COVID-19 Mass Vaccination Centers: review

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A mass vaccination center is a location, normally used for nonhealthcare activities, set up for high-volume and high-speed vaccinations during infectious disease emergencies.

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1. Introduction

At the end of 2019, a novel highly infectious coronavirus, called SARS-CoV-2, emerged in the city of Wuhan (China), causing an outbreak of unknown viral pneumonia. With preventive measures limited to nonpharmaceutical interventions (NPI) (i.e., social distancing, extensive lockdown, etc.), of various efficacy and high social costs [1], the development of COVID-19 vaccines has become a globally shared priority, and research pathways were accelerated by pharmaceutical companies and research institutes through the strong support of central governments. Eventually, various types of vaccines have been developed, ranging from more conventional formulates based on SARS-CoV-2 subunits and/or proteins, live-attenuated and inactivated viruses, replicating and nonreplicating viral vectors, virus-like particles, and cell-based vaccines, to the more innovative mRNA/DNA based vaccines [2]. To date, two mRNA vaccine formulates, and two vaccines based on nonreplicating viral vectors have been licensed to emergency use in most high-income countries, making the vaccine available to vaccination campaigns.

Vaccination of the world base population is considered the most promising but also the most challenging approach because it requires the safe and effective delivery of millions of vaccine shots in the shortest period of time, while also avoiding health inequalities. The final aim of mass vaccination is to accelerate disease control through a rapid increase in vaccination coverage, achieving immunity levels essential to meet international goals for mortality reduction, and eventually allowing the ease of NPI [3]. In such a setting, mass vaccination centers (MVCs) are fundamental in minimizing the time required to vaccinate the highest number of people [3]. Due to the unique extent of this mass vaccination campaign, it is frequently held in nontraditional or temporary settings, such as in parking lots or large indoor spaces.

Even though mass vaccination campaigns have been a common element of communicable disease control programs (e.g., H1N1 influenza during the early 1970s and then during the winter season of 2008; smallpox; poliomyelitis, and typhoid fever) in both low-middle and high-income countries worldwide—and the Centers for Disease Control and Preventions (CDC) have issued specific guidelines on how to set up mass vaccination clinics for H1N1 campaigns [4]—no clear information has been previously collected and systematically appraised in medical literature. Moreover, the working definition is often inconsistent because it increasingly emerges while health authorities all around the world are implementing MCVs for COVID-19 vaccines. For example, during spring 2021, EuroDisney Paris was temporarily converted into an MVC with a potential capability of 1000 doses/day, while the Health Ministry of Quebec in its guidelines specifically targeted 2500 doses/day, and during May 2021, MVCs from Italian high and medium-sized cities were able to immunize over 4000 subjects in a single day [5][6][7][8].

Moreover, it should be considered that MVCs for COVID-19 vaccination is the first mass vaccination of the modern era. In light of the above considerations, we performed a rapid review, of both scientific and grey literature sources, collecting and summarizing the past experiences of the MVCs in terms of buildings, staff, and time requirements, as well as for organizational programs needed. Moreover, based on retrieved information, we suggested a potential definition of a mass vaccination center. Lastly, our ultimate goal was to critically appraise the available evidence with the final aim of timely and efficiently informing policy makers in the organization of MVCs in different settings.

2. Discussion

Results of our rapid review highlighted the high heterogeneity around the characteristics, layout and management of an MVC. Moreover, only a few articles were retrieved, and almost all of them did not refer to the COVID-19 vaccination campaign, reporting on previous vaccination campaigns that were hardly comparable in terms of targeted population and logistic issues—for example, the necessity to respect all of NPI during all of the vaccination procedures in order to avoid the spread of the pathogen because of the mass gathering represented by the MVC themselves. Interestingly, some of the available guidelines on SARS-CoV-2 vaccination centers (e.g., Quebec Health Ministry, German Committee on the Protection from Biological Agents, or ABAS, but also the Operating Framework of British National Health Service) have clearly recognized such relationship, and the potential shortcomings [5][9][10]. Despite the overall heterogeneity found, some aspects can be considered as a core element of an MVC and, not coincidentally, have been implemented by the aforementioned national guidelines.

Secondly, an MVC may be only temporarily used, with the aim to centralize as much as possible the vaccination procedures, ensuring high volumes in the shortest time period. In fact, a single vaccination center, instead of multiple locations, might facilitate staff management, supply and avoid surplus or shortages in one of the centers [11]. Examples of mass vaccination sites could include stadiums, exhibition and convention halls, airports, stations, theme parks, museums, and universities or other temporary indoor or outdoor facilities. In this regard, a school could be considered a particularly good location for child vaccination because guardians/parents do not need to take time off from work, and this aspect could increase velocity and vaccine acceptance [12][13][14][15], particularly if available vaccines against SARS-CoV-2 will be eventually licensed for children and adolescents [16].

However, as available studies were largely focusing on pathogens other than SARS-CoV-2, some of the aforementioned options may be only partially appropriate. For example, German ABAS has recently stressed the importance of prioritizing facilities where the implementation of SARS-CoV-2 specific NPI was guaranteed through appropriate distancing, ventilation, appropriate access and waiting spaces [9].

Regarding supplies, the most important aspect is quite obviously the availability of a sufficient amount of vaccines, their reception and internal management, including their safe storage, particularly in terms to temperature control. Moreover, the high precision required in vaccine reconstitution necessitates dedicated areas, as well as highly trained personnel. Because these requirements are specific for some of SARS-CoV-2 vaccines, they were not clearly addressed in most of available studies on MVCs; however, quite surprisingly, this significant shortcoming was only irregularly reported in available guidelines. For example, British NHS framework clearly states that a vaccination center must “ensure a sufficient fridge capacity for vaccines, that the areas is secure and there is an area suitable for vaccine preparation”

In fact, while earlier reports suggested that the COVID-19 vaccination could be well received by the general population [17][18], a growing body of evidence, particularly from USA and Europe, suggests that a large share of the general population may exhibit substantial vaccination hesitance toward COVID-19 vaccination because of paved side effects (as thrombosis) or due to the rapidity by which vaccines have been issued [19][20]. For this reason, some authors suggested using educational videos during the waiting phase before vaccination. To achieve this goal, duplication of vaccine educational signage and content in other commonly spoken languages is needed. [21] clearly reported which type of information should be targeted by which professionals: public health experts to delivery information regarding vaccination plan; veterinarians for describing biological outbreak containment; nurses to demonstrate vaccination procedures; pharmacists to teach about storage and reconstitution of the vaccine.

Despite the slight differences retrieved among the articles, the most common aspects were entrance, registration, waiting rooms (in many cases with educational video), screening/anamnesis, vaccination room, post vaccination room, and exit. Best practices in spacing clients and minimizing crowding include personnel directing people flow, online and phone appointments and registration, wristbands or ticket number [10]. Indeed, the simulation outputs visually and numerically show the processing and waiting times, number of cars and people that can be served under different situations. Computer simulations can be considered as pivotal tools in modeling different operational solutions for complications that can occur in any of the critical vaccination phases.

Indeed, rapid reviews are an emergent method used to collect, analyze and interpret available evidence. Secondly, we did not strictly focus on COVID-19 MVC; and although it could be considered as a limit of our review, on the contrary, we believe that having also included other mass vaccination campaigns represents an added value to our work. Some examples were the use of MVC signage and educational materials translated into multiple languages reported in just four articles [22][12][23][24], and the conduction of promotional educational campaign aimed at the desired or target population for

vaccination that was reported in just three articles. Actually, educational campaigns that are coordinated with public health officials and that include trust brokers are core public health and immunization best practices to widely publicize a mass vaccine clinic before implementation.

Another significant limitation is represented by the substantial lack of evidences from Western countries other than the USA. This is particularly frustrating because some of the most successful mass campaigns against SARS-CoV-2 were performed in Israel and in high-income countries from Western Europe. In fact, such countries are only limitedly comparable to the USA, not only for the demographics (for example: in European Union, age group 65 years or older encompasses around 20.5% of the total population, compared to 16.2% in the USA) but also in terms of urban planning, with obvious consequences on the availability of adequate and accessible facilities to be converted in MVCs.

Lastly, to this day, the literature concerning this topic is still relatively sparse, allowing us only to draw preliminary conclusions. Moreover, the data mainly referred to simulation and single-day experiences that do not allow us to assess the long-term performance and impact of these mass vaccination centers. Nevertheless, to the best of our knowledge, this is the first review assessing the organization, implementation and performance of mass vaccination centers. In our view, this is an extremely relevant topic both for public health experts and policymakers involved in facing the challenges and threats posed by an infectious pandemic unprecedented in recent human history.

3. Conclusions

Results highlighted an important gap in knowledge because only a very small number of articles was retrieved on the topic. Moreover, these few available articles often under-reported many aspects of MVC organization. The current review answers to the urgency of organizing an MVC during the COVID-19 pandemic, highlighting the most important organizational aspects that should be considered in the planning. However, it should be kept in mind that organizational models might be context-specific based on structural needs or professional availability.

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