

**AN OVERVIEW; ROLES OF FAMILY PHYSICIANS IN SMALLPOX DISEASE
PREVENTION IN PRIMARY CARE CENTRES****Hassan Zaher Alqarni**

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Abstract:

Individuals lacking known exposure to the smallpox virus may nevertheless face a significant risk of contracting smallpox, contingent upon the severity of the outbreak and the efficacy of the public

health response. Individuals will be identified by public health officials and should be evaluated for relative contraindications to smallpox immunization. In 2022, monkeypox (Mpox) was designated a public health emergency. The European Medicines Agency has approved Imvanex/Jynneos, a smallpox vaccine, for protection against pox. According to the European Centre for Disease Prevention and Control, all healthcare workers (HCWs) are deemed at risk; nevertheless, in Italy, immunization was exclusively provided to laboratory personnel. This study seeks to examine smallpox vaccination coverage (VC) that offers protection against Mpox among healthcare workers (HCWs) in an Italian university hospital and to evaluate HCWs' opinions regarding the potential for Mpox vaccination. Vaccine hesitancy diminishes adult immunization rates and has been identified by the WHO as a significant health issue. Primary care physicians (PCP) are instrumental in immunization by providing vaccine counseling to their patients. This review aims to evaluate the knowledge, beliefs, attitudes, and barriers related to personal vaccination and the prevention of smallpox infection among patients, as well as recommendations for primary care physicians. Methods: The MEDLINE/PubMed, EMBASE, and Cochrane Library databases were utilized to search for and identify pertinent studies based on their titles and abstracts. Given that basic healthcare facilities are pivotal in smallpox transmission during the initial stages of an epidemic, various mathematical models advocate for pre-event smallpox immunization of healthcare workers (HCWs). The determining factor for healthcare worker voluntary immunization is the risk of disease exposure compared to the risk of adverse vaccine effects. To enhance preparedness and response, smallpox immunization is advised for individuals appointed by public health authorities to investigate and monitor first smallpox cases that may need direct patient interaction.

Introduction:

Numerous mathematical models for smallpox (variola virus) outbreaks have been suggested. All provide relevant information for public health response planners, while their conclusions differ due to varying assumptions and statistical methodologies. The models seek to reduce outbreak morbidity and mortality via diverse immunization strategies and protocols. The complication rates associated with smallpox immunization using the currently available live vaccinia virus are a considerable worry for individuals and public health response planners [1,2]. Recent data on vaccination complication rates, particularly for healthcare workers (HCWs), has emerged from the experience of vaccinia virus vaccination in the USA during the past five years. Integrating contemporary insights on vaccine problems and probable immunological pathways with mathematical models would enable public health authorities and healthcare workers to make the most informed decisions.

The study by Longini et al., titled "Containing a Large Bioterrorist Smallpox Attack: A Computer Simulation Approach," presents a discrete-time, stochastic computer simulation model that provides supplementary planning guidance for a smallpox outbreak [1]. Despite varying interpretations of the model's data, the article concludes that "Given the implementation of surveillance and containment measures, preemptive vaccination of hospital personnel would

further diminish the incidence of smallpox cases and fatalities, but would necessitate extensive prevaccination for optimal efficacy." The hospital's computer simulation involved 686 employees, a modest number compared to other tertiary care facilities, with 133 individuals having direct contact with smallpox cases before isolation protocols were implemented. Out of 828 instances, 50% originated in the hospital, and 13% of the contacts were untraceable. Preemptive smallpox (vaccinia virus) vaccination of 10% of hospital personnel, alongside surveillance and containment measures, yielded a minor impact on the average number of cases; conversely, preemptive immunization of 50% of hospital personnel resulted in a significant drop in cases. A greater quantity of preventive vaccines necessitated reduced contact tracing and 'ring' containment injections. A one-day delay in the complete implementation of surveillance and containment led to a significant outbreak [5].

Mpox, previously referred to as monkeypox, is a viral infection known as human monkeypox (HMPX), caused by the monkeypox virus (MPV), a DNA virus belonging to the orthopoxvirus genus within the Chordopoxvirinae subfamily of the Poxviridae family. Following the eradication of smallpox in 1980 and the cessation of universal smallpox vaccination, Mpox has become the primary zoonotic illness resulting from orthopoxvirus infection in humans [6].

On 23 July 2022, the World Health Organization (WHO) designated the global Mpox outbreak as a public health emergency. As of 7 June 2023, a cumulative number of 25,910 Mpox cases have been documented in European nations since the onset of the outbreak. As of 07 June 2023, Italy has confirmed 957 instances, with no additional cases reported after that date. During this outbreak, the majority of reported cases have been transmitted through sexual contact with multiple partners; however, Mpox can also disseminate through close physical contact including skin rashes, crusts, body fluids, and respiratory secretions during medical intervention. In the context of the Mpox multi-country outbreak, mass vaccination is not advised; rather, administering primary (pre-exposure) preventive vaccine (PPV) to high-risk population groups may aid in controlling the outbreak. The ECDC defines high-risk groups as those identifying as homosexual, bisexual, or other men, as well as transgender individuals who engage in sexual activities with men, along with certain kinds of professions, such as healthcare workers (HCWs) [8].

Review:

Smallpox is a severe, contagious, and occasionally fatal infectious disease. Exposure to an infected individual by direct contact, body fluid contact, or aerosolized inhalation initiates the illness process.¹⁴ The sickness often manifests within 7-17 days (average incubation 12 days) of exposure, with symptoms including high fever, myalgia, and headache. A maculopapular rash develops, usually on the infected person's face and neck. The lesions extend across the epidermis and emerge concurrently [1]. After 1-2 days, the rash papules turn vesicular and pustulous.⁴ Vesicles appear spherical and hard with dermal involvement, measuring 2-5 mm in diameter. Crusting and scabs emerge nine to ten days after initial exposure.^{3,4} Pitting scars are typical after smallpox resolution. The disease can be transmitted via airborne droplets until the skin scabs fall off.⁴ Some patients may experience a temperature spike 3-5 days after the onset of the prodrome,

which could signal subsequent bacterial infection and increased mortality. The majority of smallpox-related deaths are caused by toxemia, pneumonia, or bacteremia [2]. Mortality rates vary according to the strain of variola involved. Variola minor, which is more common among patients who have already been vaccinated against smallpox, has a fatality incidence of about 1%. In contrast, variola major can be fatal in up to 30% of patients. Hemorrhagic and malignant variants of variola have far greater fatality rates, as evidenced by a shorter incubation time, severe prodromal sickness, petechiae, and cutaneous and mucosal hemorrhage [3].

Morbidity is prevalent after a smallpox infection. Pockmarks can be seen in up to 80% of smallpox survivors, and viral keratitis causes blindness in about 1% of those infected.⁴ The incidence of arthritis among smallpox survivors who contracted the disease as children is estimated to be around 2%. Although uncommon, encephalitis can occur in smallpox victims, potentially causing retardation or death [7,8].

Primary care physicians (PCP) play an important role in adult vaccination [9]: on the one hand, their own immunization is important for their own and their patients' protection; on the other hand, motivated physicians have been shown to be more effective in vaccinating their patients [8]. The primary care physician (PCP) plays a critical role in resolving vaccine hesitancy because they are the first and most credible source of information for patients when determining whether to be vaccinated [14]. The study's goal is to determine the elements (knowledge, beliefs, attitudes, and impediments) that influence PCP vaccination decisions and recommendations to adult patients [8,9].

The Vaccinia (smallpox) vaccine can be safely administered to a carefully selected population. As of April 28, 2006, the US Department of Defense (DoD) had provided over 1,004,000 Dryvax™ (Wyeth; New York City Board of Health strain vaccinia) live virus immunizations to military operational forces and healthcare workers. Most adverse effects occurred at rates lower than historical levels, and the fatality rate directly linked to vaccination was one per million in this chosen cohort of male and female military members [9]. Other vaccinia strains, such as the Lister strain used in several European countries, may have higher expected complication rates (8.4 deaths per million vaccines). Ninety thousand individuals of the original screened military population were medically exempt, the majority due to a history of atopic dermatitis/eczema or a family member suffering from the ailment. The only tragic attributed death was that of a 22-year-old female United States Army Reservist undergoing mobilization [9]. A lupus-like illness emerged a month after having five immunizations, including smallpox and anthrax. The evidence suggested a causal link with the vaccinia vaccination. Pathology revealed lymphocytic pericarditis with eosinophils and widespread alveolar damage.¹⁰As of October 2004, 24 DoD vaccinees were hospitalized for myocardial ischemia 2-24 days after inoculation. Myocardial infarction occurred in 13 military personnel, with one fatality. Many patients with myocardial ischemia had considerable prior cardiovascular disease [10]. The coronary episodes were deemed unrelated to smallpox vaccination. An expert panel also determined that the ischemic incidents did not exceed the predicted threshold of 40 cardiac hospitalizations among unvaccinated DoD personnel. The

authors of the myocardial ischemia review, who included senior leadership from the DoD smallpox vaccination effort, concluded that the available data "do not support a causal relationship between ischemic cardiac events and receipt of the smallpox vaccine; however, this possibility cannot be excluded."

Furthermore, the 114 instances of myopericarditis (1.14/10 000) among more than 1 million vaccinated people were an unexpected consequence. All instances are resolved to the best of our knowledge. 64 patients underwent detailed follow-up; all had normal electrocardiograms (EKGs), echocardiograms, and treadmill stress tests [11]. Vaccinia myocarditis occurred at a similar rate (1/10 000) in Finnish conscripts in the late 1970s.¹⁴ An other Finnish study found asymptomatic EKG abnormalities suggestive of inflammatory myocarditis in eight of 234 (3%) conscripts who received numerous vaccines, including live vaccinia virus. People with EKG abnormalities were more likely to have a history of atopy. Myopericarditis should be investigated in the differential diagnosis of chest discomfort 4-30 days after smallpox immunization [12].

In the DoD population of one million vaccinees, "There were no cases of live vaccinia virus transmission in the workplace; most importantly, among 27 700 healthcare workers, there were no cases of provider to patient transmission." [10]. Contact transmission occurred in 55 cases, primarily at home between spouses and intimate partners, with no known adverse repercussions, including the resolution of a vaccinia keratitis case. No incidences of eczema vaccinatum or progressive vaccinia occurred as a result of an effective education and deferral program for those with a history of atopic dermatitis/eczema or immunosuppression. A thorough summary of the first 450 293 vaccines (70.5% primary and 29.5% revaccinations) administered during the program's first five months, which began on December 13, 2002, has been published [13]. The National Smallpox Preparedness Program, sponsored by the Department of Health and Human Services (HHS) through the Centers for Disease Control and Prevention (CDC), operated mostly from January to October 2003 and was aimed at civilian health care workers and public health response teams. During this time period, 37 901 civilian volunteers received the vaccinia Dryvax™ immunization, and 100 experienced significant adverse effects.¹⁷ In this dramatically different population from military personnel, 64% of the vaccinees were female. More than 75% of the vaccinees were 40 to 64 years old and had previously had vaccinia vaccination. The significant occurrences included 21 cases of myopericarditis and ten cardiac ischemia episodes. The ten ischemic events included four cases of exacerbated angina and six myocardial infarctions, with two deaths among women aged 55 and 57, one and four days following vaccination, respectively. The time between immunization and cardiac symptoms ranged from seven to fourteen days, with a median of eight days in the majority of instances. Two cases of insidious onset dilated cardiomyopathy developed two to three months following vaccination. Statistically speaking, the rate of ischemic heart events in civilian vaccinees did not appear to be higher than in a comparable unvaccinated cohort. Older revaccinees were more likely to experience adverse outcomes as a result of underlying chronic disease, particularly coronary artery disease. There was no

transmission of vaccinia to others among the almost 38 000 live virus vaccination recipients, including no nosocomial transmissions [14,15].

No further ischemic cardiac occurrences were reported following the March 26, 2003 Health Alert Notice, which deferred vaccination for persons at risk of coronary artery disease. Cardiac deferral requirements included a history of cardiac disease or three of the five major risk factors for atherosclerotic heart disease (hypertension, diabetes, hypercholesterolemia, smoking, or a first-degree relative under the age of 50). The publication of the cardiac deaths related with immunization resulted in a dramatic fall in volunteers. According to the CDC, the total number of HCWs vaccinated as of October 31, 2005 was 39,608. The civilian vaccinees experienced similar rates of predicted, avoidable, noncardiac side events to those in the military program [16].

Conclusion:

Optimal infection-control methods and appropriate site care should prevent the spread of the vaccinia virus from vaccinated healthcare workers to patients. To reduce the risk of transmission, healthcare personnel who provide direct patient care should cover their vaccination sites with gauze and a semipermeable membrane dressing to absorb exudates and provide a barrier for vaccinia virus containment; the dressing should also be covered by a layer of clothing. Dressings used to cover the site should be changed often to avoid exudate buildup and maceration. The most important measure for reducing contact transmission is continuous hand cleanliness. Hospitals should assign staff to evaluate dressings for all immunized healthcare professionals. When possible, professionals responsible for dressing changes for smallpox health-care teams should be immunized, and all individuals handling dressings should take contact precautions. Administrative leave is not typically required for newly vaccinated health-care personnel unless they are physically unable to work due to systemic signs and symptoms of illness, have extensive skin lesions that cannot be adequately covered, or are unable to follow the recommended infection-control procedures. Persons outside the patient-care context can cover their immunization sites with a permeable dressing. Hand cleanliness remains critical to avoiding unintended inoculation. The FDA has suggested that recipients of the smallpox vaccine refrain from donating blood for 21 days, or until the scab has detached. The types of smallpox vaccinations include ACAM2000, Aventis Pasteur Smallpox Vaccine (APSV), and Imvamune. Surveillance and containment measures, including immunization with replication-competent smallpox vaccine, will serve as the principal technique for attaining epidemic control. Individuals exposed to the smallpox virus face a significant risk of contracting and disseminating the disease and should receive a replication-competent smallpox vaccine, unless they are severely immunocompromised. Due to a significant probability of inadequate immune response and heightened risk of adverse events, smallpox vaccination should be contraindicated in individuals with severe immunodeficiency who are unlikely to derive benefit from the vaccine. This includes bone marrow transplant recipients within four months post-transplantation, individuals infected with HIV with CD4 cell counts below 50 cells/mm³, and those with severe combined immunodeficiency, complete DiGeorge syndrome, and other critically immunocompromised conditions necessitating isolation.

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