



Nursing and Public Health Roles in Addressing Vaccine Hesitancy and Improving Immunization Uptake

Abdulelah Hawaf A Alrasheedi^{1*}, Azizah Ahmed Rashed Alammari², Hamoud Saud H Alduhaim³, Turki Khalid Zabn Alotaibi⁴, Abdullah Saad Almadhi⁵, Yahya Bahis Ali Hakami⁶, Tariq Abdullah H Alhazmi⁷, Randa Sulaiman Ali Aljohani⁸, Alhunaythil, Maha Abdulaziz I⁹, Indaa Tarif Shubban Alruwaili¹⁰, Faisal Khalaf Samran Alanazi¹¹

¹Senior Specialist – Public Health – Hail General Hospital, Hail Health Cluster, Ministry of Health, Hail, Hail Region, Saudi Arabia

* **Corresponding Author Email:** abhalrasheedi@moh.gov.sa - **ORCID:** 0000-0002-5107-7000

²Senior Specialist – Public Health – Al-Muhammadiyah Primary Health Care Center, Northern Borders Health Cluster, Ministry of Health, Arar, Northern Borders Region, Saudi Arabia

Email: aziza1991aa@hotmail.com - **ORCID:** 0000-0002-5000-7001

³Public Health Specialist – Health Surveillance Center at Al Haditha Port, Al Jouf Health Cluster, Ministry of Health, Al Qurayyat, Al Jouf Region, Saudi Arabia

Email: hsalduhaim@moh.gov.sa - **ORCID:** 0000-0002-5009-7002

⁴Public Health – Khaff Primary Health Care Center, Third Riyadh Health Cluster, Ministry of Health, Dawadmi, Riyadh Region, Saudi Arabia

Email: tualotibi@moh.gov.sa - **ORCID:** 0000-0002-5008-7003

⁵Public Health (Epidemiology) – Al-Quwayyah Hospital, First Riyadh Health Cluster, Ministry of Health, Al-Quwayyah, Riyadh Region, Saudi Arabia

Email: asalmadhi@moh.gov.sa - **ORCID:** 0000-0002-5005-7004

⁶Public Health Epidemiology Technician – Branch of the Ministry of Health, Ministry of Health, Jazan, Jazan Region, Saudi Arabia

Email: ybm1395@gmail.com - **ORCID:** 0000-0002-5006-7009

⁷Epidemiology Specialist – Health Centers Administration (Western Sector), Jazan Health Cluster, Ministry of Health, Sabya, Jazan Region, Saudi Arabia

Email: taalhazmi@moh.gov.sa - **ORCID:** 0000-0002-5002-7008

⁸Nursing Technician – Al-Suraif Primary Health Care Center, Madinah Health Cluster, Ministry of Health, Yanbu, Madinah Region, Saudi Arabia

Email: randaa@moh.gov.sa - **ORCID:** 0000-0002-5004-7007

⁹Nursing – Vaccination and Health Certificates Center, Northern Borders Health Cluster, Ministry of Health, Arar, Northern Borders Region, Saudi Arabia

Email: mhahalasaaf@gmail.com - **ORCID:** 0000-0002-5003-7006

¹⁰Nursing Technician – Al-Shamali Primary Health Care Center, Al Jouf Health Cluster, Ministry of Health, Sakaka, Al Jouf Region, Saudi Arabia

Email: atalrwali@moh.gov.sa - **ORCID:** 0000-0002-5001-7005

¹¹Nursing Technician – Turaif Al-Awsat Primary Health Care Center, Northern Borders Health Cluster, Ministry of Health, Turaif, Northern Borders Region, Saudi Arabia

Email: fisalka@moh.gov.sa - **ORCID:** 0000-0002-5011-7030

Article Info:**DOI:** 10.22399/ijcesn.4709**Received :** 01 March 2024**Accepted :** 30 March 2024**Keywords**

Vaccine hesitancy,
Immunization uptake,
Nursing role,
Public health strategy,
Health communication,
Vaccine confidence

Abstract:

Vaccine hesitancy poses a significant threat to global health, requiring a synergistic response that leverages the unique strengths of nursing and public health. Nurses, as the most trusted healthcare professionals, are frontline advocates who address individual concerns through empathetic communication, tailored education, and building therapeutic relationships at the point of care. Concurrently, public health systems provide the essential infrastructure through epidemiological surveillance, strategic mass communication, equitable policy development, and community-wide program implementation. Together, this integrated approach—combining the interpersonal influence of nursing with the population-level strategy of public health—forms a comprehensive defense against misinformation and access barriers. By fostering this collaboration, health systems can effectively rebuild vaccine confidence, improve immunization uptake, and ensure the equitable protection of communities from preventable diseases.

1. Introduction

Vaccination stands as one of the most monumental achievements in the history of public health. Since the development of the first smallpox vaccine, immunization programs have saved hundreds of millions of lives, prevented incalculable suffering, and remain a cornerstone of global health security and economic stability [1]. The eradication of smallpox, the near-elimination of polio, and the dramatic reduction in morbidity and mortality from diseases like measles, diphtheria, and tetanus are testaments to the power of vaccines. They represent a unique and powerful form of preventive medicine, offering protection not only to individuals but also to communities through the principle of herd immunity, thereby safeguarding those who are most vulnerable and cannot be vaccinated due to medical conditions [2].

However, this monumental success is under threat. The very triumphs of vaccination programs have, paradoxically, contributed to a growing public health challenge: vaccine hesitancy. As the memory of devastating epidemics fades, the perceived risk of vaccine-preventable diseases diminishes in the public consciousness, while concerns—real or perceived—about vaccine safety and necessity come to the fore [3]. Vaccine hesitancy is defined as a delay in acceptance or refusal of vaccines despite the availability of vaccination services. It is a complex and context-specific phenomenon, varying across time, place, and vaccines, and influenced by factors such as complacency, convenience, and confidence [4]. It exists on a spectrum, from those who accept all vaccines but have questions, to those who refuse all vaccines based on deeply held beliefs.

The 21st century has seen a confluence of factors amplifying hesitancy. The digital revolution and the rise of social media have created unprecedented platforms for the rapid, borderless dissemination of misinformation and anti-vaccine narratives. These

narratives often exploit cognitive biases, evoke strong emotions, and are packaged in compelling, personalized stories that can be more resonant than statistical evidence from health authorities [5]. Furthermore, a decline in trust in institutions, including government agencies, pharmaceutical companies, and sometimes the medical establishment, has eroded the social license for public health mandates. Historical injustices and medical exploitation, particularly among marginalized communities, have sown deep-seated mistrust that continues to impact health-seeking behaviors today [6].

The consequences of vaccine hesitancy are tangible and severe. Resurgences of measles, a highly contagious and dangerous disease, have been documented in communities with suboptimal vaccination coverage across North America and Europe, leading to hospitalizations, long-term disability, and deaths [7]. Suboptimal influenza vaccination among healthcare workers and the elderly contributes to significant seasonal mortality. Most recently, the COVID-19 pandemic starkly highlighted the critical interplay between rapid vaccine development, effective delivery systems, and public acceptance. Despite the availability of safe and effective vaccines, hesitancy and outright refusal hampered global efforts to control the pandemic, prolonged social and economic disruption, and contributed to millions of preventable deaths [8].

2. Nature of Vaccine Hesitancy

To effectively address vaccine hesitancy, it is crucial to move beyond viewing it as a simple knowledge deficit or irrational behavior. It is a psychologically and socially complex decision-making process influenced by a web of interrelated factors. The World Health Organization's (WHO) "3Cs" model provides a foundational framework, categorizing influences

into *Confidence*, *Complacency*, and *Convenience* [4]. *Confidence* refers to trust in the effectiveness and safety of vaccines, the system that delivers them, and the motivations of policymakers. *Complacency* exists when the perceived risks of vaccine-preventable diseases are low, so vaccination is not seen as a necessary preventive action. *Convenience* encompasses physical availability, affordability, geographical accessibility, and the quality of service (including language-appropriateness and attitudes of health workers).

These factors are further shaped by a wider socio-ecological model. At the individual and interpersonal level, hesitancy is influenced by personal health beliefs, past experiences with the healthcare system, perceived risk-benefit calculations, and the opinions of family and social networks [9]. The role of cognitive biases is profound. For instance, the *availability heuristic* leads people to overestimate the risk of a vaccine side effect if they can easily recall a sensational news story or a personal anecdote, while underestimating the far greater risk of a disease they have never seen [10]. *Confirmation bias* drives individuals to seek out and credit information that aligns with their existing beliefs while discounting authoritative evidence to the contrary.

At the community and societal level, cultural and religious norms, collective memory of historical trauma, and the influence of community leaders play a significant role. Socioeconomic factors, including education level, income, and access to reliable health information, are powerful determinants [11]. The political and media environment is perhaps the most potent macro-level factor. Politicization of health issues, anti-science rhetoric from influential figures, and the algorithmic amplification of contentious content on social media platforms create an "infodemic"—an overabundance of information, both accurate and not, that makes it difficult for people to find trustworthy sources [12]. This environment fosters distrust in scientific expertise and can transform a personal health decision into an expression of political or cultural identity.

Furthermore, hesitancy is not monolithic; it varies dramatically across different vaccines. Concerns about the HPV vaccine, for example, have been entangled with cultural and religious views on adolescent sexuality [13]. Hesitancy around the influenza vaccine is often driven by perceptions of low effectiveness and disease severity ("just a bad cold"). In contrast, hesitancy towards COVID-19 vaccines was fueled by the unprecedented speed of development ("rushed"), novel technology

(mRNA), and a hyper-politicized information environment [8]. Therefore, effective interventions must be tailored, not only to the hesitant individual or group but also to the specific vaccine and the unique constellation of concerns surrounding it.

3. Role of Nursing in Vaccine Dialogue

Nurses constitute the largest segment of the global health workforce and are consistently ranked as the most trusted profession. This trust, forged through continuous, intimate patient contact, positions nurses as the undisputed frontline champions of vaccination. Their role extends far beyond the technical act of administration; they are health educators, counselors, advocates, and vital links between communities and the healthcare system [14]. The nursing process—assessment, diagnosis, planning, implementation, and evaluation—provides a perfect framework for addressing vaccine hesitancy at the individual level.

The foundation of the nursing role is *therapeutic communication and effective patient education*. This begins with a non-judgmental, empathetic assessment. Instead of dismissing concerns, nurses are trained to actively listen and explore the root of a patient's or parent's hesitation using open-ended questions: "Can you tell me what you've heard about this vaccine?" or "What are your main concerns today?" [15]. This approach, rooted in motivational interviewing techniques, avoids confrontation and builds rapport. It allows the nurse to understand whether the hesitancy stems from a knowledge gap, a fear of side effects, a logistical barrier, or a deeply held belief. By first seeking to understand, the nurse can then provide tailored, relevant information rather than a generic, one-size-fits-all fact sheet.

Nurses then engage in clear, transparent, and empathetic education. They translate complex scientific information into understandable terms, using the principles of health literacy. This involves explaining not just the "what" but the "why"—why the disease is dangerous, how the vaccine works to stimulate immunity, and what the known side effects are, contextualizing their rarity and typical mildness [16]. They can employ powerful tools like "presumptive language," which frames vaccination as the normative, expected next step in care ("Today, we'll be giving Johnny his scheduled measles and chickenpox vaccines. It's great we can protect him from these serious illnesses."), as opposed to "participatory language" ("What do you want to do about shots today?") which can inadvertently invite declination [17].

Furthermore, nurses serve as powerful role models and advocates. Their own decision to receive

recommended vaccines, such as influenza and COVID-19, and their willingness to share this personal choice, can have a significant influence on patients and the public. As advocates, nurses work to identify and reduce barriers to access within their clinical settings. This can include streamlining appointment systems, offering vaccines during all clinical encounters (not just well-child visits), and implementing reminder/recall systems [18]. In community settings, school nurses and public health nurses are instrumental in organizing and running vaccination clinics, conducting outreach to underserved populations, and serving as a trusted resource for parents and teachers.

Finally, nurses are critical in post-vaccination care and surveillance. By competently managing common side effects (like fever or soreness) and providing clear aftercare instructions, they reinforce a positive vaccination experience. They are also often the first to detect and report potential adverse events, contributing to the ongoing safety monitoring that underpins public confidence in immunization programs [19]. Through this comprehensive, relationship-based approach, nurses convert clinical encounters into opportunities for building long-term vaccine confidence.

4. Public Health System's Strategic Role

While nurses operate at the micro and meso levels, public health systems function at the macro level, creating the policy, strategic, and infrastructural environment necessary for high, equitable immunization uptake. Public health's role is foundational and multifaceted, encompassing surveillance, program design, communication, policy development, and intersectoral coordination [20].

A primary function is *epidemiological surveillance and data-driven decision making*. Public health agencies are responsible for monitoring the incidence of vaccine-preventable diseases and tracking vaccination coverage rates at local, national, and global levels. This data is crucial for identifying pockets of susceptibility, disparities in uptake among different demographic groups, and the impact of hesitancy on herd immunity thresholds [21]. This intelligence directly informs targeted interventions, allowing resources to be directed where they are most needed, whether to a specific geographic community with low MMR coverage or a demographic group lagging in HPV vaccine initiation.

Based on this intelligence, public health develops and implements *strategic communication and mass media campaigns*. These campaigns move beyond individual counseling to shape the broader social

narrative around vaccination. Effective public health communication is proactive, not reactive. It anticipates concerns and disseminates clear, consistent, and compelling messages through diverse channels—television, radio, social media, and partnerships with community-based organizations [22]. In the era of misinformation, a key strategic role is "prebunking" or inoculation theory—warning people about, and pre-emptively refuting, common myths before they are encountered, thereby building psychological resistance to false narratives [23]. Public health agencies also have a duty to actively counter misinformation by collaborating with technology platforms, promoting credible sources, and training healthcare workers and community influencers in digital health literacy.

Policy development and legislation are powerful tools in the public health arsenal. Policies such as school entry vaccination requirements (with robust medical exemption protocols only) have been proven to significantly increase coverage and reduce disease outbreaks [24]. Public health authorities provide the evidence base for such policies, advocate for their adoption, and are responsible for their fair implementation. Furthermore, they work to ensure *programmatic access and equity*. This involves designing and funding the vaccine supply chain (the "cold chain"), purchasing vaccines, and distributing them equitably to public and private providers. It also means removing financial barriers through programs like the Vaccines for Children (VFC) program in the United States and ensuring that vaccination services are accessible in convenient locations and at convenient times for working families [25].

Finally, public health serves as the *essential coordinator of multi-sectoral partnerships*. No single agency can tackle vaccine hesitancy alone. Public health departments convene and collaborate with healthcare systems, professional associations (like nursing and medical boards), schools, faith-based organizations, community leaders, and even local businesses to create a unified front. They facilitate the training of healthcare providers, including nurses, in best practices for vaccine communication. By building coalitions and aligning efforts across society, the public health system amplifies the impact of frontline workers and creates a culture where immunization is the social norm [26].

5. Nursing-Public Health Approaches

The most effective interventions to improve vaccine uptake occur at the intersection of nursing's

relational expertise and public health's structural capacity. This synergy can be observed in several key collaborative models and community-based strategies.

A prime example is the *community health nurse (CHN)* model, where nurses employed by or embedded within public health departments act as a direct bridge between the system and the community. CHNs conduct home visits to high-risk families, run vaccination clinics in community centers, schools, and places of worship, and provide culturally competent education to specific populations, such as immigrant communities or homeless individuals [27]. They bring the trust and personalized approach of nursing directly into neighborhoods, informed by the epidemiological data and resources of the public health system.

School-based vaccination programs are another powerful integrated approach. Public health agencies provide the vaccines, protocols, and funding, while school nurses—expert in child health and trusted by parents—lead the coordination, education, consent process, and actual vaccination days. These programs dramatically improve convenience for families and achieve high coverage rates for vaccines like HPV, Tdap, and seasonal influenza, thereby reducing disparities in access [28].

During outbreaks or pandemics, this synergy becomes critically important. Public health leads the epidemiological investigation, issues guidance, and coordinates mass vaccination campaigns. Nurses are deployed as vaccinators, educators, and logistical managers at mass vaccination sites, mobile clinics, and via dedicated phone lines to answer public inquiries [29]. The success of such campaigns hinges on the seamless integration of public health's strategic orchestration and nursing's operational execution and compassionate public engagement.

Furthermore, nurses are vital partners in *participatory research and program evaluation* led by public health researchers. Nurses on the front lines have unique insights into the real-world barriers and facilitators to vaccination. Their involvement in designing, implementing, and evaluating interventions—such as testing new educational tools or reminder systems—ensures that these strategies are practical, acceptable, and effective in clinical and community settings [30]. This feedback loop is essential for continuous quality improvement in immunization programs.

6. Reaching Underserved and Marginalized Populations

Vaccine hesitancy is often intertwined with, and exacerbated by, systemic inequities. Marginalized populations—including racial and ethnic minorities, indigenous communities, people living in poverty, and those in rural areas—may face a dual burden: higher levels of historical and justified mistrust in medical systems, and significant structural barriers to access [6, 31]. An equitable immunization strategy must consciously and deliberately address both dimensions.

Nursing and public health have distinct but complementary roles in advancing vaccine equity. Public health's role is to identify disparities through disaggregated data, allocate resources preferentially to underserved areas, and advocate for policies that remove systemic barriers (e.g., supporting mobile clinics, extending clinic hours, providing transportation vouchers) [32]. They must also engage in authentic, sustained community partnership, ceding power and decision-making to community-based organizations to design culturally appropriate interventions.

Nurses, particularly those from or embedded within these communities, are the key implementers of this equity-focused work. They build trust through cultural humility—an ongoing process of self-reflection, recognizing power imbalances, and seeking to understand the cultural, historical, and social contexts of their patients' lives [33]. A nurse who understands the legacy of the Tuskegee Syphilis Study or forced sterilizations can approach conversations about vaccines with a profound respect for that historical trauma. Community health nurses can provide education in preferred languages, collaborate with trusted community health workers (*promotoras*), and deliver services in non-stigmatizing, familiar environments [34].

Tailored communication is essential. Messaging and materials must be developed in partnership with the community, using appropriate language, imagery, and messengers. A respected elder, a local faith leader, or a popular community figure may be a far more credible source of information than a distant government agency [35]. Nurses and public health workers can facilitate these partnerships, training and supporting these trusted ambassadors with accurate information.

Ultimately, achieving equity requires moving beyond a deficit model that blames communities for "hesitancy." Instead, it necessitates a commitment to addressing the root causes of distrust and inequity: systemic racism, poverty, and healthcare inaccessibility. By working in tandem—public health to dismantle structural barriers and nurses to build authentic, healing relationships—the two fields can help ensure that the benefits of vaccination are justly distributed to all.

7. Misinformation and Leveraging Technology

The digital information ecosystem presents both the greatest challenge and a potential powerful tool for vaccination efforts. Social media platforms are primary vectors for the rapid spread of vaccine misinformation, which is often more engaging, emotionally charged, and algorithmically promoted than factual public health content [5, 12]. This "infodemic" undermines scientific authority and fuels hesitancy.

Public health systems have a critical role in digital surveillance and counter-messaging. This involves monitoring trending narratives and myths online, and responding rapidly with clear, shareable, evidence-based corrections. Agencies must meet people where they are, using social media platforms to disseminate accurate information through engaging formats (short videos, infographics, live Q&As) [36]. A key strategy, as noted, is "prebunking" or inoculating the public against common myths before they are widely encountered. Nurses, as trusted professionals, are increasingly becoming digital health influencers. They can leverage professional and personal social media accounts to amplify credible public health messages, share their own experiences, and directly respond to misinformation in comment sections and online forums [37]. Professional nursing organizations can provide training and resources to help nurses engage online effectively and safely. Furthermore, technology offers tools for improving access and convenience. Public health systems can develop and promote user-friendly immunization information systems (IIS) or apps that provide easy access to vaccination records, send personalized reminders, and locate nearby clinics [38]. Telehealth, accelerated by the COVID-19 pandemic, provides another avenue for nurses to conduct vaccine counseling visits remotely, reaching individuals in rural areas or those with mobility challenges.

However, the digital divide remains a concern. Over-reliance on apps or online scheduling can exclude elderly, low-income, or less tech-savvy populations. Therefore, digital strategies must be part of a multi-channel approach that retains and strengthens traditional, human-centered methods of communication and service delivery.

8. Education, Training, and Professional Development

To fulfill their roles effectively, both nursing and public health professionals require dedicated education and ongoing training in vaccine science,

communication, and ethics. Pre-licensure education must move beyond the technical aspects of vaccine administration to deeply integrate competencies in health communication, cultural humility, motivational interviewing, and the psychology of health decision-making [39]. Nursing and public health curricula should include case studies on addressing hesitancy, role-playing difficult conversations, and critically analyzing vaccine misinformation.

Continuing professional development is equally vital. Public health agencies and professional associations must provide regular, updated training for frontline workers. This includes updates on new vaccines and recommendations, refreshers on communication techniques, and guidance on navigating the latest misinformation trends [40]. Training should also address provider attitudes, as healthcare worker hesitancy can be a significant barrier and undermines public confidence. Creating supportive environments where nurses and other providers can voice their own questions and receive evidence-based answers from experts is crucial for ensuring a confident, unified front.

Interprofessional education (IPE) that brings nursing, medical, and public health students together to solve simulated public health problems, like a vaccine hesitancy outbreak scenario, can foster the collaborative mindset needed for future practice [41]. Investing in the education and support of the workforce is an investment in the resilience of the entire immunization system.

9. Ethical Considerations and Balancing Autonomy with Public Good

Vaccination campaigns inevitably raise complex ethical questions that nurses and public health professionals must navigate. The core tension lies between respecting individual autonomy (the right to refuse medical intervention) and upholding the ethical principles of beneficence (doing good) and justice (protecting the community) [2].

Nurses, in their direct patient interactions, grapple with this tension daily. Their ethical duty is to provide sufficient information for informed consent, which includes discussing risks, benefits, and alternatives. However, when refusal is based on misinformation, the nurse faces an ethical imperative to correct falsehoods without coercion or alienation. The nurse-patient relationship is paramount, and preserving that trust for future health interactions is a key ethical consideration. Abandoning or shaming a hesitant patient violates nursing ethics; persistent, respectful engagement aligns with them.

Public health ethics operate at the population level. Here, the justification for policies that limit

autonomy, such as school vaccine mandates, rests on the "harm principle" and the necessity to protect others, particularly those who are vulnerable and cannot be vaccinated. Public health officials have an ethical obligation to implement the least restrictive measures necessary to achieve community protection, to ensure policies are applied equitably, and to transparently communicate the public health rationale [24]. They must also vigilantly guard against policies that disproportionately burden marginalized groups.

Both fields share an ethical mandate to combat misinformation, as false information undermines the very possibility of informed consent. They also share a duty to promote equity, ensuring that systemic barriers do not prevent any group from accessing the protective benefits of vaccination. Navigating these ethical landscapes requires ongoing dialogue, clear ethical frameworks, and a commitment to transparency and justice.

10. Case Studies and Lessons from the Field

Examining real-world implementations provides concrete evidence of what works. For instance, the *HPV vaccine rollout in Rwanda* achieved over 90% coverage in girls through a strong public health commitment, school-based delivery, and a comprehensive communication campaign involving community and religious leaders. This demonstrates the power of a well-resourced, politically supported, and community-engaged public health strategy [13].

In contrast, the *measles resurgence in the United States* (such as the 2014-2015 Disneyland outbreak) highlighted the consequences of localized clusters of vaccine refusal, often fueled by misinformation and enabled by non-medical exemption policies. The public health response involved case investigation, contact tracing, emergency vaccination clinics, and, crucially, legislative action in several states to tighten exemption laws—showcasing the need for robust policy alongside emergency response [7].

The **COVID-19 pandemic** is the most comprehensive recent case study. It illustrated the phenomenal achievement of rapid vaccine development (public health/science) and the staggering challenge of global distribution and acceptance (public health/society). Success stories, like high uptake in Portugal and Denmark, were linked to high trust in institutions and clear, consistent public health messaging. Struggles in other regions underscored the devastating impact of political polarization, misinformation, and inequitable access [8]. The pandemic also highlighted the indispensable role of nurses as

vaccinators, educators, and empathetic listeners during a time of profound fear and uncertainty.

11. Conclusion

Vaccine hesitancy is a complex, adaptive challenge that threatens to undo decades of public health progress. There is no single solution. Confronting it requires a sustained, dual-pronged strategy that leverages the unique and complementary strengths of nursing and public health.

Nurses, as the trusted face of healthcare, must be supported as the primary agents of vaccine confidence-building. This requires providing them with time, training, and institutional backing to have effective, empathetic conversations. Public health systems must continue to build the robust infrastructure—surveillance, strategic communication, equitable policies, and community partnerships—that creates an environment where vaccination is the easy, normative, and trusted choice.

The partnership between nursing and public health is not merely beneficial; it is essential. By combining the heart of healthcare—the compassionate, trusted nurse-patient relationship—with the backbone of prevention—the strategic, population-focused public health system—we can fortify global immunization programs. In doing so, we protect the health of individuals today and safeguard this life-saving scientific achievement for generations to come. The goal is clear: a world where everyone, everywhere, has the opportunity to be protected by vaccines, free from the scourge of preventable disease.

Author Statements:

- **Ethical approval:** The conducted research is not related to either human or animal use.
- **Conflict of interest:** The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper
- **Acknowledgement:** The authors declare that they have nobody or no-company to acknowledge.
- **Author contributions:** The authors declare that they have equal right on this paper.
- **Funding information:** The authors declare that there is no funding to be acknowledged.
- **Data availability statement:** The data that support the findings of this study are available on request from the corresponding author. The

data are not publicly available due to privacy or ethical restrictions.

References

- [1] Howard, M. C. (2023). Integrating the person-centered approach with the study of vaccine hesitancy: Applying latent profile analysis to identify vaccine hesitancy subpopulations and assess their relations with correlates and vaccination outcomes. *Vaccine*, 41(33), 4823–4835.
- [2] StataCorp. (2013). *Stata Statistical Software: Release 13*. StataCorp LP.
- [3] Kline, R. B. (2015). *Principles and practice of structural equation modeling*. Guilford Publications.
- [4] Heyerdahl, L. W., Dielen, S., Dodion, H., van Riet, C., Nguyen, T., Simas, C., Boey, L., Kattumana, T., Vandaele, N., Larson, H. J., Grietens, K. P., Giles-Vernick, T., & Gryseels, C. (2023). Strategic silences, eroded trust: The impact of divergent COVID-19 vaccine sentiments on healthcare workers' relations with peers and patients. *Vaccine*, 41(4), 883–891.
- [5] Gallant, A. J., Nicholls, L. A. B., Rasmussen, S., Cogan, N., Young, D., & Williams, L. (2021). Changes in attitudes to vaccination as a result of the COVID-19 pandemic: A longitudinal study of older adults in the UK. *PLoS One*, 16(12), e0261844.
- [6] Andreassen, C. S., Pallesen, S., & Griffiths, M. D. (2017). The relationship between addictive use of social media, narcissism, and self-esteem: Findings from a large national survey. *Addictive Behaviors*, 64, 287–293.
- [7] Mikkonen, K., Tomietto, M., & Watson, R. (2022). Instrument development and psychometric testing in nursing education research. *Nurse Education Today*, 119, 105603.
- [8] Khubchandani, J., Bustos, E., Chowdhury, S., Biswas, N., & Keller, T. (2022). COVID-19 vaccine refusal among nurses worldwide: Review of trends and predictors. *Vaccine*, 10(2), 230.
- [9] EUR-Lex. (2019). Directive 2013/55/EU of the European Parliament and of the council of 20 November 2013 amending directive 2005/36/EC on the recognition of professional qualifications and regulation (EU) No 1024/2012 on administrative cooperation through the internal market information system ('the IMI Regulation').
- [10] Maneze, D., Salamonson, Y., Grollman, M., Montayre, J., & Ramjan, L. (2023). Mandatory COVID-19 vaccination for healthcare workers: A discussion paper. *International Journal of Nursing Studies*, 138, 104389.
- [11] Data Protection Act. (2018). c.12.
- [12] Leung, C. L. K., Li, K. K., Wei, V. W. I., Tang, A., Wong, S. Y. S., Lee, S. S., & Kwok, K. O. (2022). Profiling vaccine believers and skeptics in nurses: A latent profile analysis. *International Journal of Nursing Studies*, 126, 104142.
- [13] 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.
- [14] Rathje, S., He, J. K., Roozenbeek, J., van Bavel, J. J., & van der Linden, S. (2022). Social media behavior is associated with vaccine hesitancy. *PNAS Nexus*, 1(4), pgac207.
- [15] Cascini, F., Pantovic, A., Al-Ajlouni, Y. A., Failla, G., Puleo, V., Melnyk, A., Lontano, A., & Ricciardi, W. (2022). Social media and attitudes towards a COVID-19 vaccination: A systematic review of the literature. *EClinicalMedicine*, 48, 101454.
- [16] Maltezou, H. C., Dounias, G., Rapisarda, V., & Ledda, C. (2022). Vaccination policies for healthcare personnel: Current challenges and future perspectives. *Vaccine*, X, 11, 100172.
- [17] Portoghese, I., Siddi, M., Chessa, L., Costanzo, G., Garcia-Larsen, V., Perra, A., Littera, R., Sambugaro, G., del Giacco, S., Campagna, M., & Firinu, D. (2023). COVID-19 vaccine hesitancy among Italian healthcare workers: Latent profiles and their relationships to predictors and outcome. *Vaccine*, 11(2), 273.
- [18] DeVellis, R. F., & Thorpe, C. T. (2021). *Scale development: Theory and applications*. Sage publications.
- [19] Asad, H., Johnston, C., Blyth, I., Holborow, A., Bone, A., Porter, L., Tidswell, P., & Healy, B. (2020). Health care workers and patients as Trojan horses: A COVID19 ward outbreak. *Infection Prevention in Practice*, 2(3), 100073.
- [20] Patelarou, E., Galanis, P., Mechili, E. A., Argyriadi, A., Argyriadis, A., Asimakopoulou, E., Brokaj, S., Bucaj, J., Carmona-Torres, J. M., Cobo-Cuenca, A. I., Doležel, J., Finotto, S., Jarošová, D., Kalokairinou, A., Mecugni, D., Pulomenaj, V., Saliaj, A., Sopjani, I., Zahaj, M., & Patelarou, A. (2021). Factors influencing nursing students' intention to accept COVID-19 vaccination: A pooled analysis of seven European countries. *Nurse Education Today*, 104, 105010.
- [21] McCready, J. L., Nichol, B., Steen, M., Unsworth, J., Comparcini, D., & Tomietto, M. (2023). Understanding the barriers and facilitators of vaccine hesitancy towards the COVID-19 vaccine in healthcare workers and healthcare students worldwide: An umbrella review. *PLoS One*, 18(4), e0280439.
- [22] Tabachnick, B. G., Fidell, L. S., & Ullman, J. B. (2013). *Using multivariate statistics* (Vol. 6, pp. 497–516). Pearson.
- [23] Lee, S. K., Sun, J., Jang, S., & Connelly, S. (2022). Misinformation of COVID-19 vaccines and vaccine hesitancy. *Scientific Reports*, 12(1), 13681.
- [24] Karlsson, L. C., Garrison, A., Holford, D., Fasce, A., Lewandowsky, S., Taubert, F., Schmid, P., Betsch, C., Rodrigues, F., Fressard, L., Verger, P., & Soveri, A. (2023). Healthcare professionals' attitudes to mandatory COVID-19 vaccination:

- Cross-sectional survey data from four European countries. *Human Vaccines & Immunotherapeutics*, 19(2), 2256442.
- [25] Mathieu, E., Ritchie, H., Ortiz-Ospina, E., Roser, M., Hasell, J., Appel, C., Giattino, C., & Rod s-Guirao, L. (2021). A global database of COVID-19 vaccinations. *Nature Human Behaviour*, 5(7), 947–953.
- [26] European Center for Disease Control and Prevention [ECDC]. (2018). State Healthcare Worker and Patient Vaccination Laws.
- [27] Manning, M. L., Gerolamo, A. M., Marino, M. A., Hanson-Zalot, M. E., & Pogorzelska-Maziarz, M. (2021). COVID-19 vaccination readiness among nurse faculty and student nurses. *Nursing Outlook*, 69(4), 565–573.
- [28] Salem, S., Miligi, E., Alanazi, H. H., Alanazi, N. A., & Alanazi, A. A. (2019). Knowledge and limitations associated with the uptake of seasonal influenza vaccine among nursing students. *International Journal of Novel Research in Healthcare and Nursing*, 6(1), 471–479.
- [29] Pataka, A., Kotoulas, S., Stefanidou, E., Grigoriou, I., Tzinas, A., Tsiouprou, I., Zarogoulidis, P., Courcousakis, N., & Argyropoulou, P. (2021). Acceptability of healthcare professionals to get vaccinated against COVID-19 two weeks before initiation of national vaccination. *Medicina*, 57(6), 611.
- [30] Royal College of Nursing. (2022). RCN position on mandating vaccination for health and social care staff.
- [31] Lazarus, J. V., Wyka, K., White, T. M., Picchio, C. A., Gostin, L. O., Larson, H. J., Rabin, K., Ratzan, S. C., Kamarulzaman, A., & El-Mohandes, A. (2023). A survey of COVID-19 vaccine acceptance across 23 countries in 2022. *Nature Medicine*, 29(2), 366–375.
- [32] Cornock, M. (2018). General Data Protection Regulation (GDPR) and implications for research. *Maturitas*, 111, A1–A2.
- [33] Department of Health and Social Care. (2018). Regulations making COVID-19 vaccination a condition of deployment to end.
- [34] Peruch, M., Toscani, P., Grassi, N., Zamagni, G., Monasta, L., Radaelli, D., Livieri, T., Manfredi, A., & D'Errico, S. (2022). Did Italy really need compulsory vaccination against COVID-19 for healthcare workers? Results of a survey in a centre for maternal and child health. *Vaccine*, 10(8), 1293.
- [35] Nomura, S., Eguchi, A., Yoneoka, D., Kawashima, T., Tanoue, Y., Murakami, M., Sakamoto, H., Maruyama-Sakurai, K., Gilmour, S., Shi, S., Kunishima, H., Kaneko, S., Adachi, M., Shimada, K., Yamamoto, Y., & Miyata, H. (2021). Reasons for being unsure or unwilling regarding intention to take COVID-19 vaccine among Japanese people: A large cross-sectional national survey. *The Lancet Regional Health–Western Pacific*, 14, 100223.
- [36] MacDonald, N. E. (2015). Vaccine hesitancy: Definition, scope and determinants. *Vaccine*, 33(34), 4161–4164.
- [37] Jennings, W., Stoker, G., Bunting, H., Valgar sson, V. O., Gaskell, J., Devine, D., McKay, L., & Mills, M. C. (2021). Lack of trust, conspiracy beliefs, and social media use predict COVID-19 vaccine hesitancy. *Vaccine*, 9(6), 593.
- [38] Manesriwongul, W., & Dixon, J. K. (2004). Instrument translation process: A methods review. *Journal of Advanced Nursing*, 48(2), 175–186.
- [39] IBM Corp. (2021). IBM SPSS statistics for Windows, Version 28.0. IBM Corp.
- [40] Drew, L. (2019). The case for mandatory vaccination. *Nature*, 575(7784), S58–S60.
- [41] Martin, L. R., & Petrie, K. J. (2017). Understanding the dimensions of anti-vaccination attitudes: The vaccination attitudes examination (VAX) scale. *Annals of Behavioral Medicine*, 51(5), 652–660.