were 90-character WEAs and 39.2% (*n* = 1,873) were 360-character WEAs. Instructing information was included in 62.0% (*n* = 1,801) of 90-character messages and 88.0% (*n* = 1,649) of 360-character messages. This difference was significant (χ^2 (1) = 384.329, *p* < .001, phi = .284), with 360-character messages being more likely to include instructing information.

Adjusting information was observed in 7.1% (*n* = 206) of 90-character messages and 24.0% (*n* = 450) of 360-character messages. There was a significant difference for inclusion of adjusting information between 90- and 360-character messages (χ^2 (1) = 275.548, *p* < .001, phi = .240), whereby 360-character messages were more likely to include adjusting information.

Results are summarized in Figure 1

Figure 1

Frequencies and Percentages for Inclusion of Instructing and Adjusting Information of 90- and 360-character WEAs



Differences by Hazard Type

Next, we assessed differences in inclusion of instructing and adjusting information between WEAs sent for different hazards. We find that public safety WEAs most frequently included instructing information (*n* = 537, 80.3%), followed by technological (*n* = 158, 80.2%), and public health (*n* = 693, 80.1%) WEAs. Wildfire (*n* = 1,005, 63.2%) and other/unknown (*n* = 48, 62.3%) WEAs included instructing information less frequently. Results are summarized in Table 4.

Table 4

Inclusion of Instructing Information by Hazard Type

Hazard Type	WEAs with Instructing Information	Total *n* for Hazard Type	% of WEAs with Instructing Information
Atmospheric	382	494	77.3
Geophysical	23	34	67.6
Law enforcement	604	850	71.1
Other/unknown[a]	48	77	62.3
Public health	693	865	80.1
Public safety	537	669	80.3
Technological	158	197	80.2
Wildfire	1,005	1,591	63.2

Note. Percentages reflect the percent of messages that contain instructing information within each hazard category.

[a]Other/unknown includes messages for which the hazard was not named or could not be determined, and messages that shared information for hazards that did not fit within categories in the Warning Lexicon (e.g., general preparedness messages, polling location closures, etc.; Sutton et al., 2023).

Inclusion of adjusting information was highest in law enforcement (*n* = 214, 25.2%) WEAs, followed by other/unknown (*n* = 11, 14.3%), technological (*n* = 26, 13.2%), and public safety (*n* = 82, 12.3%) WEAs. Public health WEAs (*n* = 85, 9.8%) included adjusting information least frequently. Results are summarized in Table 5.

Table 5

Inclusion of Adjusting Information by Hazard Type

Hazard Type	WEAs with Adjusting Information	Total *n* for Hazard Type	% of WEAs with Adjusting Information
Atmospheric	55	494	11.1
Geophysical	4	34	11.8
Law enforcement	214	850	25.2
Other/unknown[a]	11	77	14.3
Public health	85	865	9.8
Public safety	82	669	12.3
Technological	26	197	13.2
Wildfire	179	1,591	11.3

Note. Percentages reflect the percent of messages that contain adjusting information within each hazard category.

[a]Other/unknown includes messages for which the hazard was not named or could not be determined, and messages that shared information for hazards that did not fit within categories in the Warning Lexicon (e.g., general preparedness messages, polling location closures, etc.; Sutton et al., 2023).

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Discussion

In this content analysis of 4,777 WEAs sent between 2019 and 2022, we find that approximately 72% of messages included protective action guidance, which, in this analysis, represents contents that reflect instructing information; this practice is supported by message design frameworks from both risk (WRM; Mileti and Sorensen, 1990) and crisis (SCCT; Coombs, 2007) communication scholarship. Additionally, 13.7% of WEAs included adjusting information—or information to help receivers psychologically cope. Although this practice is not recommended by the WRM, it is recommended by SCCT to help receivers psychologically cope with the crisis. Approximately 9% of WEAs included *both* instructing and adjusting information.

In response to RQ2, our analysis also identified three forms of adjusting information present in these WEAs: (a) providing mental health resources, (b) describing organizational actions in response to the hazard, and (c) describing organizational orders to mitigate threats associated with the hazard. The latter two represent what we call "organizational response information." Thus, we expand the definition of adjusting information applied by Liu et al. (2020), which focused only on mental health resources and coping advice, and argue that information regarding organizational efforts to address the *current* crisis and reduce harm also functions as adjusting information. In doing so, we extend the work of Coombs (2007), Liu et al. (2020), and Page (2020) to determine how organizations include adjusting information in WEA messages. Future research may show that establishing that an organization is actively involved in hazard response at the start of the warning period may help to soothe the concerns of the public, "resolving [stressors the audience is experiencing and responding to] through strategic communication that ultimately maintains and builds credibility for the communicator or organization" (Veil et al., 2008, pp. 28–29). Indeed, crises inherently hold some degree of

uncertainty, but explaining the corrective actions being taken to address the crisis can help to reduce psychological stress caused by this uncertainty (Sellnow et al., 1998).

Additionally, including organizational response information may serve to manage an organization's reputation. From an SCCT perspective, reputation threats stem from how the public views who is responsible for the crisis (Page, 2019). Organizations can communicate their response actions to help establish organizational "presence," such as actively detecting, monitoring, responding to, and communicating about an unfolding event (Helsloot & Groenendaal, 2017; Liu et al., 2020). Establishing presence can also help to avoid negative public perceptions of organizational credibility (Liu et al., 2020). This information helps to frame the responding organization as a competent responder and manager that engages in socially standardized rituals associated with leadership in times of crisis (Helsloot & Groenendaal, 2017). These principles have not yet been evaluated in the space of terse messages such as WEAs but may provide valuable insight as to how corrective actions typically associated with reputation management can affect risk communication outcomes.

In response to RQ3, our analysis also shows that the inclusion of both instructing and adjusting information was significantly higher in 360-character WEAs than in 90-character WEAs, indicating that AAs are taking advantage of the expanded character count to include additional detail in their messages about what their organizations are doing. However, the appropriateness and urgency of including this information in WEAs, which are intended to alert and warn publics of imminent threats, remains questionable.

The effects of adjusting information may be more influential for certain hazards, specifically those that are human-induced or require official intervention to resolve. In response to RQ4, our analysis shows that adjusting information was most frequently observed in law

enforcement messages, in which officials were often described as actively responding to an ongoing threat. This information may be included to reassure receivers that officers are doing their jobs and the situation is being addressed. In some cases, such information may be viewed less as an assurance and more as a statement of power and control.

The benefits of adjusting information have been well-demonstrated in crisis communication literature (e.g., Claeys et al., 2022; Page, 2020); however, these studies use long-form risk messages for long-fuse threats as their stimuli, including some messages with visual components. These messages cannot be classified as terse messages for short-fuse imminent threats as WEAs are and are not received by the public in the same ways. Thus, until researchers can demonstrate the positive effects of including adjusting information in WEAs on terse messaging outcomes recommended by the WRM, including message understanding, believing, personalizing, and deciding (see Mileti & Sorensen, 1990; Wood et al., 2018), we suggest that AAs continue to adhere to warning messaging guidelines from the WRM, which have been empirically supported in a variety of hazard contexts (see Wood et al., 2015). This is especially important when AAs must choose which contents to include in character-constrained channels such as WEAs. Less than three-quarters of the messages analyzed in this study included protective action guidance, yet we know from prior work that excluding instructing information from WEAs can result in lower message understanding and self-efficacy (Sutton et al., 2021) and delayed protective actions (Wood et al., 2018).

Limitations and Future Research

Given that extant alert and warning literature has not previously explored the presence of adjusting information in WEAs, there is a wealth of future research opportunities. We have defined and quantified the use and types of adjusting information in WEAs historically,

including organizational response information; however, the results of this content analysis do not provide any explanation as to why AAs choose to include (or exclude) adjusting information in WEAs. It would be worthwhile to conduct interviews and/or focus groups with AAs to understand why they choose to include (or exclude) adjusting information. Perhaps some AAs have been trained as public information officers, thus aligning more with the goals of crisis communication to fill informational needs (Veil et al., 2008), rather than to alert and warn publics with an emphasis on protective action. Findings from such research could be used to inform AA training materials to ensure that appropriate contents are provided in WEAs.

Additionally, this study does not assess public responses to WEAs that include adjusting information, leaving us to wonder whether its inclusion affects protective action or organizational reputation outcomes. In the month following the content analysis study presented here, the research team conducted a public message testing experiment to assess the effect of organizational response information on outcomes related to the WRM and organizational reputation. Results showed no significant effects of including organizational response information on any measured outcomes across five hazards (Sutton, 2023). Future work will investigate how the type of hazard (e.g., natural hazards versus human-induced) affects public perceptions of adjusting information contained in WEAs.

Lastly, this study identified different forms of adjusting information but did not assess forms of instructing information in WEAs. Future studies should investigate the different forms of protective action guidance in terms of types of recommended actions (e.g., “evacuate now” vs. “check local media”) and how explicit versus implied those guidance instructions are (e.g., providing a link vs. “Check for updates here:”). Additionally, some of the components of the

WRM could be used to assess the level of detail used to describe instructing information (e.g., if instructions to evacuate include the location and time at which to evacuate).

Conclusion

This study represents a crucial step toward understanding how principles of crisis communication are used in the context of alerts and warnings for imminent threats, drawing from our present knowledge of the use of instructing and adjusting information during crises. We find that adjusting information in WEAs typically takes the form of organizational response information detailing official efforts to address or mitigate threats to public safety; however, this information was included in only 13.7% of WEAs in our sample. Adjusting information was most frequently found in law enforcement messages and was significantly more likely to be included in 360-character WEAs compared to 90-character WEAs, indicating that AAs are taking advantage of less restrictive space limitations to include additional detail about hazard incidents. Instructing information, which is recommended in both the WRM (Mileti & Sorensen, 1990) and SCCT (Coombs, 2007), was present in the large majority of WEAs overall.

Crisis communication theory (e.g., Sellnow et al., 1998; Coombs, 2007; Page, 2020) suggests that adjusting information, including details of corrective actions or explanations of crisis resolution, can reduce uncertainty for message receivers, thereby reducing psychological stress and improving their perceptions of the responding organization. However, when considering the length limitations imposed on WEAs along with suggestions that adjusting information should be shared during recovery phases after a crisis and second to instructing information (Coombs, 2015), the appropriateness of including these details in WEAs remains questionable. Future work is required to determine whether any potential benefits of including

adjusting information in WEAs warrant dedicating limited characters to that information and whether this information is more important in specific hazard contexts.

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Figure Legends

Figure 1. Bar chart displaying the frequencies and percentages for inclusion of instructing and adjusting information of 90- and 360-character WEAs.