Vaccine: X 11 (2022) 100169

Contents lists available at ScienceDirect

Vaccine: X

journal homepage: www.elsevier.com/locate/jvacx

Immunization of healthcare personnel: A continuing issue

Helena C. Maltezou [a,*], Gregory A. Poland [b], Caroline M. Poland [c]

[a] Directorate of Research, Studies, and Documentation, National Public Health Organization, 3-5 Agrafon Street, Athens, Greece
[b] Mayo Vaccine Research Group, Mayo Clinic and Foundation, 200 First Street, Rochester, MN 55905, United States
[c] Poland and Associates Consulting, LLC, 10401 N Meridian St, Suite 450, Indianapolis, IN 46290, United States

Despite the availability of safe and effective vaccines for several decades, outbreaks of vaccine-preventable diseases (VPDs) still occur in healthcare facilities leading to serious morbidity, mortality, and costs. Healthcare personnel (HCP) have long been identified as a high-risk group for occupational exposure to VPDs [1]. At the same time, HCP have been sources of VPDs to susceptible patients [2]. Vaccination constitutes a key measure to protect both HCP and their patients - especially for those who cannot mount good immunologic responses and those with contraindications to vaccines. Beyond protection, immunization of HCP is justified to protect healthcare services from outbreaks, absenteeism, and presenteism. Increasingly immunizations of HCP are being integrated into preparedness and response plans to increase healthcare response capacity for future health threats [3].

In 2014 we were honored to serve as Editors of a special issue dedicated to the vaccination of HCP [4]. Since then, healthcare facilities have been faced with multiple infectious disease health crises of global importance, including the unprecedented Ebola epidemics in West Africa, measles epidemics in many countries, and the COVID-19 pandemic. Despite differences in transmission dynamics and fatality rates, these health crises had a common denominator: HCP have been disproportionately affected [5–7]. The deaths of HCP from Ebola in Sierra Leone reduced the health workforce by 6.9% which significantly reversed the performance of healthcare services [6,8]. However, while Ebola vaccine became available few years after the initial West Africa epidemics [9,10], the past decade thousands of unvaccinated or incompletely vaccinated HCP were infected with measles, often with prolonged morbidity and complications, despite insisting recommendations for measles vaccination [7,11]. Similarly, safe and effective COVID-19 vaccines were deployed within less than one year after the declaration of the pandemic. Yet, on May 24, 2021 the Director General of the World Health Organization announced at least 115,000 deaths from COVID-19 among HCP globally with a range between 80,000–180,000 deaths [12].

Vaccine hesitancy was declared as one of the top ten threats to global health by the World Health Organization in 2019 [13]. Skepticism and rejection of COVID-19 vaccination among HCP and the public emerged as a major public health issue since the release of the first COVID-19 vaccines in 2020 [14]. In the United States alone, as of September 15, 2021, 30% of HCP in hospitals were still unvaccinated [15]. A recent study demonstrated that COVID-19 vaccination of HCP significantly reduces absenteeism [16]. In light of the continuing surges of healthcare demand and hospitalizations, several countries adopted mandatory COVID-19 vaccination policies for HCP as a prerequisite for employment and most likely others will follow [17–21]. Moreover, studies from many countries consistently indicate low influenza vaccination rates and significant immunity gaps against many VPDs (e.g., up to 17% for measles, up to 25% for mumps, up to 18.6% for rubella, up to 16.7% for varicella, and up to 35% for hepatitis B) among HCP, despite long-standing vaccination recommendations [1,22,23].

The available evidence is clear and indicates that there is no single intervention other than vaccine mandates to achieve persistently high vaccination rates against influenza and other VPDs among HCP [24,25]. Immunization of HCP is even more imperative and taken on greater urgency as global vaccination coverage rates have dropped the past two years due to disruption of vaccination services [26].

The issue of vaccination policies and vaccinations in general is not an issue of regulations only. Vaccination behavior and decision-making are shaped through childhood and adolescence [27]. In the rapidly evolving scientific landscape of the past two years, vaccination behavior studies have lagged behind the rapid development of COVID-19 vaccines. It is highly likely that the COVID-19 pandemic will influence vaccination perceptions for millions of people over the coming decades - including HCP. Transparency, trust, and ethics in policy-making also influence attitudes towards vaccinations [28]. Cognitive decision-making styles are also critical and should be addressed early in the professional training of HCP [29–33]. Working within the cognitive structure and cognitive styles of HCP trainees is critical in assisting them in gaining awareness of how they themselves take in and process information, as well as in understanding how their preferred cognitive style(s) is utilized in understanding the scientific method and research/data.

* Corresponding author at: Directorate of Research, Studies, and Documentation, National Public Health Organization, 3-5 Agrafon Street, Athens, Greece.
E-mail address: maltezou.helena@gmail.com (H.C. Maltezou).

https://doi.org/10.1016/j.jvacx.2022.100169
2590-1362/© 2022 The Author(s). Published by Elsevier Ltd.
This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Because of this, academic institutions would be wise to incorporate the Preferred Cognitive Styles and Decision Making Model (PCSDM) [30] throughout the HCPs training. The PCSDM [30] can aid not only the individual HCP in understanding their own decision-making and the decision-making strategies of their patients, but this model can also help to guide communication and information intake and processing throughout a HCP educational system (undergraduate, medical school, residency, and continuing medical education). Simply garnering and producing data and facts to patients (the analytical type) alone, while ignoring other cognitive styles, will lead to a deficit in the ability to understand and address other cognitive styles. Multiple strategies for addressing different common cognitive styles, along with examples of how a HCP might hear that cognitive style articulated and strategies to engage in conversation with that cognitive style, are available [34]. Support by healthcare administrations and scientific societies is also required to make immunization of HCP a normative expectation and ethical duty among those who care for vulnerable patients. The COVID-19 pandemic has also revealed the importance of political commitment.

Below we present a brief agenda outline for an evidence-based, holistic approach to achieving high rates of vaccine coverage among HCPs:

1. Sound vaccination programs that recognize priorities, holistic approach, and the need to protect HCP and the vulnerable patients they serve
2. Vaccination policies that are based on the appropriate regulatory frame based on ethical and moral duty
3. Financial and logistic issues should be solved
4. National vaccination registries are need to follow coverage rates in real-time
5. Address vaccine hesitancy and cognitive issues early in professional training
6. Realistic, simplified communication of the expected benefits and risks of vaccines
7. Codify the above in systems, rules, and expectations that all eligible HCP must be immunized against VPDs for which safe and effective vaccines exist.

We present this collection of articles as a tribute to HCP, and especially those working in frontline roles during these challenging times. We are thankful to colleagues from academia, healthcare, and public health, who joined efforts with the hope of improving vaccination of HCP.

CRediT authorship contribution statement

Helena C. Maltezou: Conceptualization, Writing – original draft. **Gregory A. Poland:** Conceptualization. **Caroline M. Poland:** Conceptualization, contribution to writing.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: [Dr. Gregory A. Poland is the chair of a Safety Evaluation Committee for novel investigational vaccine trials being conducted by Merck Research Laboratories. Dr. Poland provides consultative advice on vaccine development to Merck & Co., Medicago, GlaxoSmithKline, Sanofi Pasteur, Johnson & Johnson/Janssen Global Services LLC, Emergent Biosolutions, Dynavax, Genentech, Eli Lilly and Company, Kentucky Bioprocessing, Bavarian Nordic, AstraZeneca, Exelixis, Regeneron, Janssen, Vyriad, Moderna, and Genevant Sciences, Inc. These activities have been reviewed by the Mayo Clinic Conflict of Interest Review Board and are conducted in compliance with Mayo Clinic Conflict of Interest policies. Dr. Poland holds patents related to vaccinia, influenza, and measles peptide vaccines. Dr. Poland has received grant funding from ICW Ventures for preclinical studies on a peptide based COVID-19 vaccine. This research has been reviewed by the Mayo Clinic Conflict of Interest Review Board and was conducted in compliance with Mayo Clinic Conflict of Interest policies.

Caroline M. Poland provides consultative advice to Sanofi Pasteur.

Helena C. Maltezou has no conflict of interest to declare.

Acknowledgements

The opinions presented in this article are those of the authors and do not necessarily represent those of their institutions.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

[1] Maltezou H, Poland G. Immunization of Health-Care Providers: Necessity and Public Health Policies. Healthcare (Basel) 2016;4(3):47. https://doi.org/10.3390/healthcare4030047.
[2] Sydnor E, Perl TM. Healthcare providers as sources of vaccine-preventable diseases. Vaccine 2014;32(38):4814–22.
[3] Gellin BG, Qadri F. Preparing for the unpredictable: the continuing need for pandemic influenza preparedness. Vaccine 2016;34(45):5391–2.
[4] Maltezou HC, Poland GA. Immunization of healthcare providers: a critical step toward patient safety. Vaccine 2014;32(38):4813. https://doi.org/10.1016/j.vaccine.2014.05.046.
[5] Gagneux-Brunon A, Botelho-Nevers E, Launay O. Are the conditions met to make COVID-19 vaccination mandatory for healthcare professionals? Infect Dis Now 2021;51(6):507–9.
[6] World Health Organization. Health worker Ebola infections in Guinea, Liberia and Sierra Leone. Available at: https://www.who.int/hrh/documents/21may2015_web_final.pdf (last accessed: January 28, 2022).
[7] Maltezou HC, Dedoukou X, Vernardaki A, Katerelos P, Kostea E, Tsiodras S, et al. Measles in healthcare workers during the ongoing epidemic in Greece, 2017–2018. J Hosp Infect 2018;100(4):e261–3.
[8] The World Bank. Disproportionate deaths among health care workers from Ebola could lead to sharp rise in maternal mortality last seen 20 years ago – World Bank report. Available at: https://www.worldbank.org/en/news/press-release/2015/07/08/disproportionate-deaths-among-health-care-workers-from-ebola-could-lead-to-sharp-rise-in-maternal-mortality-last-seen-20-years-ago—world-bank-report (last accessed: January 28, 2022).
[9] Henao-Restrepo AM, Longini IM, Egger M, Dean NE, Edmunds WJ, Camacho A, et al. Efficacy and effectiveness of an rVSV-vectored vaccine expressing Ebola surface glycoprotein: interim results from the Guinea risk vaccination cluster-randomised trial. Lancet 2015;386:857–66.
[10] Robert A, Camacho A, Edmunds WJ, Baguelin M, Muyembe Tamfum J-J, Rosello A, et al. Control of Ebola virus disease outbreaks: comparison of health care worker-targeted and community vaccination strategies. Epidem 2019;27:106–14.
[11] Hiller U, Mankertz A, Koneke N, Wicker S. Hospital outbreak of measles – evaluation and costs of 10 occupational cases among healthcare workers in Germany, February to March 2017. Vaccine 2019;37:1905–9.
[12] World Health Organization. Director-General's opening remarks at the World Health Assembly – 24 May 2021. Available at: https://www.who.int/director-general/speeches/detail/director-general-s-opening-remarks-at-the-world-health-assembly—24-may-2021 (last accessed: January 28, 2022).
[13] World Health Organization. Ten threats to global health in 2019. Available at: https://www.who.int/news-room/spotlight/ten-threats-to-global-health-in-2019 (last accessed: January 28, 2022).
[14] Biswas N, Mustapha T, Khubchandani J, Price JH. The nature and extent of COVID-19 vaccination hesitancy in healthcare workers. J Community Health 2021;46(6):1244–51.
[15] Reses HE, Jones ES, Richardson DB, Cate KM, Walker DW, Shapiro CN. COVID-19 vaccination coverage among hospital-based healthcare personnel reported through the Department of Health and Human Services Unified Hospital Data Surveillance System, United States, January 20, 2021-September 15, 2021. Am J Infect Control 2021;49(12):1554–7.
[16] Maltezou HC, Panagopoulos P, Sourri F, Giannouchos TV, Raftopoulos V, Gamaletsou MN, et al. COVID-19 vaccination significantly reduces morbidity

and absenteeism among healthcare personnel: a prospective multicenter study. Vaccine 2021;39(48):7021–7.
[17] Paterlini M. COVID-19: Italy makes vaccination mandatory for healthcare workers. BMJ 2021;373:n905.
[18] Wise J. COVID-19: France and Greece make vaccination mandatory for healthcare workers. BMJ 2021;374(374):n1797.
[19] Rimmer A. COVID vaccination to be mandatory for NHS staff in England from spring 2022. BMJ 2021;375:n2733.
[20] Sah P, Moghadas SM, Vilches TN, Shoukat A, Singer BH, Hotez PJ, et al. Implications of suboptimal COVID-19 vaccination coverage in Florida and Texas. Lancet Infect Dis 2021;21(11):1493–4.
[21] Omer SB, Benjamin RM, Brewer NT, Buttenheim AM, Callaghan T, Caplan A, et al. Promoting COVID-19 vaccine acceptance: recommendations from the Lancet Commission on Vaccine Refusal, Acceptance, and Demand in the USA. Lancet 2021;398(10317):2186–92. https://doi.org/10.1016/S0140-6736(21)02507-1.
[22] Jorgensen P, Mereckiene J, Cotter S, Johansen K, Tsolova S, Brown C. How close are countries of the WHO European Region to achieving the goal of vaccinating 75% of key risk groups against influenza? Results from national surveys on seasonal influenza vaccination programmes, 2008/2009 to 2014/2015. Vaccine 2018;36(4):442–52.
[23] Maltezou HC, Botelho-Nevers E, Brantsæter AB, Carlsson RM, Heininger U, Hübschen JM, et al. Vaccination policies of healthcare personnel in Europe: update to current policies. Vaccine 2019;37:7576–84.
[24] Cherian T, Morales KF, Mantel C, Lambach P, Al Awaidy S, Bresee JS, et al. Factors and considerations for establishing and improving seasonal influenza vaccination of health workers: Report from a WHO meeting, January 16–17, Berlin, Germany. Vaccine 2019;37(43):6255–61.
[25] Talbot TR, Schimmel R, Swift MD, Rolando LA, Johnson RT, Muscato J, et al. Expanding mandatory healthcare personnel immunization beyond influenza: Impact of a broad immunization program with enhanced accountability. Infect Control Hosp Epidemiol 2021;42(5):513–8.
[26] World Health Organization. Immunization coverage. Available at: https://www.who.int/news-room/fact-sheets/detail/immunization-coverage (last accessed: January 28, 2022).
[27] Maisonneuve AR, Witteman HO, Brehaut J, Dubé È, Wilson K. Educating children and adolescents about vaccines: a review of current literature. Exp Rev Vaccines 2018;17(4):311–21.
[28] Poland GA, Marcuse EK. Developing vaccine policy: attributes of "just policy" and a proposed template to guide decision and policy making. Vaccine 2011;29(44):7577–8.
[29] Whitaker JA, Poland CM, Beckman TJ, Bundrick JB, Chaudhry R, Grill DE, et al. Immunization education for internal medicine residents: a cluster-randomized controlled trial. Vaccine 2018;36(14):1823–9.
[30] Poland CM, Poland GA. Vaccine Education Spectrum Disorder: the importance of incorporating psychological and cognitive models into vaccine education. Vaccine 2011;29(37):6145–8.
[31] Poland CM, Brunson EK. The need for a multi-disciplinary perspective on vaccine hesitancy and acceptance. Vaccine 2015;33(2):277–9.
[32] Omer SB, Poland CM, Chamberlain AC. Interpersonal communication approaches to increase adult vaccine acceptance. In: Poland GA, Whitaker JA, editors. Vaccinations. St. Louis, Missouri: Elsevier; 2019. p. 25–34.
[33] Poland CM, Matthews AKS, Poland GA. Improving COVID-19 vaccine acceptance: including insights from human decision-making under conditions of uncertainty and human-centered design. Vaccine 2021;39(11):1547–50.
[34] Poland CM, Ratishvili T. Vaccine hesitancy and health care providers: using the preferred cognitive styles and decision-making model and empathy tool to make progress. Vaccine X, submitted for publication.