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EDITORIAL ARTICLE

Perioperative Influenza Vaccination: opportunities and strategies to meet the global call to action

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ABSTRACT

Influenza vaccination is a proven strategy vital to the promotion of population health. Global, national, and local healthcare organizations advise broad administration of seasonal influenza vaccination to occur at every opportunity. Despite established benefits of influenza vaccination and the global call to increase vaccination rate, multiple barriers beyond vaccine hesitancy have produced a gap between goal and actual influenza vaccine coverage. Proposed solutions to address these issues include developing context specific strategies that integrate with other healthcare services to target sub-populations of patients. One such strategy is influenza vaccination during the perioperative period, which is the continuum of care during the preoperative, intraoperative, and postoperative phases of care. Historical approaches to perioperative vaccination have been two-fold. The first being a conservative approach, prioritizing the need to 'first do no harm', that avoids potential risks of misinterpretation of vaccine related adverse events as perioperative complications and immunomodulation impacting efficacy of immunization. The second being a liberal approach, prioritizing the global call to use every opportunity to vaccinate with individual and population health benefits of vaccination outweighing any low and theoretical risks posed by conservative concerns. Modern strategies balance these concerns and target context specific opportunities to apply perioperative influenza vaccination through evidence-based approaches in the preoperative and intraoperative phases of care. Additionally, opportunity to administer flu vaccine in the postoperative phase are also discussed. Global perioperative healthcare providers are called to action and encouraged to utilize and build upon these strategies to meet the global need of increasing influenza vaccination. The patients we serve deserve our advancements in protecting them.

Keywords: Influenza, perioperative period, vaccination.

Introduction

Influenza vaccination is a proven strategy to reduce medical, societal, and economic impacts of influenza disease.[1,2] For the 2022-2023 season, the United States Center for Disease Control (CDC) estimates flu vaccine prevented an estimated 5.9 million influenza illnesses, 2.9 million related medical visits, 64,000 associated hospitalizations, and 3,600 associated deaths within the United States.[3] Global and national health organizations recommend promoting seasonal influenza vaccination whenever possible, due to its many benefits including prevention of illness from influenza virus, reduced severity of illness from influenza, and helping protect vulnerable populations from influenza related illness. According to the CDC and United States Department of Health and Human Services (HHS), with rare exceptions, everyone ages 6 months and older is recommended to receive the influenza vaccination.[4] Vulnerable populations, such as young children, pregnant people, elderly, and those with chronic medical conditions including asthma, diabetes, immune related diseases, and cancer, are at high risk for serious flu complications such as pneumonia, myocarditis, encephalitis, sepsis, organ failure, and death. These populations should get vaccinated with priority.[4] Additionally, the CDC and HHS provide initiative that healthcare workers should use every opportunity for administration of flu vaccine.[5] In their position paper, the World Health Organization (WHO) reports all people, especially the elderly and vulnerable, benefit from recommended immunizations through the life-course, including seasonal influenza vaccines, and those immunizations should be effectively integrated with other essential health services.[6] The European Centre for Disease Prevention and Control (ECDC) recommends expanding flu vaccine to additional age groups to ensure the most vulnerable are protected.[7] The ECDC also offers guidance, congruent with the CDC, HHS, and WHO, that it is critical to develop targeted and context specific strategies to drive vaccine demand and organizations should invest to improve access to vaccines with attention to convenience on patient's behalf.[7]

Pediatric health organizations, such as the American Academy of Pediatrics (AAP), recommend routine influenza vaccination for prevention of influenza in children.[8] In their 2023 policy paper, the AAP reinforces the importance of such guidance by reminding health care providers that children consistently have the highest attack rates of influenza in the community during seasonal influenza epidemics. Also, young children and those with certain underlying medical conditions may experience substantial morbidity, including fatal complications, from influenza infection.[8] Current expert guidance for influenza vaccination at our organization, Akron Children's Hospital (Akron, Ohio, United States), has similarly encouraged providers to "offer influenza vaccination at every opportunity, wherever patients are". Through this statement, the organization has encouraged expansion of influenza vaccination outside of what many healthcare providers and families view as the traditional setting for vaccines, outpatient primary care appointments.

There is sufficient evidence supporting benefits and broad application of influenza vaccination efforts, including pediatric populations. Statements from medical organizations across the global, national, and local healthcare continuum are consistent and aligned.

Healthcare systems and their workers should be promoting influenza vaccination broadly and, most importantly, at every possible opportunity to eligible patients. Summarily integrating the various charges for influenza vaccination, a broad statement and call to action can be given to healthcare workers: "use every opportunity to improve access and broadly vaccinate eligible patients by targeting context specific strategies that integrate with other healthcare services to meet patients where they are".

Influenza vaccine coverage gap:

Despite calls from global, national, and local organizations to expand influenza vaccination efforts, results for influenza vaccination programs, as evidenced by vaccine coverage rates (VCR), have fallen short of target levels. A recent report from the ECDC on seasonal influenza recommendations and coverage rates in member states from the 2020-21 season gives insight into existing gaps and strategy.[7] Prior goals for EU member states focused on achieving 75% vaccination coverage rate (VCR) in key target groups, including elderly and individuals at risk for more severe disease. Despite efforts to promote, fund, and increase VCR in these groups, data showed VCR remained below 75%, with multiple member states indicating stagnant to declining VCR. For example, the key target group of elderly adults >/ 65 years of age had a median VCR reported at 59%, with only Denmark achieving the 75% VCR goal. When expanded to all adults >/ 18 years, VCR dropped to 20%. This data is summarized in **Figure 1.** Children and adolescent VCR data was only reported by nine member states, and VCR among individuals with chronic medical conditions only reported by four member states, making it difficult to draw conclusions on VCR rate and trends in these high priority populations.

The HHS made influenza vaccination rate goal of 70% a priority in their Health People 2030 campaign.[9] Recent data from this campaign provided through CDC and National Center for Health Statistics (NCHS) indicates baseline VCR for all persons aged 6 months and older from the 2019-20 influenza season was 51.8%, with a minimal increase to 52.1% for the 2020-21 season.[10] Population specific VCR data from the CDC shows coverage for expanded age groups.[11] Elderly adults >/ 65 years fell just short of goal during 2019-2020 (69.8%), then exceeded HHS goal in seasons 2020-2021 (75.2%) and 2021-2022 (73.9%). VCR rates for all adults >/18 years were below goal and remained stagnant in 2019-2020 (48.4%), 2020-2021 (50.2%), and 2021-2022 (49.4%). Additionally, VCR in children >/6 months – 17 years was below goal in 2019-2020 (63.7%) with decrease coverage in subsequent seasons 2020-2021 (58.6%) and 2021-2022 (57.8%). This data summarized in **Figure 1.**

Locally, at Akron Children's Hospital our VCR goal is 50%. For pre-COVID-19 influenza seasons extending through the pandemic season of 2020-2021, our organization consistently achieved >50% VCR in our pediatric population age >/6months through 17 years during peak season, but ultimately fell short of goal for cumulative season goals (unpublished data). However, for seasons 2021-22, 2022-23, and current season 2023-24, peak and cumulative VCR have both remained below 50% goal (unpublished data).

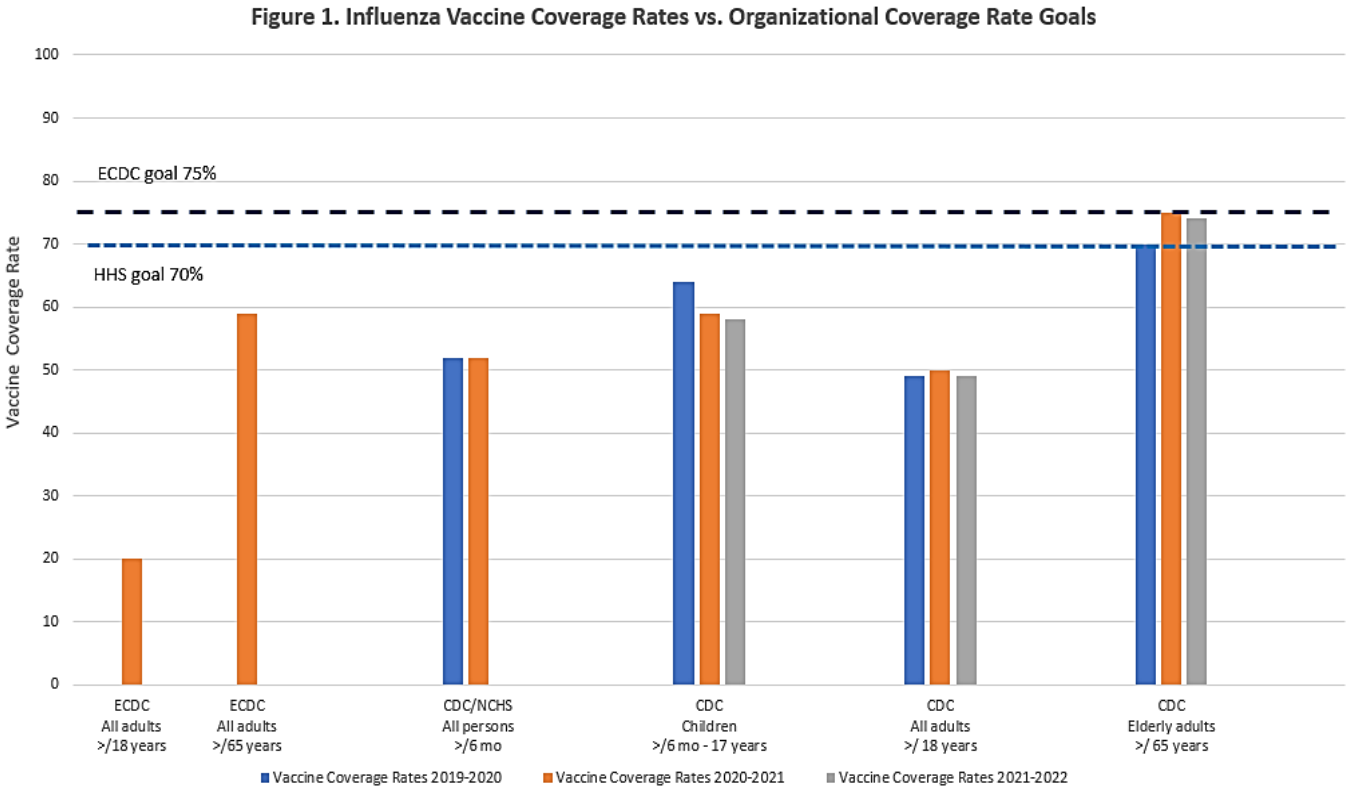

Figure 1: Influenza Vaccine Coverage Rates vs. Organizational Coverage Rate Goals

Despite many years of traditionally promoting flu vaccination through primary health care offices and influenza vaccine clinics, there remains a significant gap between goal and actual vaccine coverage at global, national, and local levels. Historically, there has always been some basal level of hesitancy and barriers to immunization recommendations and patient-parental acceptance. In 2012, the Strategic Advisory Group of Experts on Immunization (SAGE) was charged with advising the WHO on overall global policies and strategies related to immunization, including vaccine hesitancy.[12] Despite SAGE workgroup efforts, reports of vaccine hesitancy have increased significantly, becoming a common buzzword in healthcare since the start of the COVID-19 pandemic. A search performed on the PubMed search engine (United States Department of HHS, National Library of Medicine, Bethesda, Maryland, United States) gave the following results. Search terms of "vaccine hesitancy" produces 400 results during pre-COVID era years 2011-2019 and 4,772 results in COVID/post-COVID pandemic years 2020-2024. This represents over a tenfold increase in PubMed indexed literature resulting to a "vaccine hesitancy" query when comparing these time periods. While an in-depth analysis of vaccination barriers and hesitancy is beyond the scope of this editorial, it is none the less important for healthcare workers to acknowledge this topic should they truly desire to improve influenza vaccination efforts.

The global healthcare provider is in a challenging situation. There are clear and urgent directives from global, national, and local healthcare organizations to increase seasonal influenza vaccination. Moreover, there is a self-imposed

moral imperative to ensure that, when possible, health is preserved and infection prevented. Traditional efforts, hindered by vaccine hesitancy and other barriers, have not met desired vaccination rates. Are there fresh and novel opportunities for healthcare providers to meet the call to action: "use every opportunity to improve access and broadly vaccinate eligible patients by targeting context specific strategies that integrate with other healthcare services to meet patients where they are"?

Historic approach to perioperative vaccination

An additional approach outside of traditional influenza vaccination opportunities that targets a specific sub-population of patients is one such idea. Vaccination during the perioperative period, spanning the continuum from the preoperative phase, continuing through the intraoperative/procedural phase, and concluding with the postoperative recovery phase, has previously been reported. However, the merits of perioperative vaccination, especially in the pediatric population, have been debated for some time.[13,14] Benefits include multiple opportunities for interaction during the perioperative period and, while under anesthesia, an opportunity for 'pain free' immunization. However, there are concerns with vaccination during the perioperative period. One concern is anesthetic and surgical stressors may alter normal immune function and could compromise vaccine efficacy.[15] However, there is a lack of definitive evidence to support withholding perioperative vaccination in real clinical practice.[14] A second concern is that vaccine related adverse events, including anaphylaxis, fever, rash, headache, nausea, somnolence, and myalgias, have potential to be misinterpreted as anesthetic or surgical complications, clouding the differential diagnosis and delaying definitive treatment.[16–18] However, there is only a single serious vaccine related safety event reported in the perioperative literature; an infant receiving MMR vaccine, not influenza vaccine, and having febrile convulsions.[19]

These topics have created two schools of thought regarding perioperative vaccination. The conservative approach to perioperative vaccination citing a need to 'first do no harm'. Avoiding potential risks of misinterpreting vaccine related adverse events as anesthesia or surgical complications and immunomodulation impacting efficacy of immunization.[20,21] A liberal approach cites global priority and increasing call to use every opportunity to vaccinate, and the individual and population health benefits of vaccination outweighing any low and theoretical risks.[22,23] Without clear societal guidelines and lack of consensus among perioperative experts, the modern healthcare provider is faced with a dilemma.

Modern approach to perioperative influenza vaccination

Recent literature provides clarity to address and balance the topic of pediatric perioperative influenza vaccination. Rao et al published a 2022 study hypothesizing the perioperative period, more specifically the intraoperative phase while under general anesthesia, would be an ideal opportunity to increase influenza vaccination in children.[24] As general anesthesia is associated with anxiety and fear, this setting provides patient-families a "teachable moment"- that is an event motivating patients to spontaneously adopt risk reducing behaviors- in this case overcoming hesitancy to influenza vaccination.[25,26] Additionally, their organizational

workflow and processes were leveraged to offer vaccination to patients undergoing elective general anesthesia. During the study period, results showed a significant increase in influenza vaccinations from the preintervention period (2%) to intervention period (13.6%). There were no reported adverse or serious safety events related to perioperative vaccination found in the organization's safety report system. Including subsequent flu seasons, the authors report their program had administered over 3,000 vaccinations. They conclude the program successfully addressed low influenza vaccination rates through novel and alternative strategies promoting safe influenza vaccination.

A second published study is one which I served as an investigator and primary author.[27] We also sought to increase influenza vaccination rate through a novel strategy during the perioperative period. Rather than vaccinating during the intraoperative phase under general anesthesia, our local processes, policies, and workflow presented opportunity to achieve vaccination in the preoperative phase through our Perioperative Surgical Home (PSH) clinic. The Perioperative Surgical Home (PSH) is a model of care described both in adult and pediatric literature. Both adult and pediatric PSH models share key philosophy of care components including team based, patient centered approach to care designed to improve overall delivery of health care, reduce cost, and enhance value provided to the patient-family and organization.[28,29] Preoperative evaluation clinic visits, such as the PSH clinic utilized at our institution, can serve as an entry point. While this health care interaction primarily serves perioperative needs, it also provides a teachable moment, where health care providers can meet patients 'where they are' and offer high priority population health initiatives of local, national, and global significance, such as influenza vaccination.

Utilizing quality improvement methodology, we sought to accomplish two key aims: (1) to increase the rate of eligible patients receiving influenza vaccination during their PSH clinic visit (2) promote health and well-being of perioperative patients through providing protection from influenza as part of organizational influenza initiative goals. To accomplish this, we developed novel processes to identify, administer, and report vaccination of eligible patients. Results over three consecutive influenza vaccination seasons were positive. Our program grew from a preintervention period vaccination rate of 0% to exceeding vaccination rates goals of 10%, 15%, and 18%, during our three consecutive flu season study period. Like Rao et al, we did not observe safety concerns with our novel vaccination program, and there were no reported same day surgical cancellations due to influenza vaccination complications.

Both studies successfully demonstrate novel programs that meet overarching themes and directives from international, national, and local healthcare organizations. This was done by targeting a sub-population of patients through context specific strategies of already planned healthcare service appointments to reach patients with unmet flu vaccine need. There is opportunity to replicate similar programs at other organizations.

Challenges and opportunities in perioperative influenza vaccination

The potential of perioperative influenza vaccination programs is clear. In the United

States, there are 3.9 million surgeries annually in children aged 0-17 years.[30] With rates of 13-18% influenza vaccination success in the two studies above, that presents potential to vaccination an additional 530,000 to 700,000 if expanded across the United States. Global expansion would offer even more potential flu vaccine coverage. However, barriers exist. Patient-families lack of knowledge, attitude towards healthcare, trust in healthcare, cost, and past experiences have all been recognized as contributing to vaccine hesitancy.[31] In the pre-COVID-19 pandemic year of 2019, WHO reported vaccine hesitancy as a "top ten threat to global health".[32] As discussed previously, search results containing " vaccine hesitancy" on PubMed relating have increased over tenfold since the beginning of the COVID-19 pandemic. Reports of highly publicized and politicized messaging regarding the COVID-19 vaccine were reported in the United States[33,34], as well as Europe[35,36], Asia, Africa, and South America.[37] COVID-19 vaccine hesitancy has likely imparted harm onto the influenza vaccine and made achieving the call to increase influenza vaccination more challenging.

Proposed interventions to address vaccine hesitancy include efforts to improve patient-family education and knowledge, promotion of vaccination by health care workers, reducing cost barriers, and targeting sub-populations within the population health paradigm.[12,31,38,39] For the interested reader, the AAP recently published evidence based guidance on strategies to counter vaccine hesitancy.[40] Paramount to all of these strategies is effective communication to establish an open and trusting relationship between the healthcare provider and patient-families. This is consistent with our local experience to drive vaccine acceptance and increase vaccination rate through our perioperative vaccination program.[27] We developed and implemented interventions to address vaccine hesitancy by targeting a subpopulation (perioperative patients), enhancing education, optimizing communication with patient-families through fact-based discussion, encouraging healthcare workers to promote influenza vaccination, and keeping cost of vaccination low. Based on our experience, we found not only did these interventions drive vaccination rates higher, but our providers reported even families declining vaccination appreciated open, fact based, and non-judgmental communication. Hopefully, these efforts will further decrease barriers and hesitancy in such families, enabling future providers to achieve vaccination success.

Within the perioperative period we have examined pre-operative and intra-operative models to increase delivery of influenza vaccination. Are there any novel opportunities in the post-operative phase of care? Yes! And such an effort is underway at our institution. This opportunity was identified by our sedation services group during team information sharing at organization wide influenza committee meetings. The sedation services group provides elective sedation to more than 2,500 patients for a variety of diagnostic and therapeutic interventions. Leveraging collaboration with the PSH and organizational influenza committee, they developed and implemented a novel influenza vaccination process for their patient population. After pre-screening, selection, and consent, these patients receive flu vaccine during the post-procedure recovery phase, while awaiting discharge home. Preliminary internal data (unpublished) has indicated significantly increased vaccination rates and high quality,

safe outcomes in this specific patient population.

Conclusion

The perioperative period is rich with opportunity to employ novel vaccination strategies to meet influenza vaccination need. Liberalization of perioperative influenza vaccination to meet local, national, and international goals is gaining momentum. Two recent quality improvement studies demonstrate perioperative influenza vaccination is practical and safe. Though debate on perioperative vaccination remains, the global community of healthcare providers are called to action. They are encouraged to utilize and build upon recent reports to meet this call. Should their local practice and vaccination policy be permissive of vaccination under general anesthesia, Rao et al offer a scalable model. For local practice and policies better supported through pre-operative vaccination, Meyer et al offer a scalable model. Opportunity to address unmet influenza vaccination need during the post-operative phase of care also exists. Together, the global community of healthcare providers can better serve our patients and truly "use every opportunity to improve access and broadly vaccinate eligible patients by targeting context specific strategies that integrate with other healthcare services to meet patients where they are".

Conflict of Interest Statement:

The author has no conflict of interest to disclose related to this editorial.

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