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Review Article

Rebuilding Public Trust Through Strategic Vaccine Communication: Lessons from Recent Global Health Emergencies and a Framework for Future Pandemic Preparedness

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ABSTRACT

Effective vaccine communication has become a defining challenge of global health emergency preparedness, as scientific advances in vaccine development have not been accompanied by comparable gains in public trust. Experiences from recent outbreaks, particularly Ebola, COVID-19, and mpox, demonstrate that vaccine availability alone is insufficient to achieve high vaccine uptake when communication is inconsistent, misinformation proliferates, and public confidence in health institutions is weakened. This narrative review critically synthesizes current evidence to examine the determinants of public trust, evaluate the strengths and limitations of existing vaccine communication strategies, and identify priorities for future research and policy. The review highlights five interconnected determinants of effective vaccine communication: institutional transparency, evidence-based messaging, trusted community partnerships, digital information monitoring, and continuous communication adaptation. It further identifies persistent challenges, including reactive communication approaches, political polarization, inequitable access to trustworthy information, and the growing influence of artificial intelligence-driven misinformation. Current evidence is also limited by the predominance of cross-sectional studies, underrepresentation of low- and middle-income countries, and insufficient evaluation of long-term trust-building interventions. To address these challenges, we propose the Adaptive Vaccine Trust Communication (AVTC) Framework, which conceptualizes vaccine communication as a continuous adaptive process rather than a one-way transfer of information. By integrating institutional transparency, evidence-based messaging, trusted community partnerships, digital information monitoring, and continuous feedback, the framework provides a practical roadmap for strengthening public trust, improving vaccine confidence, and enhancing preparedness for future global health emergencies.

Keywords: Vaccine Communication; Public Trust; Vaccine Confidence; Global Health Emergencies; Pandemic Preparedness

Introduction

Vaccination remains one of the most effective public health interventions, preventing millions of deaths annually and reducing the burden of infectious diseases worldwide [1]. Advances in vaccine science, including genomic technologies, novel platforms such as mRNA vaccines, and accelerated regulatory pathways, have dramatically shortened the time required to develop and deploy vaccines during public health emergencies. The unprecedented speed of vaccine development during the COVID-19 pandemic demonstrated remarkable scientific progress and underscored the potential of innovation to mitigate emerging infectious disease threats [2]. However, these scientific achievements have not been matched by comparable gains in public confidence, exposing a widening gap between vaccine availability and vaccine acceptance [3,4].

Recent global health emergencies have revealed that successful vaccination programmes depend not only on scientific innovation but also on effective communication that fosters public trust. During the COVID-19 pandemic, rapidly evolving scientific evidence, inconsistent public messaging, misinformation disseminated through digital media, and political polarization undermined confidence in vaccines despite overwhelming evidence of their effectiveness [5,6]. Similar communication challenges were observed during Ebola outbreaks, where community mistrust and inadequate engagement impeded vaccination efforts [7], and during the 2022 mpox outbreak, where delayed, inconsistent, and inequitable risk communication contributed to public uncertainty and disparities in vaccine uptake [8,9]. Collectively, these experiences demonstrate that communication failures can rapidly evolve into public health failures by reducing vaccine acceptance, delaying outbreak control, and exacerbating existing health inequities.

These recurring challenges highlight that vaccine communication is not merely a mechanism for disseminating information but a strategic component of emergency preparedness that shapes individual behaviour, institutional credibility, and societal resilience. Trust is built through transparent communication, consistent messaging, meaningful community engagement, and responsiveness to public concerns, yet these elements have often been inadequately integrated into emergency response strategies. Consequently, understanding why communication succeeds in some contexts and fails in others has become an urgent public health priority.

This narrative review critically synthesizes evidence on vaccine communication during recent global health emergencies, identifies the recurring determinants of public trust, evaluates communication successes and failures across diverse settings, and proposes an adaptive conceptual framework to strengthen trust-based vaccine communication and enhance preparedness for future pandemics.

Review approach. This narrative review synthesized evidence on vaccine communication and public trust during recent global health emergencies. A structured literature search was conducted using PubMed, Scopus, Web of Science, and Google Scholar, together with reports and guidance from international public health organizations, including the World Health Organization (WHO), the U.S. Centers for Disease Control and Prevention (CDC), and UNICEF. The search focused primarily on literature published between January 2014 and June 2026 to capture evidence from the West African Ebola epidemic, the COVID-19 pandemic, the 2022 mpox outbreak, and recent advances in vaccine communication research.

Search terms included combinations of keywords such as *vaccine communication, public trust, vaccine confidence, risk communication, health communication, vaccine hesitancy, misinformation, infodemic, community engagement, COVID-19, Ebola, mpox, pandemic preparedness, and artificial intelligence*. Reference lists of key publications were also screened to identify additional relevant sources.

Studies and reports were selected based on their conceptual relevance to vaccine communication, public trust, misinformation, community engagement, communication equity, and emergency preparedness. Both empirical studies and high-quality reviews were considered, together with policy documents from recognized public health agencies. Publications not available in English, studies with limited relevance to the review objectives, conference abstracts without sufficient methodological detail, and non-peer-reviewed opinion articles were generally excluded, except where authoritative organizational reports provided important policy guidance.

As this was a narrative review, no formal systematic screening protocol, risk-of-bias assessment, or meta-analysis was undertaken. Instead, evidence was critically synthesized to identify recurring themes, areas of consensus and disagreement, methodological limitations, and emerging priorities that informed the development of the Adaptive Vaccine Trust Communication (AVTC) Framework.

Why Public Trust Determines Vaccine Success

Public trust is increasingly recognized as the foundation of successful vaccination programmes, influencing not only vaccine acceptance but also adherence to broader public health recommendations during health emergencies. Trust is a multidimensional construct that extends beyond confidence in vaccines themselves to encompass perceptions of institutions, scientific integrity, interpersonal relationships, and digital information ecosystems. Rather than operating independently, these dimensions interact dynamically to shape how individuals interpret risk, evaluate health information, and make vaccination decisions.

Institutional trust reflects public confidence in governments, public health agencies, and political leadership to act transparently, competently, and in the collective interest. During health emergencies, trust in these institutions determines whether official recommendations are perceived as credible or politically motivated. Frequent policy changes, inconsistent messaging, and perceived lack of transparency can erode institutional legitimacy, whereas timely communication, accountability, and clear acknowledgment of scientific uncertainty strengthen public confidence even in rapidly evolving situations [10].

Scientific trust complements institutional trust by shaping confidence in the evidence underpinning vaccine development and regulatory decision-making. Public acceptance depends not only on the availability of scientific evidence but also on confidence in the processes through which evidence is generated, evaluated, and communicated. Transparent reporting of clinical data, open communication about uncertainties, and visible independence of scientific experts enhance credibility, whereas conflicting expert opinions or inadequate explanation of evolving evidence may foster skepticism despite robust scientific consensus.

Interpersonal trust provides a critical bridge between institutions and communities. Healthcare professionals remain among the most trusted sources of vaccine information [3,11], while community and religious leaders often influence health behaviours by translating public health messages into culturally meaningful contexts. Their credibility becomes particularly important in populations with historical experiences of marginalization or limited trust in governmental institutions, where locally trusted messengers can substantially improve vaccine confidence and engagement.

Increasingly, trust is also mediated through the digital information environment. Social media platforms have transformed health communication by enabling rapid dissemination of both accurate information and misinformation [12], while advances in artificial intelligence have amplified the scale and sophistication of misleading content [13]. Digital trust therefore depends not only on information availability but also on individuals' ability to evaluate source credibility within an increasingly complex information ecosystem.

These four dimensions are mutually reinforcing rather than discrete. Institutional transparency strengthens confidence in scientific evidence; trusted healthcare professionals enhance the credibility of official guidance; and effective digital communication can reinforce or undermine both institutional and interpersonal trust. Vaccine confidence therefore emerges from an interconnected trust ecosystem, suggesting that sustainable communication strategies must address these dimensions collectively rather than through isolated interventions.

Lessons from Recent Global Health Emergencies

Across recent global health emergencies, communication failures have consistently emerged from recurring patterns rather than disease-specific circumstances. Experiences from COVID-19, Ebola, and mpox collectively demonstrate that public trust is shaped less by the biological characteristics of an outbreak than by the quality, consistency, and credibility of communication throughout the emergency response. Five interrelated themes illustrate how communication practices have either strengthened or undermined vaccine confidence across diverse settings.

The first recurring theme concerns the tension between communication speed and communication accuracy. Public health emergencies demand rapid dissemination of information to support timely decision-making, yet scientific knowledge inevitably evolves as new evidence emerges. During the COVID-19 pandemic, recommendations regarding mask use, vaccine eligibility, booster doses, and rare adverse events changed in response to accumulating evidence. Although such revisions reflected the self-correcting nature of science, they were frequently interpreted by the public as inconsistency or institutional uncertainty because the rationale for changing guidance was often

inadequately explained [14]. Similar challenges have been observed in previous outbreaks, where pressure for immediate communication sometimes exceeded the available evidence. These experiences demonstrate that rapid communication alone does not build trust; rather, trust depends on transparent communication that explicitly acknowledges uncertainty, explains why recommendations evolve, and prepares the public for evidence-based changes over time.

A second lesson concerns the emergence of the infodemic as a defining feature of modern health emergencies [15]. Digital communication platforms have transformed the information landscape by enabling unprecedented speed and reach of health messaging. However, these same platforms facilitate the rapid circulation of misinformation, conspiracy narratives, and emotionally charged content that often attracts greater engagement than evidence-based communication. Algorithm-driven content recommendation systems reinforce confirmation bias by creating information echo chambers, while influencers and automated social media accounts continue to amplify misleading narratives across multiple platforms. More recently, advances in generative artificial intelligence have created new opportunities for producing highly convincing text, images, audio, and video capable of disseminating health misinformation at unprecedented scale. Although empirical evidence directly linking AI-generated misinformation to vaccine uptake remains limited, recent studies have highlighted its growing potential to undermine public trust and complicate future public health communication [16]. Corrective information frequently struggles to achieve comparable visibility because misinformation appeals to emotion, identity, and existing beliefs rather than scientific evidence alone [5,12]. Consequently, vaccine communication can no longer be viewed as a process of information dissemination but must also involve proactive monitoring, rapid response to misinformation, and sustained efforts to strengthen digital health literacy before and during public health crises.

Community engagement represents a third and consistently overlooked determinant of communication success. Evidence across Ebola outbreaks and the COVID-19 pandemic demonstrates that trust is rarely transferred directly from national institutions to individuals. Instead, public confidence is often mediated through trusted local actors who possess established social credibility within their communities [3,7]. Healthcare workers, religious organizations, traditional authorities, and community-based organizations have repeatedly demonstrated greater effectiveness in addressing vaccine concerns because they communicate within existing cultural, social, and linguistic contexts [17]. In contrast, communication strategies developed centrally and delivered without meaningful community participation frequently encounter resistance, particularly among populations with historical experiences of exclusion or institutional mistrust. These observations suggest that trust is relational rather than institutional, requiring sustained partnerships with community stakeholders rather than one-directional dissemination of official messages.

A fourth lesson concerns equity in vaccine communication. Public health campaigns have often assumed that standardized messaging is universally accessible and equally persuasive across populations. However, recent emergencies have highlighted substantial disparities in communication reach and effectiveness among marginalized communities, individuals with limited health literacy, migrants, Indigenous populations, and speakers of minority languages. Structural barriers, including digital exclusion, cultural differences, socioeconomic disadvantage, and limited access to trusted healthcare providers, reduce opportunities to receive, interpret, and act upon vaccine information [9,11]. Communication strategies that overlook these contextual realities risk reinforcing existing health inequities by disproportionately benefiting populations that already possess greater access to reliable information. Effective vaccine communication therefore requires culturally responsive approaches that are adapted to diverse social, linguistic, and educational contexts rather than relying on uniform national messaging.

The final recurring theme is the increasing influence of political polarization on vaccine communication. During recent health emergencies, vaccination became intertwined with broader political debates concerning personal freedom, government authority, and public health mandates. Media framing, partisan discourse, and election politics frequently reshaped scientific recommendations into ideological narratives, reducing public confidence in health institutions and increasing resistance to vaccination among politically polarized populations [6]. Once vaccine decisions become expressions of political identity rather than assessments of scientific evidence, conventional risk communication strategies become substantially less effective [18]. Restoring trust under these circumstances requires institutional independence, transparent decision-making, and communication strategies that emphasize shared public health goals rather than partisan positions.

Although COVID-19 dominates the contemporary evidence base because of its unprecedented global scale, valuable communication lessons also emerged from Ebola and mpox that extend beyond the COVID-19 experience. During Ebola outbreaks, communication failures were closely linked to historical institutional mistrust, inadequate community engagement, and insufficient consideration of local cultural practices. Successful interventions demonstrated that meaningful collaboration with community leaders, religious organizations, and trusted local healthcare workers was essential for improving acceptance of vaccination and other public health measures. In contrast, the 2022 mpox outbreak highlighted the importance of equitable and non-stigmatizing communication. Delays in risk communication, inconsistent public messaging, and stigma directed toward affected communities contributed to confusion, discrimination, and unequal access to reliable health information. These experiences illustrate that communication strategies must not only provide accurate scientific information but also account for social context, cultural diversity, equity, and historical relationships between communities and public health institutions.

Collectively, lessons from Ebola, COVID-19, and mpox demonstrate that communication failures rarely arise from isolated messaging errors. Rather, they emerge through complex interactions among institutional transparency, evolving scientific evidence, digital information ecosystems, community relationships, sociocultural contexts, and political environments. While the specific communication challenges differed across these emergencies, each reinforced the importance of sustained trust-building, culturally responsive engagement, transparent communication, and adaptive communication systems capable of responding to changing evidence and public concerns. These cross-emergency lessons suggest that future preparedness should move beyond disease-specific communication strategies toward integrated, trust-centered systems that remain effective across diverse public health emergencies.

Figure 1 synthesizes the evolution of vaccine communication challenges across Ebola, COVID-19, and mpox by illustrating how the dominant drivers of vaccine confidence have shifted over time. Rather than depicting independent events, the figure demonstrates the progressive interaction between institutional trust, misinformation, technological change, political influences, and community engagement. This visual synthesis supports the central argument of the review that vaccine communication has evolved from a predominantly information-delivery function into a dynamic trust-building process requiring continuous adaptation throughout successive public health emergencies.

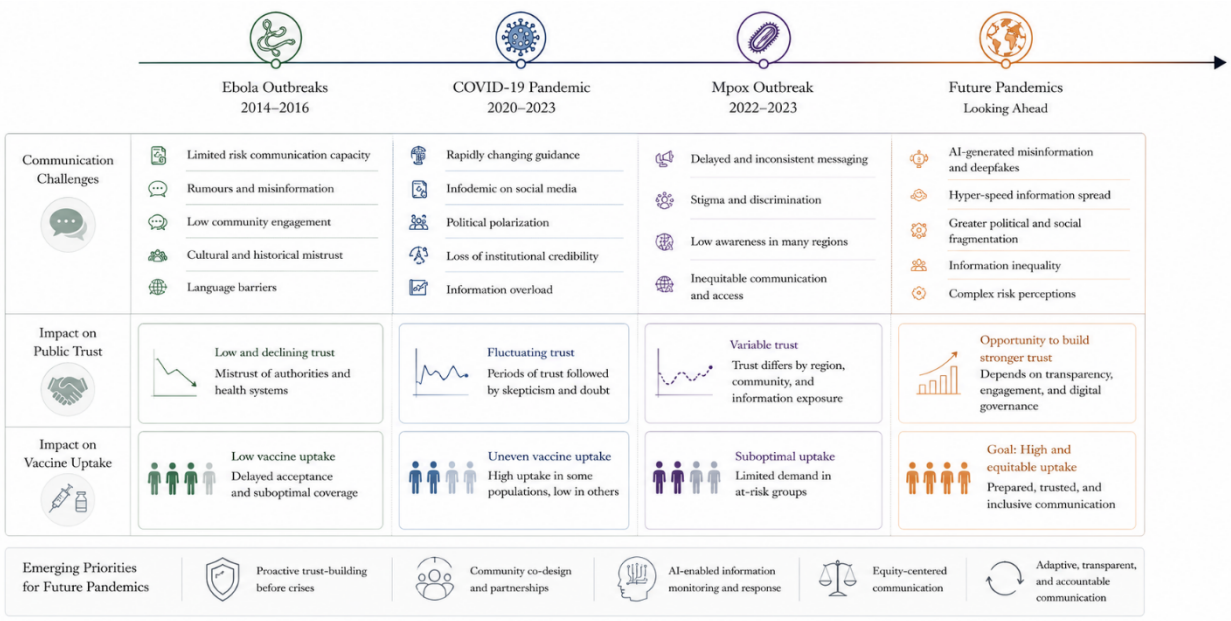

Figure 1. Evolution of Vaccine Communication Challenges Across Recent Global Health Emergencies.

The figure summarizes the progression of vaccine communication challenges observed during the Ebola outbreaks, the COVID-19 pandemic, and the 2022 mpox outbreak. It illustrates how communication barriers evolved from localized community mistrust and limited engagement to increasingly complex challenges associated with digital misinformation, political polarization, algorithm-driven information

environments, and emerging artificial intelligence-generated content. The figure highlights the corresponding communication priorities required at each stage, emphasizing that effective vaccine communication must evolve from reactive information dissemination toward adaptive, trust-centered communication systems that integrate transparency, community engagement, digital surveillance, and continuous communication improvement.

As illustrated in Figure 1, each successive public health emergency introduced new communication challenges while reinforcing lessons from previous outbreaks. The figure demonstrates that communication systems must evolve alongside scientific advances, digital information environments, and changing public expectations, providing the conceptual foundation for the adaptive communication model proposed later in this review.

Critical Appraisal of Current Vaccine Communication Strategies

Recent global health emergencies have stimulated unprecedented innovation in vaccine communication, yet their overall effectiveness has been uneven. While considerable progress has been made in expanding the reach and speed of public health messaging, many communication strategies remain insufficiently adaptive to the complex social, behavioural, and informational environments in which vaccination decisions are made. The existing evidence suggests that successful communication depends not only on disseminating accurate information but also on fostering sustained trust through transparency, engagement, and contextual responsiveness.

One of the principal strengths of contemporary vaccine communication is the capacity for rapid information dissemination through digital technologies. Public health agencies now communicate with populations in near real time using websites, social media platforms, mobile applications, and digital dashboards, enabling timely updates during rapidly evolving emergencies. Advances in behavioural science have further strengthened communication by informing message framing, risk perception research, and strategies designed to reduce vaccine hesitancy [19]. Increasing recognition of healthcare professionals as trusted communicators has also enhanced vaccine campaigns, as clinicians frequently serve as credible intermediaries between scientific institutions and the public. Furthermore, the integration of real-time epidemiological and social media surveillance has improved the ability of public health authorities to monitor emerging concerns, identify misinformation trends, and adjust communication strategies more rapidly than was possible during previous outbreaks [15].

Despite these advances, important weaknesses continue to limit the effectiveness of current communication approaches. Vaccine communication frequently remains reactive, responding to misinformation only after it has become widespread rather than anticipating public concerns through proactive engagement. Many campaigns continue to rely on standardized national messaging that inadequately reflects cultural, linguistic, socioeconomic, and regional differences, limiting relevance among diverse populations. Communication strategies also often prioritize certainty over transparency, creating difficulties when scientific recommendations evolve in response to new evidence. Failure to explicitly explain uncertainty may unintentionally undermine credibility by fostering perceptions of inconsistency rather than illustrating the iterative nature of scientific inquiry. Although behavioural science has increasingly informed message design, its integration into communication policy remains inconsistent, while meaningful collaboration with community organizations and local leaders is often confined to implementation rather than incorporated throughout communication planning and evaluation.

Although a broad consensus supports the importance of transparent and evidence-based communication, the effectiveness of individual communication strategies has been inconsistent across studies and settings. Several interventions have improved vaccine confidence, particularly when delivered through trusted healthcare professionals or community-based partnerships. However, other studies have reported only modest improvements in vaccine acceptance despite intensive communication campaigns, suggesting that communication alone cannot overcome deeply rooted political polarization, historical institutional mistrust, cultural beliefs, or structural barriers to healthcare access. These mixed findings indicate that vaccine uptake is shaped by multiple interacting determinants and that communication strategies are most effective when integrated with broader public health, social, and policy interventions rather than implemented in isolation.

Important contextual differences also emerge between high-income countries and low- and middle-income countries. Much of the available evidence originates from high-income settings with relatively well-developed health systems, widespread digital connectivity, and established communication infrastructure. In contrast, communication challenges

in many LMICs are more strongly influenced by limited healthcare access, shortages of trained health personnel, lower digital access, linguistic diversity, and historical experiences that affect institutional trust. Community engagement and locally trusted leaders often play a more central role in these settings than technology-driven communication approaches. Consequently, strategies that demonstrate effectiveness in high-income countries cannot be assumed to be directly transferable to resource-constrained environments without careful cultural and contextual adaptation.

Overall, the current evidence supports the central importance of strategic communication for strengthening vaccine confidence, but its quality remains uneven. Much of the literature consists of cross-sectional surveys and observational studies that provide valuable insights into public attitudes but offer limited evidence regarding causal relationships or long-term behavioural outcomes. Experimental studies, longitudinal evaluations, and implementation research remain comparatively scarce, limiting confidence in identifying which communication strategies consistently produce sustained improvements in public trust and vaccine uptake across diverse settings. The predominance of studies from high-income countries further constrains the global applicability of current evidence. Future research should therefore prioritize rigorous comparative and longitudinal investigations that evaluate communication interventions across different sociocultural and health system contexts while incorporating standardized measures of trust, misinformation exposure, and behavioural outcomes. Strengthening this evidence base will be essential for developing communication systems that are not only theoretically sound but also demonstrably effective in real-world public health emergencies [11,20].

Despite the overall benefits of strategic communication, evidence from recent public health emergencies indicates that communication interventions alone do not consistently translate into higher vaccine uptake. During the COVID-19 pandemic, several countries implemented large-scale public information campaigns that successfully increased public awareness but achieved only modest improvements in vaccination coverage among populations characterized by entrenched political polarization, institutional mistrust, or strong pre-existing vaccine skepticism. Similarly, communication efforts during Ebola outbreaks were less effective when they were introduced without meaningful community participation or failed to acknowledge local cultural beliefs and historical experiences with health authorities. These findings suggest that communication is a necessary but insufficient determinant of vaccine acceptance and is most effective when implemented alongside broader efforts to strengthen institutional trust, improve healthcare access, and address structural and social determinants of health.

Taken together, the heterogeneous findings indicate that no single communication strategy is universally effective; rather, successful interventions depend on the interaction between communication quality, institutional credibility, sociocultural context, and health system capacity.

Knowledge Gaps and Future Research Priorities

Despite substantial advances in vaccine communication research, important knowledge gaps continue to limit the development of evidence-informed strategies capable of sustaining public trust during and beyond global health emergencies. Addressing these deficiencies requires a shift from short-term crisis communication toward a broader research agenda that recognizes trust as a dynamic and context-dependent process.

A major evidence gap concerns the long-term dynamics of public trust. Existing research has largely focused on vaccine acceptance during acute outbreaks, while comparatively little is known about how trust is established, maintained, eroded, or restored over time. Likewise, the sustainability of communication interventions remains poorly understood, as few studies evaluate whether improvements in vaccine confidence persist beyond the immediate emergency response or translate into greater resilience during subsequent health crises. Future research should prioritize communication interventions developed and evaluated within LMICs to improve understanding of context-specific trust-building strategies and reduce the current geographical imbalance in the evidence base.

Significant population-level gaps also persist. Current evidence is disproportionately derived from adult populations in high-income countries, leaving children, older adults, migrants, refugees, and populations in low-resource settings underrepresented [11]. These groups experience distinct social, cultural, linguistic, and structural barriers that may substantially influence communication needs and trust formation. Greater contextual diversity is therefore essential to ensure that future communication strategies promote equity rather than inadvertently reinforce existing disparities.

Rapid technological change represents another important and still evolving research priority. While recent evidence suggests that generative artificial intelligence may substantially increase the scale, speed,

and sophistication of health misinformation, empirical studies evaluating its direct effects on vaccine confidence and vaccination behavior remain relatively scarce. Consequently, current concerns should be interpreted as emerging rather than definitive, highlighting the need for rigorous evaluation as these technologies become increasingly integrated into digital information ecosystems [13]. Future research should evaluate how these technologies simultaneously create new risks and opportunities for vaccine communication, while addressing ethical concerns related to privacy, transparency, and algorithmic bias.

Beyond its role in generating or amplifying misinformation, artificial intelligence also presents important opportunities to strengthen vaccine communication. AI-assisted analytics can support real-time monitoring of public sentiment, identify emerging misinformation trends, detect changes in information needs across different populations, and assist public health agencies in developing timely, evidence-based communication strategies. Large language models and multilingual AI systems may also improve access to reliable health information by generating culturally and linguistically tailored educational materials, particularly in settings with limited communication resources. However, the adoption of these technologies should be accompanied by robust ethical governance to ensure transparency, human oversight, accountability, protection of personal data, and mitigation of algorithmic bias. Future research should therefore evaluate both the effectiveness and ethical implications of AI-assisted communication systems to determine how these technologies can responsibly enhance public trust while minimizing unintended harms.

Methodological innovation is equally important. Future studies should prioritize randomized communication trials, longitudinal cohort studies, implementation science approaches, and behavioral economics frameworks to identify communication strategies that produce sustained behavioral change under real-world conditions. Comparative research across countries and health systems is also needed to distinguish context-specific determinants from universally effective communication principles. Collectively, these priorities can support the development of adaptive, evidence-based communication systems that strengthen public trust and improve preparedness for future global health emergencies.

To consolidate the major insights emerging from the literature, Table 1 summarizes the recurring themes identified across recent global health emergencies, highlights the principal limitations of the current evidence base, and outlines priority directions for future research and policy development. Collectively, these findings underscore the need for a more adaptive, trust-centered approach to vaccine communication.

Table 1. Cross-cutting themes, current limitations, and future priorities for strengthening vaccine communication and public trust during global health emergencies.

Theme	Evidence Across Recent Global Health Emergencies	Current Limitations in the Literature	Future Research and Policy Direction
Institutional trust	Public trust consistently declined when governments and health agencies issued changing or inconsistent recommendations during Ebola, COVID-19, and mpox responses [7,14].	Most studies measure trust using non-standardized, cross-sectional indicators, limiting understanding of trust dynamics over time.	Develop standardized trust metrics and conduct longitudinal monitoring to evaluate trust formation, erosion, and recovery across health emergencies.
Misinformation and digital communication	Misinformation spread rapidly through social media, algorithm-driven platforms, influencers, and emerging AI-generated content, frequently outpacing evidence-based communication [12,16].	Evidence is predominantly observational, with limited evaluation of interventions that effectively counter misinformation in real-world settings.	Integrate AI-assisted misinformation surveillance, real-time digital monitoring, and evidence-based communication interventions into emergency preparedness systems.

Theme	Evidence Across Recent Global Health Emergencies	Current Limitations in the Literature	Future Research and Policy Direction
Community engagement	Partnerships with healthcare workers, religious organizations, community leaders, and traditional authorities consistently improved vaccine confidence and uptake across diverse settings [3,17].	Community engagement strategies are poorly evaluated, and implementation processes are rarely reported or compared across contexts.	Promote community co-design of communication strategies and evaluate implementation using participatory and implementation science approaches.
Communication equity	Persistent disparities in vaccine communication effectiveness were observed among marginalized populations, migrants, Indigenous communities, individuals with limited health literacy, and populations in resource-constrained settings [9,11].	Existing evidence is heavily concentrated in high-income countries, with limited representation of LMICs and vulnerable populations.	Develop culturally tailored, context-specific communication strategies and expand research in low- and middle-income countries to improve communication equity.
Political influences	Political polarization, media framing, and debates surrounding public health mandates increasingly influenced vaccine confidence and acceptance, often overriding scientific evidence [6,18].	Mechanisms through which political narratives shape trust and vaccine behavior remain insufficiently understood.	Design depoliticized communication models that strengthen institutional independence, transparency, and evidence-based public engagement while minimizing political interference.

A New Adaptive Vaccine Trust Communication Framework (AVTC Framework)

Novelty and conceptual contribution of the AVTC Framework

Existing vaccine communication models and international guidance, including the World Health Organization's Risk Communication and Community Engagement (RCCE) framework, emphasize transparency, timely information sharing, community engagement, and evidence-based communication as fundamental principles for effective outbreak response. These approaches have made important contributions to public health practice by promoting trust and improving risk communication during infectious disease emergencies. However, they primarily provide operational guidance for communication activities rather than an integrated conceptual model describing how trust can be continuously established, monitored, strengthened, and restored throughout the entire emergency cycle.

The Adaptive Vaccine Trust Communication (AVTC) Framework extends these existing approaches by conceptualizing vaccine communication as a dynamic, continuously adaptive trust ecosystem rather than a sequence of communication interventions. Unlike conventional frameworks, AVTC explicitly integrates five interdependent domains—institutional transparency, evidence-based messaging, trusted community partnerships, digital information monitoring, and continuous feedback and communication adaptation—within a single iterative system. The framework also recognizes the growing influence of rapidly evolving digital information environments, including artificial intelligence-assisted information generation and misinformation, as integral components requiring continuous surveillance and adaptive response rather than isolated communication challenges.

A further conceptual advance is the framework's emphasis on continuous feedback loops linking public perceptions, behavioural responses, digital information surveillance, and institutional decision-making. Rather than treating communication as a predominantly one-way dissemination process, AVTC positions communities as active participants whose experiences and concerns continuously inform

communication strategies. By integrating preparedness, emergency response, and post-emergency trust recovery within one adaptive model, the framework addresses an important gap in existing vaccine communication literature and provides a practical roadmap for strengthening resilient public trust across diverse global health emergencies.

The recurring communication challenges identified across recent global health emergencies demonstrate that, despite substantial advances in vaccine communication, existing models remain predominantly reactive, fragmented, and focused on discrete communication activities rather than continuous trust development. Building upon these cross-emergency lessons, Figure 2 presents the Adaptive Vaccine Trust Communication (AVTC) Framework, which translates the evidence synthesized throughout this review into an integrated conceptual model. The framework illustrates how institutional transparency, evidence-based messaging, trusted community partnerships, digital information monitoring, and continuous communication adaptation operate as interdependent components rather than isolated communication activities.

Figure 2. Adaptive Vaccine Trust Communication (AVTC) Framework for Strengthening Public Trust During Global Health Emergencies.

The AVTC Framework conceptualizes vaccine communication as a continuous adaptive process rather than a one-way transfer of information. Institutional transparency provides the foundation for evidence-based messaging, which is strengthened through trusted community partnerships and supported by continuous digital information monitoring. Community feedback and surveillance data are continuously incorporated into communication planning, creating an iterative cycle of evaluation and adaptation. Together, these interconnected components strengthen public trust, improve vaccine confidence, support effective responses to misinformation, and enhance preparedness before, during, and after future public health emergencies.

The relationships illustrated in Figure 2 should be interpreted as continuous and bidirectional rather than linear. Institutional transparency strengthens the credibility of evidence-based messaging, while trusted community partnerships enhance message acceptance and generate feedback that informs future communication. Digital information monitoring

provides real-time situational awareness, allowing communication strategies to respond rapidly to misinformation, changing public concerns, and evolving scientific evidence. Together, these interconnected processes create a self-reinforcing cycle that continually strengthens public trust and improves preparedness for future public health emergencies.

Unlike conventional communication models that emphasize one-way transmission of health information, the AVTC Framework conceptualizes vaccine communication as a dynamic and iterative process. The framework recognizes that public trust is not a static outcome but an evolving relationship that requires continuous interaction among institutions, scientific evidence, communities, and digital information systems. Consequently, communication strategies must remain sufficiently flexible to respond to emerging evidence, changing public concerns, misinformation dynamics, and community feedback throughout the course of an emergency.

As illustrated in Figure 2, the framework comprises five interconnected domains. Institutional transparency provides the foundation by promoting openness, accountability, timely disclosure of information, and clear communication of scientific uncertainty. This transparency strengthens confidence in governmental and public health institutions while creating the conditions necessary for public trust. Building on this foundation, evidence-based messaging translates evolving scientific evidence into clear, accurate, culturally appropriate, and accessible communication that explains not only current recommendations but also the reasons underlying changes in public health guidance.

The third domain, trusted community partnerships, recognizes that confidence is frequently transferred through healthcare professionals, community leaders, religious organizations, and other locally trusted stakeholders who contextualize scientific information within the social and cultural realities of their communities. These partnerships are complemented by digital information monitoring, which enables continuous surveillance of online information ecosystems to detect misinformation, identify emerging public concerns, and monitor the influence of rapidly evolving technologies, including artificial intelligence-generated content. The final domain, continuous feedback and communication adaptation, closes the communication cycle by integrating community perspectives, behavioural responses, and real-time surveillance into ongoing refinement of communication strategies.

Rather than functioning as isolated components, these five domains operate as an adaptive system in which each element continuously informs the others. Institutional transparency enhances the credibility of evidence-based messages, trusted community partnerships improve message acceptance, digital monitoring provides situational awareness, and continuous feedback enables communication strategies to evolve alongside changing scientific evidence, public perceptions, and misinformation trends. By shifting vaccine communication from episodic information delivery to an adaptive trust-building process, the AVTC Framework offers a practical roadmap for strengthening communication resilience and improving preparedness for future global health emergencies.

Practical implementation of the AVTC Framework

The AVTC Framework is intended to support vaccine communication across all phases of public health preparedness, including preparedness, emergency response, and post-crisis recovery. Its implementation requires coordinated action among governments, public health agencies, healthcare institutions, and community organizations, with each stakeholder contributing complementary functions within the adaptive communication cycle.

At the governmental level, implementation should focus on establishing transparent governance structures, ensuring timely disclosure of scientific evidence, coordinating communication across agencies, and maintaining public accountability throughout evolving emergencies. National preparedness plans should incorporate communication strategies alongside surveillance, vaccination, and emergency response activities rather than treating communication as a separate or secondary function.

Public health agencies can operationalize the framework by integrating epidemiological surveillance with real-time monitoring of traditional and digital media to identify emerging misinformation, track public concerns, and rapidly adapt communication strategies. These agencies should also develop standardized indicators to monitor public trust, communication reach, and message effectiveness over time, allowing communication performance to be evaluated alongside conventional public health outcomes.

Healthcare institutions play a central role by equipping healthcare professionals with training in risk communication, behavioural science, and culturally responsive communication. As trusted sources of health information, clinicians can translate evolving scientific evidence into clear, context-appropriate messages while addressing individual concerns during routine healthcare interactions.

Community organizations, religious institutions, civil society groups, and local leaders are essential partners for ensuring that communication strategies remain culturally appropriate, locally relevant, and responsive to community priorities. Their involvement should extend beyond message dissemination to include co-design, continuous feedback, and evaluation of communication interventions. Together, these coordinated activities enable the AVTC Framework to function as a continuously adaptive system that strengthens institutional credibility, supports informed decision-making, and promotes resilient public trust before, during, and after future health emergencies.

Limitations of the Review

This review should be interpreted in light of several limitations. First, as a narrative review, the synthesis did not follow a formal systematic review protocol and therefore was not designed to identify every relevant publication on vaccine communication. Although a structured search strategy was employed to enhance transparency, study selection ultimately involved author judgement regarding conceptual relevance, introducing the possibility of selection bias.

Second, the review relied primarily on peer-reviewed publications and authoritative reports published in English. Consequently, important evidence reported in other languages or within the grey literature may not have been captured, potentially limiting the global representation of communication experiences, particularly from low- and middle-income countries.

Third, no formal assessment of methodological quality or risk of bias was undertaken because the objective of this review was to provide a conceptual synthesis rather than a quantitative evaluation of intervention effectiveness. As a result, the strength of individual studies was not weighted systematically, and conclusions should be interpreted within the context of the heterogeneous evidence base currently available.

Finally, the proposed Adaptive Vaccine Trust Communication (AVTC) Framework is a conceptual model derived from critical synthesis of the literature rather than empirical validation. Although it integrates recurring themes identified across recent global health emergencies, future research should evaluate the framework prospectively using implementation studies, longitudinal designs, and standardized measures of public trust, communication effectiveness, misinformation exposure, and vaccine uptake across diverse health system settings.

Future validation of the AVTC Framework

Although the AVTC Framework is grounded in the recurring themes identified across the current evidence base, its effectiveness should be evaluated through empirical research conducted in diverse public health settings. Future studies should examine whether implementation of the framework improves communication quality, strengthens institutional credibility, enhances vaccine confidence, and increases vaccination uptake compared with conventional communication approaches.

Validation could be undertaken using a combination of quantitative and qualitative methods. Longitudinal cohort studies and implementation science designs would be particularly valuable for examining how trust evolves throughout different phases of public health emergencies. Cluster-randomized or quasi-experimental evaluations could compare jurisdictions or healthcare systems implementing the AVTC Framework with those using standard communication strategies.

Appropriate evaluation indicators may include standardized public trust indices, vaccine confidence measures, vaccination coverage, exposure to and prevalence of misinformation, public engagement across digital and community platforms, timeliness of communication responses, stakeholder participation in communication planning, and implementation outcomes such as feasibility, acceptability, fidelity, and sustainability. Comparative evaluations across high-income and low- and middle-income countries would further clarify the framework's adaptability to different health system contexts and sociocultural environments.

Empirical validation of these indicators would not only strengthen confidence in the AVTC Framework but also support its refinement as communication technologies, public expectations, and digital information ecosystems continue to evolve.

Public Health and Policy Implications

The lessons from recent global health emergencies demonstrate that vaccine communication should be recognized as a core component of public health preparedness rather than a reactive activity implemented during crises. Building public trust requires sustained investment before emergencies occur through transparent governance, continuous community engagement, and institutional credibility that can withstand periods of scientific uncertainty. Strengthening trust in advance of future outbreaks is likely to improve both vaccine acceptance and broader compliance with public health interventions. International agencies should also support capacity building for communication systems in resource-

constrained settings by investing in local risk communication expertise, digital infrastructure, and sustainable community partnerships that strengthen preparedness before future outbreaks occur.

Governments and public health agencies should invest in resilient risk communication infrastructure capable of delivering timely, coordinated, and evidence-based information across multiple communication channels. Healthcare professionals should receive regular training in risk communication, behavioral science, and strategies for addressing vaccine concerns [19], enabling them to serve as effective and trusted communicators within their communities. Communication systems should also incorporate continuous monitoring of misinformation across digital platforms, allowing rapid identification of emerging narratives and proportionate evidence-based responses [15].

Future communication policies should prioritize cultural responsiveness by tailoring messages to diverse linguistic, educational, and sociocultural contexts rather than relying on standardized national campaigns. At the same time, artificial intelligence should be incorporated responsibly to complement, not replace, human expertise in vaccine communication. AI-assisted tools can enhance misinformation surveillance, monitor public sentiment, support multilingual communication, and facilitate rapid development of evidence-based messaging. Nevertheless, these technologies require transparent governance, human oversight, privacy protection, and regular evaluation to ensure that they strengthen rather than undermine public trust. Integrating AI within ethically governed communication systems offers an opportunity to improve preparedness while preserving the credibility and accountability of public health institutions.

Conclusion

Future pandemic preparedness will depend not only on scientific advances in vaccine development but equally on the ability of health systems to cultivate and sustain public trust. As recent global health emergencies have demonstrated, communication is not simply a mechanism for transmitting information but a strategic determinant of vaccine confidence, public cooperation, and health system resilience. Strengthening trust therefore requires a fundamental shift from reactive crisis messaging to proactive, transparent, and adaptive communication that evolves alongside scientific evidence, public expectations, and emerging information challenges. The Adaptive Vaccine Trust Communication (AVTC) Framework proposed in this review provides a conceptual foundation for embedding trust-building within routine public health practice through institutional transparency, evidence-based messaging, community partnerships, digital information monitoring, and continuous communication adaptation. Recognizing public confidence as essential public health infrastructure and investing in it with the same commitment devoted to vaccine innovation will be critical for strengthening societal resilience and improving preparedness for future global health emergencies.

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References

1. Shattock AJ, Johnson HC, Sim SY, Carter A, Lambach P, Hutubessy RCW, et al. Contribution of vaccination to improved survival and health: modelling 50 years of the Expanded Programme on Immunization. Lancet. 2024;403(10441):2307–16. https://doi.org/10.1016/S0140-6736(24)00850-X
2. Graham BS. Rapid COVID-19 vaccine development. Science. 2020;368(6494):945–6. https://doi.org/10.1126/science.abb8923
3. World Health Organization. Ten threats to global health in 2019 [Internet]. Geneva: World Health Organization; 2019 [cited 2026 Jul 10]. Available from: https://www.who.int/news-room/spotlight/ten-threats-to-global-health-in-2019
4. de Figueiredo A, Simas C, Karafillakis E, Paterson P, Larson HJ. Mapping global trends in vaccine confidence and investigating barriers to vaccine uptake: a large-scale retrospective temporal modelling study. Lancet. 2020;396(10255):898–908. https://doi.org/10.1016/S0140-6736(20)31558-0
5. Loomba S, de Figueiredo A, Piatek SJ, de Graaf K, Larson HJ. Measuring the impact of COVID-19 vaccine misinformation on vaccination intent in the UK and USA. Nat Hum Behav. 2021;5(3):337–48. https://doi.org/10.1038/s41562-021-01056-1
6. Fortunato P, Lombini A. Behind political affiliation: how moral values, identity politics, and party loyalty have affected COVID-19 vaccination. PLOS ONE. 2025;20(9):e0330881. https://doi.org/10.1371/journal.pone.0330881
7. Vinck P, Pham PN, Bindu KK, Bedford J, Nilles EJ. Institutional trust and misinformation in the response to the 2018–19 Ebola outbreak in North Kivu, DR Congo: a population-based survey. Lancet Infect Dis. 2019;19(5):529–36. https://doi.org/10.1016/S1473-3099(19)30063-5
8. Choi Y, Fox AM. Communities at risk for mpox and stigmatizing policies: a randomized survey, Republic of Korea, 2022. Am J Public Health. 2023;113(10):1120–7. https://doi.org/10.2105/AJPH.2023.307368
9. Centers for Disease Control and Prevention. Mpox equity and anti-stigma toolkit [Internet]. Atlanta: CDC; 2023 [cited 2026 Jul 10]. Available from: https://archive.cdc.gov/www_cdc_gov/poxvirus/mpox/resources/toolkits/equity.html
10. Lazarus JV, Ratzan SC, Palayew A, Gostin LO, Larson HJ, Rabin K, et al. A global survey of potential acceptance of a COVID-19 vaccine. Nat Med. 2021;27(2):225–8. https://doi.org/10.1038/s41591-020-1124-9
11. Solís Arce JS, Warren SS, Meriggi NF, Scacco A, McMurry N, Voors M, et al. COVID-19 vaccine acceptance and hesitancy in low- and middle-income countries. Nat Med. 2021;27(8):1385–94. https://doi.org/10.1038/s41591-021-01454-y
12. Vosoughi S, Roy D, Aral S. The spread of true and false news online. Science. 2018;359(6380):1146–51. https://doi.org/10.1126/science.aap9559

13. Menz BD, Kuderer NM, Bacchi S, Modi ND, Chin-Yee B, Hu T, et al. Current safeguards, risk mitigation, and transparency measures of large language models against the generation of health disinformation: repeated cross-sectional analysis. BMJ. 2024;384:e078538. https://doi.org/10.1136/bmj-2023-078538
14. Kreps SE, Kriner DL. Model uncertainty, political contestation, and public trust in science: evidence from the COVID-19 pandemic. Sci Adv. 2020;6(43):eabd4563. https://doi.org/10.1126/sciadv.abd4563
15. World Health Organization. Managing the COVID-19 infodemic: promoting healthy behaviours and mitigating the harm from misinformation and disinformation [Internet]. Geneva: World Health Organization; 2020 [cited 2026 Jul 10]. Available from: https://www.who.int/news/item/23-09-2020-managing-the-covid-19-infodemic-promoting-healthy-behaviours-and-mitigating-the-harm-from-misinformation-and-disinformation
16. Broniatowski DA, Jamison AM, Qi S, AlKulaib L, Chen T, Benton A, et al. Weaponized health communication: Twitter bots and Russian trolls amplify the vaccine debate. Am J Public Health. 2018;108(10):1378–84. https://doi.org/10.2105/AJPH.2018.304567
17. Gilmore B, Ndejjo R, Tchetchia A, de Claro V, Mago E, Diallo AA, et al. Community engagement for COVID-19 prevention and control: a rapid evidence synthesis. BMJ Glob Health. 2020;5(10):e003188. https://doi.org/10.1136/bmjgh-2020-003188
18. Golos AM, Hopkins DJ, Bhanot SP, Buttenheim AM. Partisanship, messaging, and the COVID-19 vaccine: evidence from survey experiments. Am J Health Promot. 2022;36(4):602–11. https://doi.org/10.1177/08901171211049241
19. Brewer NT, Chapman GB, Rothman AJ, Leask J, Kempe A. Increasing vaccination: putting psychological science into action. Psychol Sci Public Interest. 2017;18(3):149–207. https://doi.org/10.1177/1529100618760521
20. Sallam M. COVID-19 vaccine hesitancy worldwide: a concise systematic review of vaccine acceptance rates. Vaccines (Basel). 2021;9(2):160. https://doi.org/10.3390/vaccines9020160