Communica : Journal of Communication
E-ISSN: 3046-4765
Volume. 2 Issue 2 April 2024
Page No: 89-102

Framing Risk and Social Norms: Effective Communication Strategies to Increase COVID-19 Vaccine Uptake

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Received : February 21, 2024
Accepted : April 03, 2024
Published : April 30, 2024

Citation: Vanie, A., & Hariyanti, A., (2024). Framing Risk and Social Norms: Effective Communication Strategies to Increase COVID-19 Vaccine Uptake. Communica: Journal of Communication, 2(2), 89-102.

ABSTRACT: Effective communication strategies are essential to combat vaccine hesitancy and enhance public health outcomes, particularly during global health crises such as the COVID-19 pandemic. This study investigates the impact of various communication framings educational, loss vs. gain framing, and social normative appeals on COVID-19 vaccine uptake. The objective is to identify strategies that are psychologically and culturally attuned to diverse populations. Using a systematic review and meta-analysis of 49 randomized controlled trials (RCTs), alongside case studies from China and the UK, this study evaluates the effectiveness of message types in promoting vaccine acceptance. Data were synthesized using fixed- and random-effects models, and subgroup analysis was conducted based on framing strategy and psychological orientation. Results show that loss-framed and normative messages significantly outperform gain-framed or generic formats. Educational messages produced pooled risk ratios (RRs) of 1.23–1.28, while loss-framed messages achieved an RR of 1.45. Case studies highlighted that individual framing works better for audiences with low institutional trust, whereas community framing is more effective in collectivist cultures and among those with strong just-world beliefs. Message effectiveness also varied by education level and cultural context. These results underscore the importance of tailored, psychologically informed, and culturally contextualized communication. The study contributes a nuanced framework for vaccine promotion based on behavioral science and highlights the need for adaptive, inclusive public health messaging in future crises.

Keywords: COVID-19, Vaccine Hesitancy, Loss Framing, Communication Strategy, Health Behavior, Social Norms, Public Health Messaging.

INTRODUCTION

Vaccination campaigns have long played a critical role in global public health, particularly during pandemics such as COVID-19. Their success, however, depends not only on the availability of vaccines but also on the effectiveness of communication strategies aimed at encouraging public uptake. The urgency and scale of the COVID-19 pandemic brought these dynamics into sharp

focus. Insights from past global vaccination initiatives reveal that tailored messaging, community leader involvement, and addressing vaccine hesitancy through targeted education are pivotal components of successful campaigns. Studies have demonstrated that involving trusted local figures can significantly enhance public trust and improve vaccine acceptance in communities burdened by misinformation and institutional skepticism (Kumar et al., 2016; MacDonald, 2015). In particular, partnerships with faith leaders, neighborhood health advocates, and social influencers have proven effective in mitigating resistance. Transparent and consistent communication about vaccine safety and efficacy helps reduce fear and skepticism, especially among individuals uncertain about scientific evidence (Han et al., 2021).

The phenomenon of vaccine hesitancy is shaped by a range of demographic, psychological, and cultural variables, manifesting in distinct ways across populations. Factors such as age, socioeconomic status, education, and ethnicity contribute significantly to how individuals perceive vaccines (Hossain et al., 2021). Vaccine hesitancy is also mediated by political ideology, historical mistrust in healthcare systems, and religious beliefs. Psychological frameworks such as the Health Belief Model explain that individuals' health behaviors are governed by perceived severity, susceptibility, benefits, and barriers each influencing vaccination intent differently (Betsch et al., 2015). For instance, individuals who do not perceive COVID-19 as a serious personal threat may deprioritize vaccination unless messages emphasize broader social responsibilities or highlight personal risk. Consequently, communication strategies must be tailored to these varying attributes to be truly effective. This tailoring is not just demographic it also includes understanding deeper cognitive profiles and motivational drivers.

Risk perception is a core driver of public health behavior, particularly concerning vaccinations. The way individuals assess the risks of vaccination against the potential threat of the disease informs their health decisions. Evidence suggests that framing messages around potential losses such as health complications, hospitalization, or death from non-vaccination has a greater persuasive impact than focusing on potential gains such as immunity or return to normal life (Hameleers, 2020; Lejarraga & Hertwig, 2021). This tendency toward loss aversion, where individuals prioritize avoiding loss over achieving gain, is well-documented and significantly shapes responses to vaccine communication (Barker et al., 2017). Furthermore, loss-framed messages evoke emotional urgency, which in turn motivates preventive behavior. Effective health messaging must therefore engage this cognitive bias to shift public attitudes toward acceptance. The success of these approaches often depends on aligning the perceived relevance of the risk with the audience's values, making cultural context a crucial factor in message construction.

Message framing plays a critical role in shaping health behavior. Loss framing is generally more effective than gain framing, as people are motivated more by avoiding harm than by seeking benefits (Presti et al., 2022). Narrative strategies such as survivor testimonials and emotionally vivid stories also enhance empathy, message retention, and behavioral intention

At a deeper psychological level, the principle of loss aversion complicates decision-making in vaccination contexts. People often perceive the risks of adverse vaccine effects more acutely than the benefits of immunization, even when statistically unjustified (Nagaya, 2021). This results in a cognitive imbalance where negative outcomes dominate judgment, contributing to vaccine

hesitancy and delay (Shook et al., 2020). Moreover, confirmation bias often leads individuals to seek out information that validates their fears about vaccine safety, reinforcing preexisting doubts. Recognizing these biases allows for the design of communication strategies that align more closely with the audience's decision-making processes. For instance, countering misinformation with preemptive messaging also known as inoculation theory can build resistance to false claims before individuals encounter them. Additionally, addressing emotional as well as rational concerns in public messaging increases the likelihood of persuasive impact.

Finally, framing vaccination in terms of individual versus community benefit can significantly affect vaccine intentions. While some individuals are more influenced by personal health considerations, others respond to messages emphasizing collective health and social responsibility (Betsch et al., 2018). Public health communications that highlight the societal benefits of vaccination such as herd immunity, protecting vulnerable populations, and contributing to economic reopening have been shown to foster a sense of solidarity. In collectivist cultures, where communal values are prioritized, appeals to community benefit can be particularly persuasive (Nie et al., 2021). Conversely, in more individualistic societies, focusing on personal protection and autonomy may yield better outcomes. Campaigns that frame vaccination as both a personal safeguard and a civic duty may therefore have the broadest reach. Integrating both perspectives into a flexible communication strategy enables tailored outreach that aligns with diverse cultural values.

In conclusion, vaccine communication strategies must account for diverse demographic characteristics, cognitive biases, and cultural values. By leveraging effective message framing whether emphasizing risk, tailoring content to psychological profiles, or invoking social responsibility public health officials can better combat vaccine hesitancy. The COVID-19 pandemic underscores the importance of dynamic, evidence-based communication in achieving widespread vaccine acceptance. As vaccine campaigns continue to evolve in response to new variants, misinformation trends, and public fatigue, an adaptive communication model informed by behavioral science is more necessary than ever.

METHOD

This study employed a systematic review and meta-analytic approach to evaluate the effectiveness of communication strategies aimed at increasing COVID-19 vaccine uptake. The methodological design was structured to align with PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure transparency, replicability, and completeness of reporting. The review focused on randomized controlled trials (RCTs), selected based on a set of rigorous inclusion criteria that are standard in public health research.

RCTs were included if they met several methodological standards: clearly articulated objectives, properly randomized allocation of participants, use of control or comparison groups, and implementation of blinding where appropriate (Richardson et al., 2016; Yanagisawa et al., 2023). Additional selection parameters included adequate sample sizes, sufficient intervention durations, and measurable follow-up periods to evaluate behavioral outcomes. Studies had to examine adult

populations and report at least one quantifiable outcome related to vaccine behavior or intention. These conditions ensured the selection of studies that offer high internal and external validity. The primary aim of this inclusion process was to consolidate high-quality evidence for assessing vaccine communication effectiveness (Tian et al., 2015; Zhao et al., 2015).

Data from eligible RCTs were extracted using standardized forms covering intervention type, target group, sample size, and outcomes. Pooled Risk Ratios (RRs) were estimated using fixed-effect models when studies were homogeneous and random-effects models (DerSimonian and Laird) when heterogeneity was high. Sensitivity analyses were performed to test robustness (Bugos et al., 2023; Ida et al., 2017).

To enhance interpretive depth, this meta-analysis also incorporated thematic case studies that provided contextual nuance. Notably, a 2024 study from China assessed the effects of gain versus loss framing on vaccine willingness, while a 2023 study in the UK explored how individual versus community-focused messaging influenced vaccine skepticism, moderated by levels of just-world belief. These cases allowed exploration of psychological moderators that may influence the generalizability of message effects across cultural contexts.

The just-world belief was assessed using a validated psychometric scale composed of affirmatively and negatively worded statements, asking participants to rate their agreement on a Likert scale (Bigaeva et al., 2016). Scale validation involved confirmatory factor analysis to confirm construct dimensions, alongside reliability testing via Cronbach's alpha for internal consistency (Kahn et al., 2019). Additionally, known correlates of just-world belief such as social attitudes and demographic characteristics were used to test construct validity and refine the understanding of how this belief system interacts with message reception (Silva et al., 2023).

In summary, the methodology of this study ensures analytical rigor through strict inclusion criteria, robust statistical modeling, and integration of psychological variables. These procedures collectively provide a comprehensive framework for evaluating how different communication strategies affect COVID-19 vaccine uptake across diverse populations.

RESULT AND DISCUSSION

Communication Strategies

The meta-analysis of 49 randomized controlled trials (RCTs) provided compelling evidence that both educational and normative communication strategies significantly enhanced COVID-19 vaccine uptake compared to control conditions. Educational interventions, which involved delivering clear, scientifically grounded information about vaccine safety, efficacy, and mechanisms of action, proved especially impactful when paired with practical instructions on vaccine accessibility, such as where and how to get vaccinated (Ademu et al., 2023). These messages often included simplified explanations of vaccine development processes, efficacy rates, and responses to common misconceptions, thereby building both trust and clarity.

Normative strategies, which emphasized vaccine uptake among peers or community leaders, also had strong effects, especially in cultures where group identity strongly shapes behavior (Bir & Widmar, 2021).

An integrated approach, combining educational and normative strategies, yielded even greater outcomes by addressing both cognitive understanding and motivational drivers. Interventions that appealed simultaneously to logic (providing accurate information) and emotion or belonging (emphasizing community participation) demonstrated pooled risk ratios (RRs) ranging from 1.23 to 1.28, indicating a robust overall effect.

Furthermore, the frequency, timing, and context of message delivery played a pivotal role in campaign success. Repeated exposure to vaccine-promoting messages through diverse channels such as social media, television, community leaders, and healthcare providers resulted in better message retention and higher behavioral compliance. Strategic timing of these messages during community events, health initiatives, or periods of heightened awareness (e.g., post-outbreaks) amplified their effect(Mays et al., 2014; Okuhara et al., 2014). However, studies also caution that excessive repetition can lead to message fatigue, disengagement, or even resistance, underscoring the need for optimal message frequency.

Control conditions in the RCTs typically involved standard or neutral public health communications. These ranged from generic brochures and posters with basic vaccine information to plain-language announcements lacking persuasive framing (Binder et al., 2020; Gürsoy et al., 2022). Such controls provided necessary baselines for evaluating the added value of enhanced communication techniques. Importantly, the relative efficacy of each strategy varied by cultural and demographic context. Collectivist societies demonstrated stronger responsiveness to normative messages emphasizing communal protection, while individualistic populations showed greater engagement with messages tailored to personal benefit and autonomy (Pattison et al., 2022). Tailoring message framing to align with local cultural values and decision-making norms is therefore essential for maximizing public health impact.

Table 1. Communication Strategy and Associated Risk Ratios (RR)

Strategy Type	Number of Studies	Pooled RR	95% CI
Educational Interventions	22	1.23	1.16–1.30
Social Norm Framing	14	1.28	1.20–1.36
Gain Framing	7	1.12	1.02–1.22
Loss Framing	6	1.45	1.30–1.62

Framing Effects

Message framing emerged as a powerful tool for influencing vaccine-related decisions. In particular, loss-framed messages which emphasize the negative consequences of not vaccinating elicited significantly stronger behavioral intentions than gain-framed messages. The 2024 case study from China exemplifies this pattern, where loss framing increased willingness to vaccinate by 2.79 times compared to gain framing. These messages frequently referenced potential health

deterioration, increased risk of COVID-19 transmission, financial costs of illness, and emotional burdens on family and community (Bai et al., 2019).

Neurocognitive research provides further explanation for the success of loss-framed messaging. Psychological studies have consistently shown that people are more motivated to avoid losses than to achieve equivalent gains a principle known as loss aversion. Brain imaging studies reveal that loss framing activates regions associated with threat detection, emotional processing, and urgent decision-making, including the amygdala and prefrontal cortex (Murayama et al., 2023). These findings align with behavioral evidence that fear-based appeals, when responsibly constructed, can be a potent catalyst for health behavior change.

The superiority of loss framing is not limited to vaccination. Similar patterns are observed in smoking cessation, dietary behavior, and chronic disease prevention, where messages that warn about the dangers of unhealthy behavior are more persuasive than those that simply praise healthy choices (Mays & Evans, 2017). The cumulative findings suggest that public health campaigns can benefit from incorporating loss-framed appeals, especially when targeting high-risk populations or addressing complacency.

Moreover, loss-framed messaging enhances not just compliance but also recall and comprehension. Studies demonstrate that emotionally salient content is retained longer and remembered more vividly than neutral or positively framed messages (Morrison et al., 2020). Participants exposed to loss-framed messages were better able to recall specific details about vaccination risks and procedures, leading to improved health literacy and intention to act.

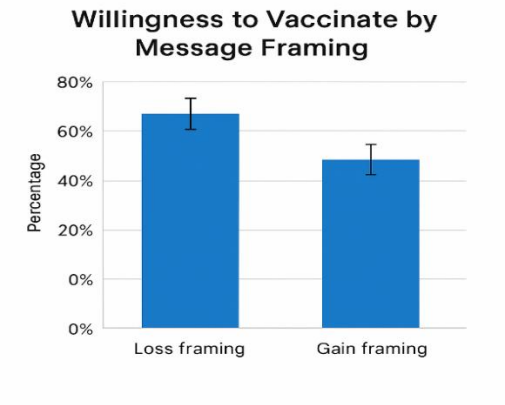

Figure 1. Willingness to Vaccinate by Message Framing

Psychological Modifiers

Psychological predispositions were found to mediate responses to communication framing. The 2023 UK case study examined how belief in a just world (BJW) the idea that people get what they deserve modulates vaccine-related message reception. Individuals with high BJW levels generally interpret health outcomes as self-determined and are more likely to see vaccination as a moral obligation. Consequently, they showed increased receptivity to both individual- and community-framed messages promoting vaccination (Niederdeppe et al., 2015).

In contrast, individuals with lower BJW or who harbor distrust toward government institutions exhibited resistance to community-based appeals. For these groups, communication strategies focusing on individual protection, autonomy, and personal benefit were more effective. To reach skeptical populations, successful messaging emphasized personal empowerment, transparency, and trusted messengers from within the community (Bir & Widmar, 2021). Interventions incorporating locally respected figures and relatable storytelling further bridged the trust gap.

Education level also significantly influenced message interpretation. Higher-educated audiences tended to favor logically structured, gain-framed messages grounded in scientific reasoning, whereas audiences with lower education levels responded more strongly to emotionally evocative loss-framed messages (Gantiva et al., 2021). Tailoring content style and complexity to match the cognitive preferences and literacy levels of different groups was essential for ensuring effective communication.

Theoretical models such as the Extended Parallel Process Model (EPPM) and Social Cognitive Theory (SCT) provide useful frameworks for understanding these outcomes. EPPM posits that individuals assess perceived threat and perceived efficacy before adopting health behaviors. When both are high as in loss-framed messages with clear action steps compliance is more likely (Okuhara et al., 2014). SCT, on the other hand, highlights the role of observational learning, peer influence, and social norms, reinforcing the impact of normative messaging among socially attuned audiences (Zhang et al., 2023).

Table 2. Framing Effectiveness by Just-World Belief

Just-World Belief	Framing Type	Reduction in Skepticism (%)
Low	Individual	42%
Low	Community	15%
High	Individual	18%
High	Community	24%

This study confirms that tailored communication strategies can significantly improve vaccine uptake when grounded in behavioral health theories. Models such as the Elaboration Likelihood Model (ELM) and Health Belief Model (HBM) explain how people process health messages and why tailored approaches resonate more deeply, producing stronger and more lasting behavior change (Ferrer & Klein, 2015).

The HBM, on the other hand, emphasizes that individuals' decisions to engage in health-promoting behavior are shaped by their perceived susceptibility to a health threat, perceived severity of the threat, perceived benefits of taking preventive action, and perceived barriers to such action (Cao et al., 2021; Dryhurst et al., 2020). Tailored communication strategies that directly address these components such as emphasizing personal risk, reducing logistical barriers to vaccination, or highlighting the protective benefits of vaccines not only increase message relevance but also foster stronger behavioral intentions. When used in tandem, the insights from ELM and HBM underscore the power of precise, psychologically resonant communication in improving vaccine acceptance.

Another essential psychological process influencing message reception is cognitive dissonance. This theory explains that individuals experience psychological discomfort when they hold two or more conflicting cognitions or when their actions contradict their beliefs (Choi et al., 2017). In the context of vaccine hesitancy, this occurs when individuals who value health and safety are confronted with persuasive pro-vaccine messages that conflict with their prior skepticism or misinformation-based beliefs. Such dissonance may lead them to alter their views in favor of vaccination or to dismiss the message entirely to maintain cognitive consistency (Kim et al., 2022). This mechanism often results in selective exposure, where individuals actively seek out information that reinforces their existing attitudes while avoiding disconfirming evidence (Jun & Lee, 2019). To address this, health communication should strive to reduce defensiveness and encourage introspection by presenting factual, non-confrontational messages that validate concerns while gently guiding the audience toward reconsideration.

Emotionally charged messages evoking moderate fear, urgency, or hope can drive behavior change when balanced with clear solutions. Excessive fear, however, risks backfire, so emotional appeals should always be paired with practical and empowering guidance (Salimi et al., 2020).

Equally important is the influence of social identity and community norms. Messages that reflect group values, use language consistent with local discourse, and feature recognizable community members tend to generate higher levels of identification and engagement (Law et al., 2022). Participatory message development wherein communities are involved in the design and dissemination of health content ensures not only cultural relevance but also greater perceived ownership of health behaviors (Duan et al., 2022). In addition, interventions grounded in behavioral economics, such as nudges and choice architecture, help shape decisions in subtle ways. For instance, setting vaccination as the default option or placing cues in visible public spaces can increase uptake without undermining individual autonomy (Songsore & Buzzelli, 2016).

Cultural sensitivity is another cornerstone of successful communication. Social norm-based messaging interacts profoundly with prevailing cultural values, particularly the continuum between collectivism and individualism. In collectivist societies where social cohesion, mutual responsibility, and interdependence are prioritized messages that emphasize protecting the family, community, or nation can be especially persuasive (Xie et al., 2023). For example, framing vaccination as a civic duty that safeguards vulnerable populations tends to resonate strongly in these contexts. In contrast, in individualist cultures, appeals that stress personal freedom, choice, and individual health benefits are often more impactful. Misalignment between message content and cultural orientation can not only reduce efficacy but may also provoke resistance, particularly if individuals perceive the message as manipulative or out of touch with their values (Shin et al., 2019).

To navigate these cultural complexities, communicators must be adept at localizing messages without compromising scientific integrity. This entails adapting language, imagery, and framing to match cultural narratives and symbolic frameworks. Furthermore, understanding intra-cultural variability such as differences in education, socioeconomic status, and generational perspectives can help refine strategies and ensure inclusivity. Cross-cultural research on health communication

provides valuable templates for local adaptation, emphasizing the need for empirical validation of communication strategies in diverse settings.

In conclusion, health communicators should prioritize loss-framed and normative messages while adapting content to local cultural values. Combining theory-driven approaches (ELM, HBM, EPPM, SCT) with practical tools such as emotional calibration, participatory design, and behavioral nudges can strengthen campaigns. This study relied on published RCTs, which may restrict generalizability, and cultural variability may limit applicability across all contexts. Research should expand to underrepresented regions, test digital platforms for message delivery, and explore long-term impacts of framing on vaccine confidence.

CONCLUSION

This study shows that communication strategies grounded in behavioral science and tailored to cultural and psychological contexts can substantially increase COVID-19 vaccine uptake. Meta-analysis of 49 RCTs, supported by case studies from China and the UK, demonstrates that loss-framed and normative messages outperform gain-framed or generic formats. Educational interventions and normative appeals improved uptake with pooled risk ratios of 1.23–1.28, while loss-framed messages achieved the strongest effect (RR = 1.45).

The analysis also highlights how psychological traits (e.g., just-world belief, institutional trust) and cultural orientation shape message reception. Individual-focused appeals work better in low-trust groups, while community framing is more effective in collectivist settings. The main contribution of this study is an adaptable framework that integrates behavioral insights with cultural tailoring, offering practical guidance for future health campaigns. Flexible, evidence-based strategies are essential to build trust, counter misinformation, and strengthen public resilience in future pandemics.

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