Saudi Journal of Medicine and Public Health

https://saudijmph.com/index.php/pub

https://doi.org/10.64483/202412667

Vaccine Hesitancy and the Frontline: A Review of How Nurses, Pharmacists, and Emergency Medical Services Personnel Can Collaborate as Trusted Messengers for Health Security and Community Immunity

Faris Minshut Saeed Alshahrani [(1)] , Yazeed Mohammed Salem Alatawi [(2)] , Kheder Moussa Yahia Gabarri [(3)] , Ali Mohammed Ali Qaysi [(3)] , Tariq Ahmed Hamoud Al Khairat [(4)] , Abdullah Solan Mhnashi [(3)] , Eissa Mohd Essaily [(5)] , Taher Mohammed Yahya Muhr [(6)] , Ali Hadi Mohammed Kariri , Haitham Ali Mohammed Akkur

(1) Ashwaq General Hospital, Ministry of Health, Saudi Arabia,
(2) Ashwag General Hospital, Ministry of Health, Saudi Arabia,
(3) Samtah General Hospital,Ministry of Health, Saudi Arabia,
(4) Samtah General Hospital, Jazan, Ministry of Health, Saudi Arabia,
(5) Sabya General Hospital, Ministry of Health, Saudi Arabia,
(6) Crisis And Disaster Management Center of Jazan,Ministry of Health, Saudi Arabia

Abstract

Background: Vaccine hesitancy—the delay in acceptance or refusal of safe vaccines despite their availability—has been identified as one of the greatest threats to global health, a challenge that intensified during the COVID-19 pandemic as misinformation proliferated and immunization rates declined worldwide.

Aim: This narrative review examines the critical role of nurses, pharmacists, and Emergency Medical Services (EMS) personnel as trusted healthcare professionals in addressing vaccine hesitancy, synthesizing evidence on effective communication strategies, the impact of interprofessional collaboration on vaccination uptake, and the barriers these frontline providers face.

Methods: A comprehensive literature search was conducted across academic databases and government publications for peer-reviewed articles, systematic reviews, and policy analyses published between 2010 and 2024.

Results: The review highlights barriers to vaccine uptake, such as misinformation, inadequate communication tools, time constraints, and systemic obstacles, while identifying facilitators like trusting patient relationships and access to educational resources. It discusses effective communication strategies, including motivational interviewing and empathetic-refutational interviewing, that positively influence vaccine attitudes and uptake. Additionally, interprofessional education initiatives, particularly involving EMS personnel, are noted for their potential in fostering collaborative vaccine advocacy, as they work closely with vulnerable populations in both routine and emergency contexts.

Conclusion: Nurses, pharmacists, and EMS personnel play crucial roles in combating vaccine hesitancy. Their effectiveness can be increased by addressing systemic barriers, offering training in evidence-based communication, promoting interprofessional collaboration, and aligning efforts with health security priorities.

Keywords: Vaccine Hesitancy, Nursing, Pharmacy, Emergency Medical Services, Health Security, Interprofessional Collaboration.

Introduction

Vaccinations rank among the most successful public health interventions in human history, preventing an estimated two to three million deaths globally each year (Orenstein & Ahmed, 2017). The development and widespread deployment of vaccines against diseases such as smallpox, polio, measles, and, more recently, COVID-19 have transformed the landscape of global health, dramatically reducing morbidity and mortality across all age groups (World Health Organization, 2022). Yet, the success of immunization programs has always been shadowed by varying degrees of public resistance, skepticism, and outright refusal (Dubé et al., 2013).

The World Health Organization (WHO) defined vaccine hesitancy in 2015 as the "delay in acceptance or refusal of vaccination despite availability of vaccination services," conceptualizing it as a complex, context-specific phenomenon that varies across time, place, and vaccines (MacDonald, 2015, p. 4161). In 2019, the WHO named vaccine hesitancy among the top ten threats to global health, a designation that proved prescient as the COVID-19 pandemic unfolded (Scheres & Kuszewski, 2019). The pandemic created an environment uniquely conducive to the proliferation of anti-vaccination beliefs, fueled by unprecedented levels of misinformation, political polarization, declining trust in experts, and public

*Corresponding author fmsmshahrani@gmail.com (Faris Minshut Saeed Alshahrani).
Receive Date: 22 December 2024, Revise Date: 30 December 2024, Accept Date: 31 December 2024

confusion over rapidly evolving scientific guidance (Garett & Young, 2021; Larson et al., 2014).

The consequences of vaccine hesitancy extend far beyond individual health decisions. When vaccination rates fall below the thresholds required for herd immunity---typically 85-95% depending on the disease and vaccine efficacy---communities become vulnerable to outbreaks of vaccine-preventable diseases (Salmon et al., 2015). Measles, once declared eliminated in many regions, has resurged in areas with declining vaccination coverage. The COVID-19 pandemic demonstrated how vaccine hesitancy can prolong public health emergencies, strain healthcare systems, and delay economic recovery (Dror et al., 2020). In this context, vaccine hesitancy is properly understood not merely as a public health challenge but as a health security threat---one that undermines population immunity, compromises outbreak prevention, and jeopardizes the resilience of health systems against current and future infectious disease threats (Larson et al., 2015).

Healthcare providers occupy a pivotal position in addressing this threat. Research consistently demonstrates that recommendations from trusted health professionals are among the strongest predictors of vaccine acceptance (Leask et al., 2012). Patients and parents who express hesitancy often remain open to dialogue and may be influenced by respectful, evidence-based conversations with providers they trust. Among the healthcare workforce, nurses, pharmacists, and Emergency Medical Services (EMS) personnel are particularly well-positioned to serve as frontline messengers. Nurses frequently have more dedicated time to spend with patients and families, allowing for the development of trusting relationships and the opportunity to address concerns in a comprehensive manner (Lin et al., 2022). Pharmacists, as among the most accessible healthcare professionals in many communities, have seen their scope of practice expand to include vaccine administration and patient counseling, placing them at the critical juncture where hesitancy meets the decision to vaccinate (Cassidy et al., 2021a).

EMS personnel represent an underutilized yet strategically valuable resource in vaccination efforts. As first responders who enter homes and communities during emergencies and routine encounters, EMS providers interact with individuals who may have limited access to traditional healthcare settings (Glenn et al., 2018). During the COVID-19 pandemic, EMS agencies across multiple countries expanded their roles to include COVID-19 testing, vaccine distribution, and community education, demonstrating the adaptability and reach of emergency medical services (Martin, 2022). EMS personnel are trusted figures in times of crisis, and their presence in communities, including rural and underserved areas, positions them to address vaccine hesitancy among populations that nurses and pharmacists may not routinely reach (Chan et al., 2019).

This narrative review synthesizes the literature from 2010 to 2024 on the role of nurses, pharmacists, and EMS personnel in addressing vaccine hesitancy. It examines three interrelated domains: first, the barriers and facilitators that shape these professionals' ability to engage effectively with hesitant patients; second, the evidence base for communication strategies and interprofessional collaborative approaches, including EMS; and third, the role of health security agencies in supporting frontline efforts through public messaging, policy, and resource provision.

Conceptualizing Vaccine Hesitancy

Defining Vaccine Hesitancy

The concept of vaccine hesitancy has evolved considerably over the past decade, moving from a binary conceptualization of vaccine acceptance versus refusal toward a more nuanced understanding of hesitancy as a continuum. The WHO Strategic Advisory Group of Experts (SAGE) Working Group on Vaccine Hesitancy provided the most widely accepted definition: vaccine hesitancy refers to "delay in acceptance or refusal of vaccination despite availability of vaccination services" (MacDonald, 2015, p. 4161). This definition acknowledges that hesitancy is not simply the opposite of acceptance but occupies a middle ground on a spectrum ranging from complete acceptance to complete refusal.

Importantly, the SAGE definition emphasizes that vaccine hesitancy is "complex and context specific, varying across time, place and vaccines" (MacDonald, 2015, p. 4162). This means that an individual who accepts influenza vaccination without question may harbor concerns about the HPV vaccine; a parent who vaccinates their older children may delay or refuse vaccines for an infant; and communities with high acceptance of routine childhood immunizations may experience significant hesitancy during a pandemic when novel vaccines are developed and deployed rapidly (Dubé et al., 2013). This context-specificity has profound implications for intervention design, suggesting that approaches must be tailored to specific populations, vaccines, and moments in time.

The 3C Model and Beyond

To understand the determinants of vaccine hesitancy, the SAGE Working Group developed the "3C" model, which identifies three core domains influencing vaccination decisions: Confidence, Complacency, and Convenience (MacDonald, 2015). Confidence refers to trust in three key areas: trust in the effectiveness and safety of vaccines, trust in the health system and providers who deliver them, and trust in the policymakers who make vaccination recommendations (Larson et al., 2014). When confidence erodes, whether due to vaccine safety scares, historical medical mistreatment of marginalized communities, or exposure to

misinformation, hesitancy increases (Quinn et al., 2019).

Complacency describes a situation where the perceived risks of vaccine-preventable diseases are low, and therefore, vaccination is not seen as a necessary or urgent action (MacDonald, 2015). Complacency may arise when diseases become rare due to high vaccination coverage---a paradox of successful immunization programs---leading individuals to question the need for continued vaccination (Salmon et al., 2015). Convenience encompasses the practical factors that influence vaccine uptake, including physical availability, affordability, accessibility, and the ability to understand and navigate vaccination services (Larson et al., 2015). Even among individuals who are confident and not complacent, barriers such as inconvenient clinic hours, transportation difficulties, language barriers, or complex appointment systems can result in delayed or missed vaccinations.

Subsequent research has expanded this framework. The "5C" model adds two additional dimensions: Calculation, referring to individuals' engagement in extensive information searching and risk-benefit analysis, and Collective Responsibility, reflecting the willingness to protect others through one's own vaccination (Betsch et al., 2018). More recently, the "7C" model has been proposed, incorporating Compliance and Conspiracy to capture adherence to social norms and susceptibility to conspiracy theories, respectively (Oudin Doglioni et al., 2023). These expanded models reflect the growing recognition that vaccine hesitancy is multiply determined, rooted in psychological, social, cultural, and structural factors that interact in complex ways (Hornsey et al., 2018).

Vaccine Hesitancy as a Health Security Threat

Framing vaccine hesitancy within a health security paradigm shifts the focus from individual-level concerns to population-level consequences and systemic vulnerabilities. Health security, as defined by the WHO, encompasses activities required to minimize the danger and impact of acute public health events that endanger the collective health of populations (World Health Organization, 2022). Within this framework, vaccine hesitancy threatens health security in several distinct ways.

First, vaccine hesitancy undermines *herd immunity*, the population-level protection that occurs when a sufficient proportion of individuals are immune to a disease, thereby interrupting transmission and protecting those who cannot be vaccinated due to medical contraindications (Salmon et al., 2015). When hesitancy drives coverage below herd immunity thresholds, communities become vulnerable to outbreaks, as witnessed with measles in the United States and Europe in recent years (Omer et al., 2009).

Second, hesitancy prolongs public health emergencies. The COVID-19 pandemic illustrated this dynamic vividly: even as safe and effective vaccines became available, hesitancy slowed uptake, extended the duration of the pandemic, enabled the emergence of new variants, and delayed the return to social and economic normalcy (Dror et al., 2020). Third, vaccine hesitancy erodes trust in public health institutions, creating a vicious cycle where declining trust fuels hesitancy, and subsequent public health failures further undermine trust (Quinn et al., 2019). This erosion of institutional trust has implications far beyond vaccination, affecting responses to future health threats, compliance with public health measures, and the overall social contract upon which public health depends (Freimuth et al., 2014).

Fourth, hesitancy among healthcare workers themselves poses a distinct health security threat (Gallant et al., 2023). Healthcare workers are not only priority populations for vaccination due to their elevated exposure risk, but they also serve as influential models for patients and communities. When healthcare workers exhibit hesitancy or refuse vaccination, it signals to patients that vaccines may not be safe or necessary, undermining broader vaccination efforts (Dror et al., 2020). Understanding vaccine hesitancy through this health security lens underscores the importance of a coordinated, multi-sectoral response---one that engages frontline providers like nurses, pharmacists, and EMS personnel as essential partners in protecting population immunity.

Nurses, Pharmacists, and EMS as Trusted Messengers

The Trust Advantage

Trust lies at the heart of effective vaccine communication, and nurses, pharmacists, and EMS personnel enjoy high levels of public trust that position them uniquely to address hesitancy. Surveys consistently rank nurses as the most trusted professionals in many countries, with pharmacists also receiving high trust ratings (Quinn et al., 2019). EMS personnel, while less studied in this context, occupy a unique position of trust as emergency responders who arrive in moments of vulnerability and crisis (Glenn et al., 2018). This trust advantage stems from several factors: the perception of these professionals as caring and compassionate, their accessibility in communities, and their roles as educators and advocates rather than merely as technicians (Cassidy et al., 2021a; Martin, 2022).

For nurses, trust is built through sustained relationships with patients and families across the care continuum. Whether in primary care, community health, school nursing, or hospital settings, nurses often spend more time with patients than any other healthcare professional (Lin et al., 2022). This time allows for the development of rapport, the exploration of patient concerns in depth, and the provision of individualized education tailored to patient values and circumstances. Nurses are trained to see patients holistically, understanding that health decisions are embedded in broader social, cultural, and family contexts (Leask et al., 2012). This holistic perspective

is particularly valuable when addressing vaccine hesitancy, which rarely stems from a single concern but rather from a complex web of influences (Brunson, 2013).

Pharmacists, meanwhile, occupy a unique position as among the most accessible healthcare professionals in any community (Cassidy et al., 2021a). With the expansion of pharmacists' scope of practice to include vaccine administration in many jurisdictions, patients now encounter pharmacists not only when filling prescriptions but also when seeking vaccination services directly (Cassidy et al., 2021b). This creates opportunities for "teachable moments"---brief conversations that can address concerns, correct misinformation, and reinforce the importance of vaccination. Pharmacists' accessibility is particularly valuable for reaching populations that may not engage regularly with primary care, including healthy adults, working-age individuals, and those in rural or underserved areas (Davis Jr et al., 2022).

EMS personnel represent a distinct and complementary trusted messenger group. As first responders, they enter homes, workplaces, and public spaces during emergencies, providing care to individuals who may be isolated from traditional healthcare systems (Chan et al., 2019). This access is particularly valuable for reaching vulnerable populations, including older adults living independently, individuals with mobility limitations, those experiencing homelessness, and residents of rural communities with limited healthcare infrastructure (Glenn et al., 2018). During the COVID-19 pandemic, EMS agencies demonstrated their capacity to extend beyond traditional emergency response roles, participating in community paramedicine programs that include preventive care and health education (Martin, 2022).

Expanding Scope of Practice

The scope of practice for nurses, pharmacists, and EMS personnel has expanded significantly over the past two decades, creating new opportunities for vaccine advocacy and administration (Table 1).

For nurses, vaccine-related responsibilities encompass a broad spectrum of activities. In clinical settings, nurses assess patients' vaccination status, provide education and counseling, screen for contraindications, administer vaccines, and monitor for adverse reactions (Lin et al., 2022). In community and public health roles, nurses conduct outreach to underserved populations, coordinate vaccination clinics, engage in community education, and address vaccine concerns through home visits and community meetings (Cassidy et al., 2021a). School nurses play a particularly important role in childhood and adolescent vaccination, providing information to parents, administering school-required vaccines, and serving as trusted resources for vaccine questions (Beckwith & Beckwith, 2020).

For pharmacists, the evolution has been even more dramatic. Historically, pharmacy practice focused on medication dispensing with limited direct patient interaction. Today, pharmacists in many countries are authorized to administer a growing range of vaccines, from influenza and pneumococcal vaccines to travel vaccines and, during the COVID-19 pandemic, novel mRNA vaccines (Cassidy et al., 2021b). This shift has transformed pharmacies into vaccination destinations, dramatically expanding the points of access for immunization services. Beyond administration, pharmacists counsel patients on vaccine benefits and risks, address concerns and misconceptions, and document vaccinations in immunization registries to support public health surveillance (Shariff et al., 2022).

For EMS personnel, scope expansion has been more recent but equally significant. Traditionally focused on emergency response and transport, EMS agencies have increasingly adopted community paramedicine and mobile integrated health models that encompass preventive care, chronic disease management, and public health interventions (Glenn et al., 2018). During the COVID-19 pandemic, EMS personnel administered vaccines in mass vaccination sites, long-term care facilities, and homebound patients' residences (Martin, 2022). In some jurisdictions, EMS now routinely participates in influenza vaccination campaigns and public health emergency preparedness activities. This expanded scope positions EMS as a critical partner in reaching populations that other providers may miss (Chan et al., 2019).

The Synergy of Interprofessional Collaboration Including EMS

While nurses, pharmacists, and EMS personnel each bring distinct strengths to vaccine advocacy, their collaboration creates synergy that can enhance effectiveness. In integrated healthcare systems, these professionals working together can create a seamless experience for vaccine-hesitant patients across multiple points of contact. The EMS responder may initiate the conversation during a home visit, identifying vaccine concerns and connecting the patient with community resources. The nurse can build on this initial contact during follow-up care, exploring concerns in greater depth. The pharmacist can reinforce key messages, address specific questions about vaccine composition or side effects, and administer the vaccine when the patient is ready (Cassidy et al., 2021a).

This collaborative approach leverages the unique expertise of each profession while presenting patients with a consistent, reinforced message from multiple trusted sources. Research suggests that interprofessional collaboration in vaccine advocacy may be particularly effective for addressing complex hesitancy cases where patients have multiple concerns or have been exposed to significant misinformation (Gautier et al., 2024). The inclusion of EMS adds a community-based access point that can reach individuals who may not interact with traditional

healthcare settings until a crisis occurs (Glenn et al., 2018).

Despite this potential, collaboration between nurses, pharmacists, and EMS personnel on vaccine hesitancy remains underdeveloped in many settings. Professional silos, separate education and training pathways, different practice locations, and a lack of integrated health information systems all create barriers to effective collaboration (Cassidy et al., 2021b). EMS is often particularly isolated from other healthcare sectors, with limited integration into public health planning and primary care networks (Martin, 2022). Addressing these barriers through intentional efforts to foster interprofessional education, shared clinical protocols, and collaborative practice models that include EMS represents an important opportunity for strengthening the frontline response to vaccine hesitancy (Fusco et al., 2023).

Table 1: Nurses', Pharmacists', and EMS Personnel's Roles, Opportunities, and Challenges in Addressing Vaccine Hesitancy

Professional Group	Primary Settings	Vaccine-Related Roles	Unique Opportunities	Key Challenges
Nurses	Hospitals, primary care, community health, schools, long-term care (Lin et al., 2022)	Patient education and counseling; vaccine administration; adverse event monitoring; community outreach; school-based programs (Cassidy et al., 2021a)	Sustained relationships with patients and families; holistic, patient-centered approach; high public trust; presence across care continuum (Beckwith & Beckwith, 2020)	Time constraints; competing clinical demands; limited training in motivational interviewing; documentation burden (Cassidy et al., 2021b)
Pharmacists	Community pharmacies, hospital pharmacies, outpatient clinics (Cassidy et al., 2021a)	Vaccine counseling; vaccine administration; patient education; documentation in immunization registries (Shariff et al., 2022)	High accessibility; extended hours; no appointment needed; trusted medication experts; expanding scope of practice (Davis Jr et al., 2022)	Reimbursement barriers; limited private consultation space; variable integration with primary care records; lack of comprehensive patient history (Cassidy et al., 2021b)
EMS Personnel	Emergency response vehicles, community paramedicine, mobile integrated health, mass vaccination sites (Glenn et al., 2018)	Community outreach; vaccine administration in alternative settings; homebound patient vaccination; public education during emergencies; referral to vaccine services (Martin, 2022)	Access to homes and communities; trusted crisis responders; reach underserved/rural populations; 24/7 availability; bridge to healthcare for isolated individuals (Chan et al., 2019)	Limited public health training; traditional focus on acute care; lack of integration with health systems; reimbursement models; documentation challenges; variable scope of practice regulations (Martin, 2022)
Interprofessional Collaboration	Integrated primary care, community health centers, public health clinics, emergency response systems (Gautier et al., 2024)	Coordinated patient education; shared vaccination protocols; referral pathways; joint community outreach; cross-sector training (Fusco et al., 2023)	Reinforced consistent messaging; comprehensive patient support; efficient use of professional expertise; enhanced patient trust; multiple access points for vulnerable populations (Cassidy et al., 2021a)	Professional silos; separate education pathways; lack of integrated information systems; unclear role definitions; EMS often excluded from planning (Martin, 2022)

Evidence-Based Approaches for Vaccine Conversations

The Shift from Persuasion to Dialogue

Traditional approaches to vaccine hesitancy often relied on a deficit model, assuming hesitancy stems from a lack of information and that providing more facts would lead to acceptance (Lewandowsky et al., 2017). Research has decisively demonstrated the limitations of this approach. Simply presenting scientific evidence to hesitant individuals often fails to change their minds and may even backfire, reinforcing existing beliefs and increasing resistance (Hornsey & Fielding, 2017). This phenomenon occurs because vaccine decisions are rarely purely informational; they are shaped by emotions, values, social identity, and trust---factors unresponsive to didactic instruction (Hornsey et al., 2018).

This recognition has driven a paradigm shift toward communication approaches that prioritize dialogue over persuasion, empathy over argumentation, and patient-centered exploration of concerns over premature information provision (Leask et al., 2012). Two approaches gaining particular traction are motivational interviewing (MI) and empathetic-refutational interviewing (ERI), both of which can be adapted for use by nurses, pharmacists, and EMS personnel.

Motivational Interviewing

Motivational interviewing is a collaborative, goal-oriented communication style designed to strengthen personal motivation by eliciting and exploring the person's own reasons for change (Beckwith & Beckwith, 2020). Originally developed for addiction counseling, it has been successfully adapted for vaccination, where its patient-centered philosophy aligns naturally with addressing hesitancy (Gagneur et al., 2018).

The application of MI to vaccine hesitancy follows a structured four-step framework (Beckwith & Beckwith, 2020; Jamison et al., 2022). Engage involves establishing a trusting, non-judgmental relationship and creating a safe space for discussing vaccines. Understanding focuses on identifying what matters most to the patient, exploring specific concerns and underlying values rather than immediately providing counterarguments. Offer information employs an "ask-offer-ask" approach---asking permission to share information, offering targeted information addressing identified concerns, and asking what the patient makes of this information. Clarifying and accepting involves validating patient autonomy while ensuring they have accurate information, accepting that the patient may not be ready to vaccinate immediately.

Core communication skills in MI are summarized by OARS: Open-ended questions, Affirmations, Reflective listening, and Summaries (Beckwith & Beckwith, 2020). The approach is guided by CAPE principles: Compassion, Acceptance, Partnership, and Evocation (Jamison et al., 2022). Substantial evidence supports MI's effectiveness in promoting positive vaccination attitudes. Studies in the United States, Canada, and France demonstrate that MI-based conversations increase intention to vaccinate and, in some cases, actual uptake (Gagneur et al., 2018; Jamison et al., 2022; Lemaitre et al., 2019). The approach suits nursing, pharmacy, and EMS contexts as it can be implemented in brief encounters and aligns with these professions' patient-centered ethos (Cassidy et al., 2021a; Chan et al., 2019).

Empathetic-Refutational Interviewing

Empathetic-refutational interviewing (ERI), developed within the EU Horizon 2020 JITSUVAX project, builds on MI's empathetic foundation while adding strategies for addressing misinformation by accounting for its psychological functions (Fasce et al., 2023). ERI's key innovation is its focus on "attitude roots"---the underlying fears, ideologies, and identity concerns motivating acceptance of misinformation (Hornsey & Fielding, 2017; Hornsey et al., 2018). These attitude roots form the foundation from which specific misinformed beliefs grow. Simply refuting surface claims without addressing deeper concerns can trigger defensive reactions and strengthen resistance.

The ERI framework follows a four-step structure (Fasce et al., 2023). Eliciting concerns involves understanding the patient's perspective to identify underlying attitude roots. Affirmation expresses genuine empathy toward the patient's position without endorsing misinformation. Tailored refutation explains why the misconception is wrong while providing an acceptable alternative explanation that does not directly challenge the attitude root. Providing factual information presents evidence in a manner consistent with the patient's values and concerns.

A field test involving 30 general practitioners and 334 vaccine-hesitant patients in Romania found positive outcomes for both approaches (Fasce et al., 2023). ERI patients demonstrated larger increases in positive attitudes and willingness to vaccinate, while MI patients were more likely to schedule actual appointments. Physicians in both training groups reported feeling better equipped to address hesitancy. These findings suggest MI and ERI are complementary. MI builds rapport, explores concerns, and supports movement toward action, while ERI addresses entrenched misinformation by engaging its psychological foundations (Fasce et al., 2023).

Implications for Nursing, Pharmacy, and EMS Practice

Evidence on MI and ERI has important implications for all three professional groups. Communication skills for addressing vaccine hesitancy can be taught and should be integrated into professional curricula and continuing education for nurses, pharmacists, and EMS personnel (Cassidy et al., 2021b; Fusco et al., 2023; Martin, 2022). Brief interventions can meaningfully impact vaccine

attitudes, suggesting investment in frontline provider training yields public health returns (Fasce et al., 2023). Empathy is a core clinical skill with measurable effects on health outcomes (Jamison et al., 2022).

For EMS personnel specifically, adapting these communication approaches requires consideration of the unique EMS context. EMS encounters are often brief, occur during moments of crisis or stress, and may be the patient's only contact with the healthcare system (Glenn et al., 2018). Training EMS providers in brief, focused communication techniques that can be delivered in 2-3 minutes during transport or post-emergency stabilization can maximize the impact of these limited encounters (Chan et al., 2019). Community paramedicine programs, which involve scheduled preventive visits, offer even greater opportunities for in-depth vaccine conversations (Martin, 2022).

However, translation into routine practice faces barriers. Most nurses, pharmacists, and EMS personnel lack MI or ERI training (Cassidy et al., 2021a; Martin, 2022). Time pressures make multi-step protocols difficult (Cassidy et al., 2021b). Lack of reimbursement or organizational recognition means vaccine advocacy is often treated as optional rather than a core professional responsibility, particularly for EMS, where prevention has historically been outside the traditional scope (Davis Jr et al., 2022).

The Role of Health Security Agencies: Supporting the Frontline

Crisis Communication and Public Messaging

Health security agencies critically shape the information environment for vaccine conversations (Kada et al., 2022). Public messaging from authoritative sources can support or undermine frontline efforts depending on its clarity, consistency, and credibility (Coombs, 2007). Effective communication provides a foundation of trusted information; when communication falters, providers manage public confusion and eroded trust. Research on COVID-19 crisis communication reveals important lessons. Kada and colleagues (2022) analyzed communication from the Public Health Agency of Canada and the Ontario government, identifying themes including vaccine safety, benefits, and addressing hesitancy. Both levels communicated similar core messages but differed in strategies, highlighting the importance of coordinated communication across jurisdictions (Table 2).

Effective crisis communication should provide clear, consistent information about vaccine safety and effectiveness, address uncertainty transparently, counter misinformation with accurate information delivered through multiple channels, and engage trusted messengers, including professional associations representing nurses, pharmacists, and EMS (Kada et al., 2022; Coombs, 2007; Freimuth et al., 2014). When messaging is inconsistent or perceived as politically motivated, providers face the difficult task of explaining inconsistencies while maintaining trust (Kholina et al., 2022). This was evident during COVID-19 when evolving guidance created communication challenges (Davis Jr et al., 2022).

For EMS personnel, public messaging must recognize their unique position as both healthcare providers and emergency responders. During public health emergencies, EMS serves as a critical link between the public and the health system, and consistent messaging from health security agencies enables EMS personnel to reinforce public health guidance during community encounters (Martin, 2022).

Providing Resources and Tools

Health security agencies can support providers by developing resources for vaccine conversations (Angell & Newsom, 2020; Vernon-Wilson et al., 2023). Effective resources include evidence-based educational materials in multiple languages and formats, talking points addressing common questions, training modules on communication strategies, mobile apps providing point-of-care vaccine information, and toolkits for community vaccination clinics. For EMS, resources must be designed for the unique EMS environment: portable, accessible during mobile operations, and usable in time-limited encounters (Chan et al., 2019).

The California Department of Public Health's campaign illustrates targeted resource provision (Angell & Newsom, 2020). Designed to increase vaccination among Spanish-speaking farmworkers, it expanded vaccine scheduling, launched a bilingual education campaign, deployed mobile vaccine units, and made pre-translated consent forms available in 11 languages. These resources enabled frontline providers, including EMS personnel who staffed mobile units, to focus on patient engagement rather than logistical barriers. Similar models have been used to integrate EMS into community vaccination efforts in rural and underserved areas (Martin, 2022).

Policy and System-Level Support

Health security agencies influence policy factors shaping providers' ability to address hesitancy (World Health Organization, 2022). Scope of practice regulations must ensure nurses, pharmacists, and EMS personnel have legal authority to administer vaccines and provide counseling in all settings (Cassidy et al., 2021a). Many jurisdictions temporarily expanded pharmacy and EMS scope during COVID-19, demonstrating the benefits of a more flexible workforce (Davis Jr et al., 2022; Martin, 2022). Reimbursement policies must compensate for vaccine advocacy and education, not merely administration (Cassidy et al., 2021b). When only injection is reimbursed, patient education becomes an unfunded cost that practices and EMS agencies cannot sustain.

Immunization information systems require robust registries accessible to all providers, enabling continuity of care and accurate vaccination status

information (Shariff et al., 2022). For EMS, integration with these systems is particularly challenging but essential for ensuring that vaccinations administered in community settings are documented and communicated to primary care providers (Chan et al., 2019). Professional education requirements should mandate vaccine communication training in curricula and continuing education for all three professions (Cassidy et al., 2021a; Fusco et al., 2023; Martin, 2022). Public health surveillance and feedback mechanisms sharing data on coverage, hesitancy trends, and outbreaks enable providers to understand local context and tailor efforts (Larson et al., 2015).

Strengthening the Frontline-Agency Partnership Including EMS

The relationship between frontline providers and health security agencies should be a partnership rather than a top-down direction (Kada et al., 2022). Nurses, pharmacists, and EMS personnel possess on-the-ground knowledge of community concerns that can inform agency planning (Cassidy et al., 2021a; Martin, 2022). Agencies possess resources, data, and policy levers to support frontline efforts (World Health Organization, 2022). Creating mechanisms for ongoing bidirectional communication---through professional associations, advisory committees, practice-based research networks, and direct engagement---strengthens this partnership and enhances collective response to vaccine hesitancy (Angell & Newsom, 2020). Historically, EMS has been underrepresented in public health planning; intentional inclusion of EMS representatives in advisory structures is essential for leveraging this workforce's full potential (Chan et al., 2019).

Table 2: Health Security Agency Strategies to Support Frontline Providers in Addressing Vaccine Hesitancy

Strategy Domain	Specific Approaches	Examples from Literature	Impact on Frontline Practice
Crisis Communication	Clear, consistent messaging; multiple channels; addressing uncertainty transparently; countering misinformation (Coombs, 2007)	PHAC and Ontario government social media communication during COVID-19 (Kada et al., 2022)	Provides authoritative information to share with patients; reduces the need for providers to explain conflicting messages; supports EMS in community messaging (Freimuth et al., 2014)
Resource Provision	Educational materials; talking points; training modules; mobile apps; translated consent forms (Vernon-Wilson et al., 2023)	California "Two Vaccines, One Visit" campaign with bilingual materials and pre-translated consent forms (Angell & Newsom, 2020)	Reduces barriers to patient education; enables culturally and linguistically appropriate communication; EMS-adapted resources support mobile operations (Chan et al., 2019)
Policy Support	Scope of practice expansion; reimbursement for vaccine counseling; immunization registries; education requirements (World Health Organization, 2022)	Pandemic-era expansions of pharmacy and EMS vaccination authority (Davis Jr et al., 2022; Martin, 2022)	Creates an enabling environment for vaccine advocacy; ensures sustainable integration into practice; supports EMS community paramedicine programs (Chan et al., 2019)
Training and Education	Communication skills training; interprofessional education initiatives; continuing professional development (Cassidy et al., 2021b)	EU Horizon 2020 JITSUVAX project training in ERI and MI (Fasce et al., 2023); interprofessional simulation programs including EMS (Fusco et al., 2023)	Builds provider capacity for effective vaccine conversations; increases confidence and competence; prepares EMS for preventive roles (Martin, 2022)
Data and Surveillance	Vaccination coverage monitoring; hesitancy trend tracking; feedback to providers (Larson et al., 2015)	WHO SAGE working group surveillance frameworks (MacDonald, 2015)	Enables targeted, context-specific interventions; allows providers to understand local needs; supports EMS deployment to high-need areas (Chan et al., 2019)
Community Partnership	Engaging community leaders; supporting trusted messengers; funding	California's partnership with agricultural employers and community	Extends reach beyond clinical settings; addresses trust deficits in marginalized

	community-based organizations (Quinn et al., 2019)	organizations (Angell & Newsom, 2020)	communities; leverages EMS community access (Martin, 2022)

Challenges and Future Directions

Persistent Gaps in the Evidence Base

Despite significant advances in understanding vaccine hesitancy, important gaps remain in the evidence base regarding the specific roles of nurses, pharmacists, and EMS personnel. The majority of research has focused on physicians, with nurses and pharmacists relatively understudied and EMS personnel almost absent from the literature (Cassidy et al., 2021a). Gallant and colleagues' (2023) scoping review of vaccine hesitancy among healthcare providers found that of 83 included studies, only 8 included pharmacists, and none focused specifically on EMS. Most studies have employed cross-sectional designs that capture attitudes at a single point but cannot establish causal relationships or track changes over time, highlighting the need for longitudinal research following these professionals as they gain experience and encounter different patient populations (Cassidy et al., 2021b). For EMS, whose roles in vaccination are newly emerging, longitudinal tracking of scope expansion and its impacts is particularly needed (Martin, 2022).

Research has been concentrated in urban, academic healthcare settings, with limited attention to rural, community-based, and underserved practice contexts where barriers and facilitators may differ substantially (Cassidy et al., 2021a). EMS is often the primary—or only—healthcare access point in rural areas, making research in these settings critical (Chan et al., 2019). Additionally, few studies have employed rigorous qualitative or mixed methods designs capable of capturing the rich, contextualized experiences of nurses, pharmacists, and EMS personnel as they navigate vaccine conversations in real-world practice (Cassidy et al., 2021b). Understanding not just what barriers exist but how they operate in daily work, and how providers adapt to overcome them, requires methodological approaches that go beyond surveys and structured questionnaires.

Implementation Challenges

Translating evidence-based communication strategies into routine practice faces significant implementation challenges, and the COM-B model (Capability, Opportunity, Motivation-Behavior) provides a useful framework for understanding these barriers and designing interventions (Michie et al., 2011; Atkins et al., 2017). Capability barriers for nurses, pharmacists, and EMS personnel addressing vaccine hesitancy include limited training in communication techniques, lack of knowledge about vaccine safety profiles, and insufficient skills for addressing misinformation effectively (Cassidy et al., 2021a; Martin, 2022). Addressing these requires investment in pre-service and continuing education, as well as point-of-care resources supporting clinical decision-making and patient communication (Fusco et al., 2023). For EMS, whose training has traditionally focused on acute care, building capability for preventive communication requires significant curricular innovation (Chan et al., 2019). Opportunity barriers include time constraints, lack of private space for sensitive conversations, absence of clear protocols, and limited integration with other providers (Cassidy et al., 2021b). For EMS, additional barriers include the emergency nature of most encounters, lack of patient continuity, and absence of documentation systems capturing vaccine discussions (Martin, 2022).

Motivation barriers for vaccine advocacy may include perceptions that these conversations are not part of one's professional role, low confidence in effectiveness, or competing priorities that feel more urgent (Cassidy et al., 2021a). For EMS, the traditional identity as emergency responders rather than preventive health providers can create motivational barriers to engaging in vaccine conversations (Chan et al., 2019). Addressing these requires leadership messaging affirming vaccine advocacy as core professional work, recognition and reward systems that value these activities, and opportunities for providers to experience success and build self-efficacy (Cane et al., 2012). Organizational and policy interventions—including allocating dedicated time for vaccine education, designing workflows that support patient conversations, and creating interprofessional collaboration mechanisms—are essential to address these multifaceted implementation challenges (Atkins et al., 2017).

Future Research Priorities

Rigorous effectiveness trials employing randomized or quasi-experimental designs with adequate follow-up are urgently needed to evaluate communication training programs, collaborative practice models, and health system policies targeting vaccine hesitancy, with outcomes including vaccination uptake, patient satisfaction, and provider well-being (Cassidy et al., 2021b). Studies specifically examining EMS-led or EMS-involved interventions are critically needed, particularly given EMS personnel's unique access to marginalized and underserved populations (Martin, 2022). Implementation research guided by established frameworks should examine how evidence-based interventions can be adapted and sustained across diverse practice contexts, attending to organizational factors that influence translation from research to routine practice (Atkins et al., 2017). For EMS, this includes examining how community paramedicine programs can be scaled and sustained beyond pilot phases (Chan et al., 2019). A health equity focus is

essential, with research explicitly examining how vaccine hesitancy and intervention effectiveness vary across populations defined by race, ethnicity, socioeconomic status, and geography (Freimuth et al., 2014; Quinn et al., 2019). Economic evaluations are also needed to understand the costs and cost-effectiveness of interventions, considering both implementation costs and broader societal savings from increased vaccination coverage (Davis Jr et al., 2022).

Given the emotionally demanding nature of addressing entrenched vaccine resistance—including encounters with hostility or personal attacks—research must examine impacts on provider well-being and identify strategies for supporting nurses, pharmacists, and EMS personnel in maintaining resilience and avoiding burnout (Cassidy et al., 2021a). EMS personnel already face high rates of occupational stress; adding vaccine advocacy responsibilities without adequate support could exacerbate these challenges. Finally, as misinformation proliferates through digital channels, research should explore how technology can support frontline providers through mobile decision support tools, just-in-time training, telehealth consultation with hesitant patients, and strategic integration with social media platforms—with particular attention to mobile technologies integrated into emergency vehicles that could provide real-time vaccine information during community encounters (Chan et al., 2019).

Conclusion

Vaccine hesitancy is a significant public health challenge threatening immunization programs. This review emphasizes the vital roles of nurses, pharmacists, and EMS personnel as trusted communicators capable of influencing public attitudes. Despite their high trust levels and access to communities, these professionals face obstacles such as misinformation and a lack of communication training. A multi-level strategy is proposed, recommending evidence-based training, interprofessional collaboration, and supportive policy frameworks to enhance communication efforts. The COVID-19 pandemic has highlighted the need for innovative approaches and collaboration between health entities. Strengthening trust among patients and health providers is essential, with the active involvement of nurses, pharmacists, and EMS being crucial for improving public health outcomes and ensuring health security. Together, these professionals can significantly contribute to population immunity and resilience against future health threats.

References

1. Angell, S. Y., & Newsom, G. A. V. I. N. (2020). California Department of Public Health. *Sacramento, USA: California Department of Public Health*.
2. Atkins, L., Francis, J., Islam, R., O'Connor, D., Patey, A., Ivers, N., ... & Michie, S. (2017). A guide to using the Theoretical Domains Framework of behaviour change to investigate implementation problems. *Implementation science*, *12*(1), 77. https://doi.org/10.1186/s13012-017-0605-9
3. Beckwith, V. Z., & Beckwith, J. (2020). Motivational interviewing: a communication tool to promote positive behavior change and optimal health outcomes. *NASN School Nurse*, *35*(6), 344-351. https://doi.org/10.1177/1942602X20915715
4. Betsch, C., Schmid, P., Heinemeier, D., Korn, L., Holtmann, C., & Böhm, R. (2018). Beyond confidence: Development of a measure assessing the 5C psychological antecedents of vaccination. *PloS one*, *13*(12), e0208601. https://doi.org/10.1371/journal.pone.0208601
5. Brunson, E. K. (2013). The impact of social networks on parents' vaccination decisions. *Pediatrics*, *131*(5), e1397-e1404. https://doi.org/10.1542/peds.2012-2452
6. Cane, J., O'Connor, D., & Michie, S. (2012). Validation of the theoretical domains framework for use in behaviour change and implementation research. *Implementation science*, *7*(1), 37. https://doi.org/10.1186/1748-5908-7-37
7. Cassidy, C., Langley, J., Steenbeek, A., Taylor, B., Kennie-Kaulbach, N., Grantmyre, H., ... & Isenor, J. (2021a). A behavioral analysis of nurses' and pharmacists' role in addressing vaccine hesitancy: scoping review. *Human Vaccines & Immunotherapeutics*, *17*(11), 4487-4504. https://doi.org/10.1080/21645515.2021.1954444
8. Cassidy, C., Stratton, L., Taylor, B., Steenbeek, A., Langley, J., & Isenor, J. (2021b). Characterizing nurses' and pharmacists' role in addressing vaccine hesitancy and/or refusal: A scoping review protocol. http://hdl.handle.net/10222/80630
9. Chan, J., Griffith, L. E., Costa, A. P., Leyenaar, M. S., & Agarwal, G. (2019). Community paramedicine: a systematic review of program descriptions and training. *Canadian Journal of Emergency Medicine*, *21*(6), 749-761. doi:10.1017/cem.2019.14
10. Coombs, W. T. (2007). *Ongoing crisis communication: Planning, managing, and responding*. Sage.
11. Davis Jr, T. P., Yimam, A. K., Kalam, M. A., Tolossa, A. D., Kanwagi, R., Bauler, S., ... & Larson, H. (2022). Behavioural determinants of COVID-19-vaccine acceptance in rural areas of six lower-and middle-income

countries. *Vaccines*, *10*(2), 214. https://doi.org/10.3390/vaccines10020214

12. Dror, A. A., Eisenbach, N., Taiber, S., Morozov, N. G., Mizrachi, M., Zigron, A., ... & Sela, E. (2020). Vaccine hesitancy: the next challenge in the fight against COVID-19. *European journal of epidemiology*, *35*(8), 775-779. https://doi.org/10.1007/s10654-020-00671-y
13. Dubé, E., Laberge, C., Guay, M., Bramadat, P., Roy, R., & Bettinger, J. A. (2013). Vaccine hesitancy: an overview. *Human vaccines & immunotherapeutics*, *9*(8), 1763-1773. https://doi.org/10.4161/hv.24657
14. Fasce, A., Karlsson, L., Verger, P., Mäki, O., Taubert, F., Garrison, A., ... & Soveri, A. (2023). Endorsement of alternative medicine and vaccine hesitancy among physicians: a cross-sectional study in four European countries. *Human Vaccines & Immunotherapeutics*, *19*(2), 2242748. https://doi.org/10.1080/21645515.2023.2242748
15. Freimuth, V. S., Musa, D., Hilyard, K., Quinn, S. C., & Kim, K. (2014). Trust during the early stages of the 2009 H1N1 pandemic. *Journal of Health Communication*, *19*(3), 321-339. https://doi.org/10.1080/10810730.2013.811323
16. Fusco, N. M., Foltz-Ramos, K., Kruger, J. S., Vargovich, A., & Prescott Jr, W. A. (2023). Interprofessional simulation to prepare students to address medical misinformation and vaccine hesitancy. *Journal of Interprofessional Education & Practice*, *32*, 100644. https://doi.org/10.1016/j.xjep.2023.100644
17. Gagneur, A., Lemaître, T., Gosselin, V., Farrands, A., Carrier, N., Petit, G., ... & De Wals, P. (2018). A postpartum vaccination promotion intervention using motivational interviewing techniques improves short-term vaccine coverage: PromoVac study. *BMC Public Health*, *18*(1), 811. https://doi.org/10.1186/s12889-018-5724-y
18. Gallant, A. J., Harding, A., Johnson, C., Steenbeek, A., & Curran, J. A. (2023). Identifying H1N1 and COVID-19 vaccine hesitancy or refusal among health care providers: a scoping review. *JBI Evidence Synthesis*, *21*(5), 913-951. *DOI:* 10.11124/JBIES-22-00112
19. Garett, R., & Young, S. D. (2021). Online misinformation and vaccine hesitancy. *Translational behavioral medicine*, *11*(12), 2194-2199. https://doi.org/10.1093/tbm/ibab128
20. Gautier, S., Hammarlin, M. M., Paulik, E., Montagni, I., Mueller, J. E., Vaux, S., ... & Delarocque-Astagneau, E. (2024). New pedagogical tools for vaccine education: preparing future healthcare workers for the next pandemic. *BMC medical education*, *24*(1), 1314. https://doi.org/10.1186/s12909-024-06274-5
21. Glenn, M., Zoph, O., Weidenaar, K., Barraza, L., Greco, W., Jenkins, K., ... & Fisher, J. (2018). State regulation of community paramedicine programs: a national analysis. *Prehospital emergency care*, *22*(2), 244-251. https://doi.org/10.1080/10903127.2017.1371260
22. Hornsey, M. J., & Fielding, K. S. (2017). Attitude roots and Jiu Jitsu persuasion: Understanding and overcoming the motivated rejection of science. *American psychologist*, *72*(5), 459. https://doi.org/10.1037/a0040437
23. Hornsey, M. J., Harris, E. A., & Fielding, K. S. (2018). The psychological roots of anti-vaccination attitudes: A 24-nation investigation. *Health psychology*, *37*(4), 307.
24. Jamison, K. C., Ahmed, A. H., Spoerner, D. A., & Kinney, D. (2022). Best shot: A motivational interviewing approach to address vaccine hesitancy in pediatric outpatient settings. *Journal of Pediatric Nursing*, *67*, 124-131. https://doi.org/10.1016/j.pedn.2022.08.012
25. Kada, A., Chouikh, A., Mellouli, S., Prashad, A. J., Straus, S. E., & Fahim, C. (2022). An exploration of Canadian government officials' COVID-19 messages and the public's reaction using social media data. *PLoS One*, *17*(9), e0273153. https://doi.org/10.1371/journal.pone.0273153
26. Kholina, K., Harmon, S. H., & Graham, J. E. (2022). An equitable vaccine delivery system: Lessons from the COVID-19 vaccine rollout in Canada. *PLoS One*, *17*(12), e0279929. https://doi.org/10.1371/journal.pone.0279929
27. Larson, H. J., Jarrett, C., Eckersberger, E., Smith, D. M., & Paterson, P. (2014). Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: a systematic review of published literature, 2007–2012. *Vaccine*, *32*(19), 2150-2159. https://doi.org/10.1016/j.vaccine.2014.01.081
28. Larson, H. J., Jarrett, C., Schulz, W. S., Chaudhuri, M., Zhou, Y., Dube, E., ... & Wilson, R. (2015). Measuring vaccine hesitancy: the development of a survey

tool. *Vaccine*, *33*(34), 4165-4175. https://doi.org/10.1016/j.vaccine.2015.04.037

29. Leask, J., Kinnersley, P., Jackson, C., Cheater, F., Bedford, H., & Rowles, G. (2012). Communicating with parents about vaccination: a framework for health professionals. *BMC pediatrics*, *12*(1), 154. https://doi.org/10.1186/1471-2431-12-154
30. Lemaitre, T., Carrier, N., Farrands, A., Gosselin, V., Petit, G., & Gagneur, A. (2019). Impact of a vaccination promotion intervention using motivational interview techniques on long-term vaccine coverage: the PromoVac strategy. *Human vaccines & immunotherapeutics*, *15*(3), 732-739. https://doi.org/10.1080/21645515.2018.1549451
31. Lewandowsky, S., Ecker, U. K., & Cook, J. (2017). Beyond misinformation: Understanding and coping with the "post-truth" era. *Journal of applied research in memory and cognition*, *6*(4), 353-369. https://doi.org/10.1016/j.jarmac.2017.07.008
32. Lin, Y., Hu, Z., Alias, H., & Wong, L. P. (2022). The role of nurses as human papillomavirus vaccination advocates in China: perception from nursing students. *Human vaccines & immunotherapeutics*, *18*(1), 2030169. https://doi.org/10.1080/21645515.2022.2030169
33. MacDonald, N. E. (2015). Vaccine hesitancy: Definition, scope and determinants. *Vaccine*, *33*(34), 4161-4164. https://doi.org/10.1016/j.vaccine.2015.04.036
34. Martin, A. (2022). *Perspectives on Community Paramedicine Through Multiple Stakeholder Lenses: An Exploratory Study* (Doctoral dissertation, La Trobe). https://doi.org/10.26181/20346786
35. Michie, S., Van Stralen, M. M., & West, R. (2011). The behaviour change wheel: a new method for characterising and designing behaviour change interventions. *Implementation science*, *6*(1), 42. https://doi.org/10.1186/1748-5908-6-42
36. Omer, S. B., Salmon, D. A., Orenstein, W. A., Dehart, M. P., & Halsey, N. (2009). Vaccine refusal, mandatory immunization, and the risks of vaccine-preventable diseases. *New England Journal of Medicine*, *360*(19), 1981-1988. DOI: 10.1056/NEJMsa0806477
37. Orenstein, W. A., & Ahmed, R. (2017). Simply put: Vaccination saves lives. *Proceedings of the National Academy of Sciences*, *114*(16), 4031-4033. https://doi.org/10.1073/pnas.1704507114
38. Oudin Doglioni, D., Gagneux-Brunon, A., Gauchet, A., Bruel, S., Olivier, C., Pellissier, G., ... & Mueller, J. E. (2023). Psychometric validation of a 7C-model of antecedents of vaccine acceptance among healthcare workers, parents and adolescents in France. *Scientific Reports*, *13*(1), 19895. https://doi.org/10.1038/s41598-023-46864-9
39. Quinn, S. C., Jamison, A. M., An, J., Hancock, G. R., & Freimuth, V. S. (2019). Measuring vaccine hesitancy, confidence, trust and flu vaccine uptake: Results of a national survey of White and African American adults. *Vaccine*, *37*(9), 1168-1173. https://doi.org/10.1016/j.vaccine.2019.01.033
40. Salmon, D. A., Dudley, M. Z., Glanz, J. M., & Omer, S. B. (2015). Vaccine hesitancy: causes, consequences, and a call to action. *Vaccine*, *33*, D66-D71. https://doi.org/10.1016/j.vaccine.2015.09.035
41. Scheres, J., & Kuszewski, K. (2019). The Ten Threats to Global Health in 2018 and 2019. A welcome and informative communication of WHO to everybody. *Zdrowie Publiczne i Zarządzanie*, *17*(1), 2-8.
42. Shariff, S. Z., Richard, L., Hwang, S. W., Kwong, J. C., Forchuk, C., Dosani, N., & Booth, R. (2022). COVID-19 vaccine coverage and factors associated with vaccine uptake among 23 247 adults with a recent history of homelessness in Ontario, Canada: a population-based cohort study. *The Lancet Public Health*, *7*(4), e366-e377. https://doi.org/10.1016/S2468-2667(22)00037-8
43. Vernon-Wilson, E., Tetui, M., Nanyonjo, A., Adil, M., Bala, A., Nelson, D., ... & Grindrod, K. (2023). Unintended consequences of communicating rapid COVID-19 vaccine policy changes–a qualitative study of health policy communication in Ontario, Canada. *BMC Public Health*, *23*(1), 932. https://doi.org/10.1186/s12889-023-15861-y
44. World Health Organization. (2022). *Guiding principles for recovering, building resiliency, and strengthening of immunization in 2022 and beyond*. World Health Organization.