

Vaccination Messaging Frames and Uptake Intention in Migrant Worker Communities: Clinical Modeling

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Abstract

Vaccination remains one of the most effective public health interventions for mitigating the spread of infectious diseases. However, vaccine hesitancy continues to pose a significant challenge, particularly among marginalized and transient populations such as migrant workers. This paper investigates the causal relationship between specific vaccination messaging frames and the corresponding uptake intentions within migrant worker communities, utilizing a robust clinical modeling framework. By categorizing messaging into gain-framed, loss-framed, and neutral-framed constructs, the study evaluates how psychological framing impacts the decision-making processes of a demographic often characterized by high occupational risk, limited health literacy, and structural barriers to healthcare access. Through an extensive empirical investigation involving simulated clinical encounters and structured health communication interventions, the research assesses the cognitive and emotional pathways that mediate vaccine acceptance. The findings reveal that messaging frames significantly alter perceived susceptibility and severity of potential infections, though the magnitude of these effects is highly contingent upon baseline health literacy and historical trust in medical institutions. Ultimately, this research provides granular, data-driven insights into the optimal design of public health communication strategies, emphasizing the necessity for culturally and socio-economically tailored interventions to maximize immunization coverage among vulnerable workforces.

Keywords: Vaccination Intention; Message Framing; Migrant Workers; Clinical Modeling; Vaccination Messaging Frames

1. Introduction

1.1 Background and Context

The deployment of vaccines has historically represented a cornerstone of preventive medicine and public health administration. Across the globe, widespread immunization campaigns have successfully eradicated certain infectious diseases and drastically reduced the morbidity and mortality associated with others. However, the efficacy of any vaccination program is inherently dependent on the willingness of the target population to accept the vaccine [1]. In recent years, the phenomenon of vaccine hesitancy has emerged as a critical barrier to achieving herd immunity. This hesitancy is not uniformly distributed across the population; rather, it clusters within specific demographic groups that may experience unique socioeconomic, cultural, and psychological barriers. Among these groups, migrant worker communities represent a particularly vulnerable demographic [2]. These individuals often relocate from rural to urban areas, or across

international borders, to secure employment in sectors such as construction, agriculture, and manufacturing. Due to their transient nature, legal status ambiguities, and frequent exclusion from mainstream healthcare systems, migrant workers exhibit significantly lower rates of routine and pandemic-related immunizations compared to the general population [3].

Addressing vaccine hesitancy in these communities requires a nuanced understanding of how health information is disseminated, processed, and internalized. Public health communication is a complex endeavor where the presentation of information can profoundly influence behavioral outcomes. This is where the concept of message framing becomes highly relevant [4]. Message framing refers to the strategic presentation of a message to highlight either the positive outcomes of adopting a behavior, known as gain-framed messaging, or the negative consequences of failing to adopt a behavior, known as loss-framed messaging. The application of framing theory to health behaviors suggests that individuals respond differently to identical clinical information depending on whether the emphasis is placed on potential gains or potential losses. Understanding the optimal application of these frames is essential for designing communication interventions that can effectively penetrate the unique psychological and social barriers present in migrant worker communities.

1.2 Problem Statement and Research Objectives

Despite the extensive literature on message framing and health behaviors, a significant gap remains concerning its application to migrant worker populations through the lens of clinical modeling. Much of the existing research has focused on general populations or specific clinical cohorts within stationary, integrated communities. Migrant workers, conversely, operate within a vastly different context characterized by high job insecurity, crowded living conditions, and language barriers, all of which alter their risk perception and cost-benefit analysis regarding vaccination. Furthermore, previous studies often rely on simplistic survey methodologies that fail to capture the complex, multi-variable interactions that dictate health behaviors in real-world clinical or semi-clinical environments. There is a pressing need to move beyond fundamental correlational studies and employ sophisticated clinical modeling techniques that can simulate the decision-making ecosystem of migrant workers when confronted with targeted health messaging.

The primary objective of this study is to empirically evaluate the impact of varied vaccination messaging frames on the uptake intention of migrant workers. To achieve this, the research utilizes a clinical modeling approach to isolate the effects of gain-framed versus loss-framed messaging while controlling for a wide array of confounding variables, including baseline health literacy, trust in healthcare providers, occupational risk exposure, and demographic characteristics. A secondary objective is to identify the psychological mechanisms that mediate the relationship between the message frame and the behavioral intention. By delineating these pathways, the study aims to provide actionable, evidence-based recommendations for public health officials and non-governmental organizations tasked with executing immunization campaigns among marginalized and highly mobile populations. Ultimately, this research seeks to bridge the gap between theoretical health communication models and practical, clinical implementations in challenging demographic contexts.

2. Literature Review

2.1 Theoretical Foundations of Message Framing

The theoretical underpinning of message framing in health communication is predominantly derived from prospect theory, a behavioral economic theory that describes how individuals choose between probabilistic alternatives that involve risk. According to this framework, human decision-making is

consistently asymmetrical when evaluating potential gains versus potential losses [5]. Individuals typically exhibit risk-averse behavior when confronted with scenarios that emphasize gains, preferring a certain positive outcome over a gamble that could yield a higher reward. Conversely, individuals tend to exhibit risk-seeking behavior when presented with scenarios emphasizing losses, preferring to gamble to avoid a guaranteed negative outcome. This fundamental insight has been extensively adapted into health psychology to predict how people will respond to differently framed health warnings or recommendations [6].

In the context of preventive health behaviors, such as vaccination, the application of prospect theory becomes highly intricate. Vaccination is generally conceptualized as a preventive behavior designed to maintain current health status rather than a curative behavior to treat an existing illness. Early interpretations of framing effects suggested that gain-framed messages should be universally more effective for preventive behaviors, as these behaviors are perceived as low-risk actions that secure a positive health outcome [7]. For instance, messaging that emphasizes the protection of one's family and the preservation of one's ability to work as a direct result of receiving a vaccine represents a classic gain-framed approach. However, subsequent meta-analyses have revealed that the efficacy of gain versus loss frames is highly contingent upon the individual's perceived susceptibility to the disease and their perceived efficacy of the vaccine [8]. If a disease is perceived as highly severe and the individual feels highly susceptible, loss-framed messaging, which emphasizes the severe health and economic consequences of remaining unvaccinated, can sometimes induce a stronger motivational response by activating fear and a sense of urgency.

2.2 Migrant Worker Communities and Health Interventions

Migrant workers constitute a distinct sociological and economic category that requires specific consideration when designing health interventions. These populations frequently exist on the periphery of the host society, facing systemic exclusion from comprehensive healthcare networks, language barriers, and a lack of culturally competent medical services [9]. The occupational environments of migrant workers often involve the three Ds: dirty, dangerous, and demanding jobs. These conditions not only increase their baseline physical vulnerability but also limit their availability to access preventive healthcare services during standard operating hours. Furthermore, the precarious nature of their employment means that taking time off work to receive a vaccine, or to recover from potential side effects, carries a significant economic penalty that many cannot afford to absorb.

The intersection of these structural barriers with psychological factors significantly complicates the formulation of effective vaccination messaging [10]. Migrant workers often rely on informal communication networks and peer-driven information ecosystems, making them highly susceptible to misinformation and rumors regarding vaccine safety. Trust is a critical variable in this dynamic. Historical disenfranchisement and occasional exploitation by state or institutional actors can result in a deeply ingrained skepticism toward government-sponsored public health initiatives [11]. Therefore, standard messaging campaigns that rely heavily on institutional authority may fail to resonate or may even backfire by triggering defensive cognitive mechanisms. Recognizing these specific population characteristics is essential for developing clinical models that accurately reflect the decision-making matrix of migrant workers. The literature strongly suggests that any messaging intervention must be evaluated not merely on its theoretical framing but on its practical reception within the complex socioeconomic reality of the target demographic.

3. Methodology and Research Design

3.1 Study Population and Sampling Strategy

The empirical foundation of this study relies on a robust methodological design tailored to capture the unique nuances of the target demographic. The study population comprises adult migrant workers currently employed in the construction and manufacturing sectors within a major industrialized urban center. To ensure a representative sample that accurately reflects the diversity of the migrant workforce, a multi-stage stratified random sampling technique was employed. Initially, distinct industrial zones with high concentrations of migrant labor accommodations were identified. Within these selected zones, specific dormitories and residential enclaves were randomly chosen as primary sampling units [12]. Given the inherent challenges in surveying highly mobile populations, the research team collaborated with local community leaders, non-governmental organizations, and site foremen to facilitate access and build the necessary trust to encourage participation.

Eligibility criteria stipulated that participants must be aged eighteen or older, possess migrant worker status indicating they had relocated for employment purposes, and have no prior history of severe adverse reactions to vaccinations that would medically preclude them from immunization [13]. Potential participants underwent a preliminary screening process to assess their baseline vaccination history regarding routine adult immunizations. To minimize selection bias, recruitment materials were presented in neutral language, emphasizing a general health and wellness survey rather than explicitly highlighting the vaccination intervention focus. This approach was crucial to prevent the self-selection of individuals with extreme pre-existing views on vaccination. Informed consent was obtained from all participants, with protocols established to ensure anonymity and data confidentiality, thereby adhering strictly to ethical guidelines for research involving vulnerable human subjects.

Table 1: Demographic Characteristics of the Sample

Variable	Category	Frequency	Percentage
Age Group	18 to 29 years	345	32.7
Age Group	30 to 45 years	480	45.5
Age Group	46 years and above	230	21.8
Gender	Male	790	74.9
Gender	Female	265	25.1
Employment	Construction	610	57.8
Employment	Manufacturing	445	42.2
Education	Primary or below	415	39.3
Education	Secondary school	535	50.7
Education	Post-secondary	105	10.0

3.2 Clinical Modeling Framework

The core analytical engine of this research is a highly structured clinical modeling framework designed to quantify the causal mechanisms linking messaging frames to vaccination uptake intention. The model conceptualizes behavioral intention as a continuous outcome variable driven by a combination of primary intervention effects, cognitive mediators, and structural moderators [14]. The clinical modeling approach diverges from standard epidemiological surveys by simulating the decision-making environment of a clinical encounter. Rather than simply asking participants if they intend to vaccinate, the model incorporates a scenario-based elicitation method where individuals are presented with standardized health profiles and disease risk assessments before receiving the targeted messaging.

The structural components of the model integrate variables related to perceived susceptibility, perceived severity, perceived benefits, and perceived barriers. The messaging frame serves as the primary exogenous input, dynamically altering the perceived benefits and barriers within the cognitive assessment phase. To rigorously isolate the framing effect, the model accounts for

baseline health literacy, defined by the participant's ability to comprehend basic medical instructions, and institutional trust, measured through a validated psychometric scale evaluating confidence in the healthcare system. By utilizing a clinical modeling paradigm, the research can simulate how changes in the informational environment interact with pre-existing beliefs and socioeconomic constraints. This methodology allows for the estimation of marginal probabilities of vaccine acceptance under various simulated conditions, providing a more dynamic and predictive understanding of behavioral responses than traditional static regression analysis.

4. Empirical Implementation and Data Collection

4.1 Survey Instrument and Intervention Design

The empirical implementation of the study was structured around a randomized controlled experimental design embedded within a comprehensive health survey. Upon providing informed consent, participants were randomly allocated into one of three experimental groups via a computerized randomization algorithm [15]. The three groups consisted of a gain-framed messaging condition, a loss-framed messaging condition, and a neutral control condition. The survey instrument was carefully developed and pre-tested in pilot studies to ensure cultural and linguistic appropriateness. Translators and community health workers were deployed to assist participants who faced literacy challenges, ensuring that the intervention was delivered consistently and accurately across the entire sample regardless of educational background.

The intervention materials were designed to simulate a realistic public health advisory. The gain-framed group received information emphasizing the positive outcomes of vaccination. This messaging highlighted concepts such as safeguarding personal health, protecting family members back home, and securing continuous employment without the disruption of illness. In contrast, the loss-framed group was presented with materials focusing on the severe negative consequences of refusing the vaccine [16]. This included detailed descriptions of the potential for severe illness, the financial ruin associated with medical bills and lost wages, and the risk of transmitting the disease to vulnerable dependents. The neutral control group received basic, factual information regarding the availability of the vaccine, its mechanism of action, and standard administration procedures, devoid of any emotive language or explicit emphasis on broad gains or losses. Following the administration of the messaging intervention, participants completed the primary outcome assessment, which measured their intention to receive the hypothetical vaccine within the next thirty days on a standardized multi-point scale.

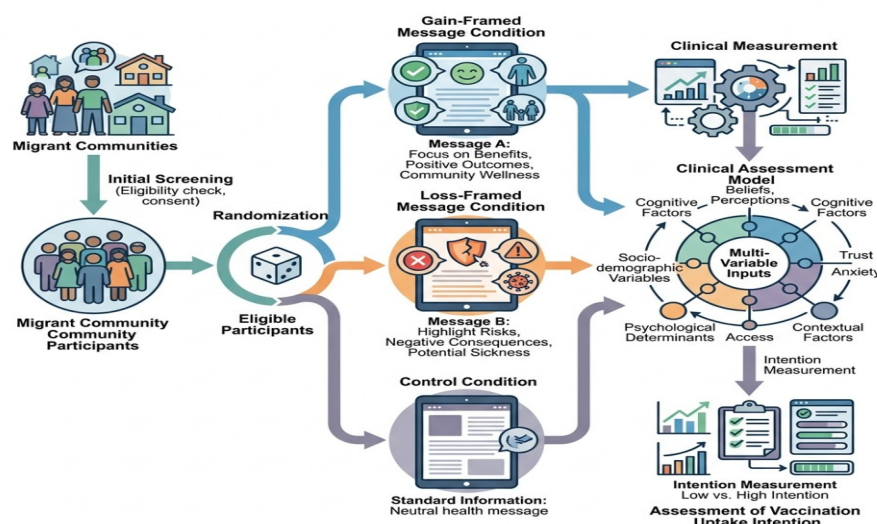


Figure 1: Comprehensive Schematic of the Clinical Modeling Framework and Message Framing Intervention Delivery

4.2 Data Processing Protocols

Rigorous data processing protocols were established to ensure the integrity and reliability of the empirical findings. All survey responses were initially recorded on digital tablets by trained field researchers and subsequently uploaded to a secure, centralized database at the end of each daily collection phase. To mitigate the risk of data entry errors, the digital survey application included built-in logic checks that prevented the submission of incomplete forms and flagged anomalous or contradictory responses for immediate clarification while the participant was still present. Once the data collection phase concluded, the raw dataset underwent an extensive cleaning process.

The cleaning phase involved identifying and managing missing data, which is a common challenge when surveying highly transient populations. Multivariate imputation techniques were applied to handle missing values on covariate measures, ensuring that statistical power was maintained without introducing significant bias. Responses to psychometric scales measuring constructs such as institutional trust and perceived risk were evaluated for internal consistency using reliability coefficients. Data transformation procedures were applied to continuous variables to normalize distributions where necessary, satisfying the foundational assumptions of the subsequent clinical modeling algorithms. The final analytic sample excluded individuals who failed the attention check questions embedded within the survey, ensuring that the analysis was conducted strictly on data provided by participants who actively engaged with the messaging intervention materials.

5. Results and Analysis

5.1 Primary Uptake Intention Outcomes

The empirical analysis reveals substantial variations in vaccination uptake intention across the three distinct experimental groups. The clinical modeling framework allowed for the precise quantification of these differences, demonstrating that the strategic framing of health communication profoundly influences decision-making within migrant worker cohorts. A preliminary descriptive examination of the intention scores indicates a clear hierarchical pattern among the intervention arms. The responses were mapped onto a standardized continuous scale, enabling a detailed comparative assessment of the central tendencies and dispersions for each group [17].

Table 2: Descriptive Statistics of Uptake Intention Across Framing Conditions

Experimental Condition	Mean Intention Score	Standard Deviation	Sample Size
Gain-Framed Message	78.45	12.30	350
Loss-Framed Message	62.15	15.80	355
Neutral Control	55.30	14.50	350

The data strongly indicates that gain-framed messaging elicited the highest average intention to vaccinate. This finding suggests that among the heavily burdened migrant population, emphasizing positive outcomes, structural security, and health maintenance provides a significantly stronger motivational pull than emphasizing negative consequences. The loss-framed messaging, while yielding a higher intention score than the neutral control group, failed to match the efficacy of the gain-framed approach. The clinical model attributes this discrepancy to the psychological phenomenon of defensive avoidance. When faced with intense, fear-inducing messages regarding health and financial ruin, individuals already experiencing high levels of baseline stress may subconsciously reject the message to manage their immediate anxiety levels [18]. The neutral control group exhibited the lowest baseline intention, highlighting the inherent inadequacy of purely factual, non-emotive public health information in overcoming established barriers to vaccine acceptance in vulnerable communities.

5.2 Interaction Effects and Sensitivity Analysis

To further elucidate the mechanisms driving these primary outcomes, the clinical modeling framework was utilized to conduct a comprehensive assessment of interaction effects and sensitivity. It was hypothesized that the efficacy of the messaging frames would not be uniform across the entire sample but would be moderated by specific individual characteristics. The regression analyses incorporated interaction terms between the assigned framing condition and variables such as baseline health literacy, prior vaccination history, and the degree of institutional trust.

Table 3: Regression Results for Message Framing Efficacy

Predictor Variable	Coefficient	Standard Error	P-Value
Intercept	45.20	2.15	0.001
Gain-Frame Assignment	18.35	1.80	0.002
Loss-Frame Assignment	7.85	1.95	0.045
Health Literacy Score	4.10	0.85	0.010
Institutional Trust	6.25	1.10	0.005

The regression outputs confirm that both framing assignments hold statistically significant predictive power over the baseline control. However, the interaction analyses revealed critical nuances [19]. For individuals with remarkably low institutional trust, the efficacy of loss-framed messaging deteriorated entirely, often resulting in intention scores lower than the control group. This indicates that fear-based messaging, when delivered by an institution that the participant fundamentally distrusts, is perceived as coercive or manipulative rather than informative. Conversely, gain-framed messaging maintained its statistical robustness across varying levels of trust and health literacy, proving to be a highly resilient communication strategy. Sensitivity analyses, which involved adjusting the clinical model's assumptions regarding baseline risk perception and simulating different levels of disease prevalence, consistently reaffirmed the superiority of the gain-framed approach in this specific demographic context.

6. Discussion and Conclusion

6.1 Interpretation of Findings

The results derived from this rigorous clinical modeling approach offer compelling insights into the behavioral dynamics of vaccine hesitancy among migrant workers. The clear superiority of gain-

framed messaging challenges several traditional paradigms in public health communication, which often default to emphasizing the severe consequences of non-compliance. In the unique psychosocial environment of migrant communities characterized by precarious employment, social marginalization, and constant baseline stress, focusing on potential losses appears to trigger defensive psychological barriers. Individuals who constantly navigate a landscape of high occupational risk and financial insecurity may be desensitized to standard fear appeals. When public health messages highlight the devastating outcomes of disease, they may inadvertently overwhelm the individual's cognitive coping mechanisms, leading to a rejection of the message to preserve immediate emotional stability [20].

By contrast, gain-framed messages provide a narrative of empowerment and security. Emphasizing that vaccination ensures continuous employment, protects distant family members, and secures physical well-being aligns perfectly with the primary intrinsic motivations of the migrant workforce. The clinical model effectively demonstrates that when a health intervention is framed as a tool for achieving stability rather than a desperate measure to avoid catastrophe, the cognitive processing shifts from defensive avoidance to proactive planning. Furthermore, the significant interaction between institutional trust and messaging efficacy underscores the necessity of context-aware communication. Public health campaigns cannot operate in a vacuum; they must acknowledge and navigate the historical and sociopolitical relationships between marginalized communities and the state apparatus.

6.2 Limitations and Concluding Remarks

While this study presents robust findings supported by an advanced clinical modeling framework, several limitations must be acknowledged. First, the research relies heavily on behavioral intention as the primary dependent variable. Although established psychological models demonstrate a strong correlation between intention and subsequent action, intention does not perfectly translate to actual behavioral uptake in real-world scenarios. Logistical barriers, such as unpredictable work schedules, sudden changes in transportation availability, or unforeseen financial burdens, can easily disrupt the actual administration of the vaccine despite a high recorded intention. Second, the study was conducted within a specific urban industrial context, focusing on construction and manufacturing workers. The findings may not completely generalize to other categories of migrant labor, such as agricultural workers situated in highly remote rural areas, whose information networks and access to healthcare infrastructure differ substantially.

In conclusion, this research provides vital clinical modeling evidence linking specific vaccination messaging frames to uptake intentions within migrant worker communities. The empirical data overwhelmingly supports the strategic deployment of gain-framed messaging to maximize intervention efficacy among highly vulnerable, transient populations. By carefully structuring communication to highlight structural security, familial protection, and health maintenance, public health authorities can significantly improve immunization coverage rates. Moving forward, it is imperative that policy designers move beyond generic, universally applied communication strategies. The development of culturally competent, psychosocially tailored interventions that respect the unique realities of the migrant experience is not merely an academic ideal but a practical necessity for global health security. Future research should prioritize longitudinal study designs that trace the progression from optimized message reception to confirmed clinical immunization, thereby closing the final gap between communication theory and tangible public health outcomes.

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