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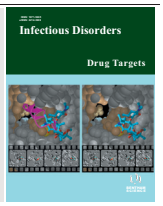
PERSPECTIVE

COVID-19 Mass Vaccination and Flu Season: Concern for Decreased Public Health Measures and Worsening the Influenza Situation



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Abstract: Reports show that other ordinary childhood infections like measles or influenza are likely to reemerge. The re-emergence of infectious diseases may happen due to the direct impact of the pandemic on the community because of decreased access to health and medical services, interrupted transport systems, weaknesses in the supply chain, flight restrictions, closings of the border, and international trade problems. The most prevalent cause (60.9%) for low vaccine uptake and coverage during the current pandemic was fear of exposure to the COVID-19 virus outside the home. The expectation and hope that the pattern of reduction in transmission and number of influenza cases will continue over the next flu season depend on continued adherence to nonpharmaceutical interventions and their long-term application. But there is always the fear and threat of increasing the spread of influenza by reducing the movement restrictions and low adherence to protective health measures due to vaccination. So far, not much information has been published about the interaction between different infectious diseases in the background of the coronavirus pandemic and related interventions. The purpose of this article is to examine the general effects of the COVID-19 vaccination on the spread of influenza in the coming seasons.

Keywords: COVID-19, mass vaccination, flu season, influenza, public health, NPIs, public health measures, risk compensation.

1. INTRODUCTION

Since the introduction of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), millions of people have been infected with this virus, and its growing trend continues with its clinical and epidemiological consequences [1-4]. Various infectious diseases have been identified in the contemporary world, which directly or indirectly cause various complications and pathogenesis mechanisms [5-10]. With the efforts made, appropriate vaccines/treatments have been developed, for many of them, although, in contrast, we still do not have effective treatments or vaccines for some. As well as, the existing treatments have encountered problems such as drug resistance or the inability of the host/vaccine to mount sufficient protection against infection [7, 11-13]. In addition to clinical complications and Complex signs/symptoms reported with COVID-19, other complications that appear to be indirectly related to this infection/disease are gradually emerging [1, 9, 14-17]. COVID-19 and seasonal flu share the same high-risk group and may harm the elderly and people with chronic complications [18, 19].

Influenza vaccination protects people from influenza-related illnesses, reduces the burden on the national health system during the COVID-19 pandemic, and facilitates public health measures to combat respiratory virus infections. However, maintaining a flu vaccination service is difficult because the COVID-19 pandemic can disrupt immunization programs in many countries during the winter [20].

Still, there are many unanswered questions about the COVID-19 pandemic. Also, there are reports that other common childhood infections like measles or Influenza are likely to reemerge [18-21] because routine vaccination uptake and coverage drop sharply, primarily affecting the timeliness of routine childhood immunization. Re-emergence may happen due to the direct effects of the Coronavirus disease 2019 (COVID-19) pandemic on the community [21, 22]. In addition, access to health and medical services has been decreased by interrupted transport systems, weaknesses in the supply network, flight restrictions, closings of borders, and global trade problems [23-25]. The most prevalent cause (60.9%) of low vaccine uptake and coverage during the current pandemic was fear of exposure to the COVID-19 virus outside the home [22]. Despite the availability of a wide range of influenza vaccines in many countries, vaccination coverage in adults is less than 50% in most cases [26]. Worldwide identification of COVID-19 cases resulted in global efforts to establish measures to pre-

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vent the further spread of the infection using closing public places, offices, and schools and to implement interventions to decline mass gatherings and social interactions. These interventions affect not only the spread of SARS-CoV-2 but also the spread of other respiratory infections. Limited cases of influenza infection were reported worldwide during the fall and winter of 2020-21. The number of deaths related to influenza decreased by 95% since the COVID-19 pandemic compared to the same previous seasons [27]. Influenza disease puts significant pressure on health care systems yearly by affecting vulnerable groups such as children between 6 months - 5 years and the elderly (65 or older) [28]. Studies have shown that children aged 2-17 with a high virus titer are the most critical spreaders of influenza. And those with low or no previous immunity transmit the virus more and for longer than their peers [29, 30]. Annually, among people worldwide, 5–15% [31, 32], including about 5% to10% of adults and up to 20% to30% of children, contract influenza each year [33]. Factors involved in the spread of influenza virus infection, as well as circulating virus strain, population immunity, and implementation of nonpharmaceutical interventions (NPIs) in response to the SARS-CoV-2 pandemic, likely have an essential role in reducing influenza incidence worldwide [19, 26, 34-36]. The impacts of such interventions on the subsequent season are still unknown, leading to a critical public health question: what will happen in the 2021-22 influenza season? SARS-CoV-2 and seasonal flu are distinct organisms; however, both are transmitted by respiratory droplets through the respiratory tract [26, 37]. Also, some report that their co-infection doubles the risk of death [28]. Studies show that implementing NPIs one day earlier than the parallel model reduces COVID-19 mortality by about 2.4%. It has also been shown that faster adoption of protective measures reduces the number of cases and mortality in non-COVID-19 [38].

The expectation and hope that the pattern of reduction in transmission and number of influenza cases will continue over the next flu season depend on continued adherence to NPIs and their long-term application [19, 26, 39, 40]. Continued use of masks, local lockdown, and office closures -as long as needed- can significantly reduce the risk of both infections. But there is always the fear and threat of increasing the spread of influenza by reducing the movement restrictions and low adherence to protective health measures as a result of vaccination and improving the COVID-19 statutes [20, 26]. After time since the start of the pandemic, reports showed an increase in indifference, desuetude, and resistance to implementing NPIs, which is called pandemic fatigue [41], as adherence to antiseptic hand sanitisers declined from 86% to 24%. Social distancing decreased from 86% to around 45% [42].

Because concerns exist that manufacturers may divert their production capacity to COVID-19 vaccines, they should call upon ensuring a sufficient supply of influenza vaccines to allow large-scale immunization programs [18].

Immunity against the flu virus is usually acquired through maternal immunity during pregnancy, vaccination, or natural infection by exposure to the virus, which protects the person against influenza infection with the other strain in the following year with a variable degree of effectiveness [36]. Evidence suggests that vaccination provides little protection against the flu in later years compared to natural infection. Still, it appears that immunity from natural infection can be traced for several seasons [27]. Delay in accepting or rejecting a vaccine injection, even if a suitable vaccine is available, is called vaccine hesitancy, declared by the WHO as one of the ten most severe threats to global health in 2019. Vaccine hesitancy has different causes and characteristics that may manifest themselves in different forms and intensities depending on the study population, time and place of administration, and even the type of vaccine [43]. Due to the low level of influenza virus activity during the past autumn/winter [2020-2021], many peoples were not immunized by acquiring infection or with a flu vaccination. Also, the population's immunity to Influenza dropped due to vaccine hesitancy and pandemic fatigue, raising concerns about a more robust return of the flu infection in the upcoming season. A possible reduction or elimination of public health measures against COVID-19 can also strengthen the outbreak of Influenza in the next season [36]. Data from previous years have shown that long periods of low flu incidence in past years can increase the number of susceptible populations with low levels of immunity in the community and cause more severe epidemic peaks that usually occur earlier than normal years [36]. With the announcement of the discovery and distribution of vaccines against COVID-19 infection worldwide, the level of risk perception and fear of infection will decrease in response to this promising news. Also, a sense of security and safety replaces the current sense of fear and vulnerability to infection. It is noteworthy that, at the beginning of the pandemic, the WHO warned about face mask use when or where has no indication, as it can cause neglect the other protective measures such as hand washing and physical distancing practices due to a false sense of security [44, 45]. This countermeasure has been stated in various terms, such as the Peltzman effect or risk compensation, a phenomenon that can also occur in people vaccinated with the SARS-CoV-2 vaccine [45-47]. The risk compensation theory states that a drop in perceived risk caused by access to prevention techniques and measures may increase risky behaviors.

Influenza activity is expected to increase in the next flu season due to decreased implementation of COVID-19 measures. Since the Influenza virus is the most common secondary pathogen found in patients with COVID-19, there is also concern that the national healthcare system may be overwhelmed by the co-circulation of COVID-19 and the influenza virus [20].

By introducing several effective vaccines against COVID-19 infection, the risk of unintended consequences includes a reduction in adherence of the population to NPIs such as hand hygiene, wearing masks, social/physical distance, limiting mass gatherings, and adherence to quarantine protocols. Compliance with NPIs can be reduced if people need less protection or if rules and guidelines lose their vital importance because more attention and hope is being paid to the vaccine. These factors can change by social condition, time, and place. The results of an interesting study showed that within 48 hours of receiving the flu vaccine, subjects were exposed to other humans about twice as much as 48 hours before the vaccine was given. Participants were una-

ware of any change in their behaviour and level of social interaction. Social behaviour increased two days after vaccination compared to the same time before vaccination. The number of people each person dealt with within 48 hours increased from 54 to 101. The average number of people in the communities in which the subjects participated increased significantly from 2.4 to 5.5 [48]. The fact that both COVID-19 and flu are circulating every fall and winter simultaneously and the development of the SARS-CoV-2 vaccine may increase the behavioural changes and non-compliance with the NPIs, coverage and uptake of influenza vaccine is even more critical than usual. Data from some epidemiological surveys show that crude cumulative incidence of COVID-19 infection was higher among people who received only one/first dose of vaccine compared to unvaccinated individuals and among persons who injected two doses of vaccine during the study period [49-52]. Evaluation of other vaccines, such as influenza and Lyme disease, also proposed the possibility of a rebound in risk-taking by receiving the vaccine [48, 53].

Influenza vaccine intake was relatively stable during the first influenza season along with the COVID-19 pandemic. In contrast, the adult influenza vaccine uptake decreased after the widespread availability of the COVID-19 vaccine (the 2021-202 season). During the 2020-2021 and 2021-2022 flu season, vaccine uptake in children decreased evenly but remained stable in the elderly regardless of Covid-19 immunization uptake [54].

In addition, by increasing the speed and rate of vaccination and the number of vaccinated people from a limited perspective and lack of specialized knowledge, people will feel misled security by imagining the creation of herd immunity long before it was established [47, 55]. Studies showed the most significant impact of risk compensation is on interventions whose continued implementation causes disruption or inconvenience to people or its effect is quite apparent. As lockdown and office closures are intrusive and conspicuous while wearing a mask and maintaining social distance in public places is not very annoying, their effects are visible [56]; they can be implemented and adhered to for a more extended period.

An increase in the number and variety of travelling locations often increases the risk of exposure to factors that can affect a person's health. Mainly, visiting certain places as well as hospitals, schools, or mass gathering events during an epidemic (such as COVID-19 and the flu) often puts a person at higher risk for exposure and transmission of infection [57]. The effectiveness of influenza and other vaccines is not 100%, and the flu vaccine is estimated to be about 50% (ranging from 25-60%) effective [58]. Also, some public health emergencies like the current pandemic have a declining impact on vaccine uptake and coverage for a wide range of infectious diseases, causing the risk of reemerging ancient Vaccine-Preventable Diseases (VPDs) diseases tend to increase [21]. A study on the challenges of distributing COVID-19 vaccinations reported that health care workers (HCWs) influenza vaccine uptake was low in some regions, even at 37%. As COVID-19 has contributed to excess deaths and waiting lists, similar concerns arise if staff are diverted to the vaccine drive [59]. Next fall/winter may not be so fortunate for health systems as the demand for health care systems is expected to far outweigh the need for health care during the flu season of the past few seasons [18]. The effectiveness of different vaccine platforms and their uptake/coverage rate is the main contributor to determining the real-world effects of an influenza vaccination strategy [60]. Despite the lack of accurate data on the effectiveness of vaccines in real life, studies show that influenza vaccines reduce the risk of infection in children and adults by 30% - 11% and 60%, respectively [58]. Seasonal influenza vaccination seems cost-effective, especially in children and the elderly; establishing compulsory vaccination for healthcare personnel in some regions had promising results [21]. Establishing and starting a vaccination program before the onset of flu cases in the community and continued vaccination during the fall and winter are crucial in determining the vaccine's effectiveness and benefits [61] (Table **1**).

CONCLUSION AND FUTURE OUTLOOK

To compensate for the problem of sustained behavioural changes and their stability during serious situations like pandemics or global disasters (that may last for an extended period), humans tend to adopt different coping mechanisms to deal with fatigue and apathy [62]. The seasonal influenza morbidity and mortality rate is directly related to the public health system's preparedness and responsiveness during a crisis. In this regard, emphasis should be placed on the two crucial infection prevention measures currently available: mass immunization by approved flu vaccines and continued maintenance of NPIs until community immunity or safety is established. The flu vaccine can be injected simultaneously, before or after the currently available COVID-19 vaccines [61, 63]. Even though the flu vaccine is not as effective as the COVID vaccine, it is still effective at preventing severe diseases and more effective than not.

Because of the intervention of many known and unknown factors in determining the fate of the upcoming influenza season, we can't say what the coming flu season will look like next year. Historically, several infections put the health care system under a lot of pressure every autumn and winter, making it critical that our hospitals are prepared as possible for unforeseen circumstances; obviously, we should be prepared for the worst-case scenario. Although vaccines and vaccination is the most important human achievement in controlling infectious diseases and rapid development of COVID-19 vaccines indicates a remarkable advancement in science. But evidence suggests that in addition to extensive vaccination, health measures must be taken to control both influenza seasons and the COVID-19 pandemic.

The last year was the field of the encounter between influenza season and the COVID-19 pandemic and its preventive measures in the absence of vaccination. Also, the upcoming fall and winter will be the arena for collision between the results and possible complications of COVID-19 vaccine discovery and development and seasonal influenza. This study briefly lists the concerns and ambiguities about the upcoming flu season. It highlights the expected benefits of implementing COVID-19 control measures, especially in significantly reducing the burden of influenza infection in the past season. Until determination of the fate of the inter-

Table 1. Barriers to influenza vaccination uptake.

Barrier	Causes	Strategies to resolve
Low vaccine coverage	*1-* Misinformation *2-* Fear of getting COVID-19 *3-* Belief in the ineffectiveness of the vaccine *4-* Vaccine shortage	*1- Coadministration of COVID and influenza vaccines to eligible persons during the same general practice or pharmacy visit* *2- Broadening of eligibility criteria* *3- Population education*
Logistics and distribution issues	*1-* The economic problem of governments *2-* resource shift to COVID-19 pandemic control	*1- Proper Funding* *2- Supply chain management* *3- Coordination between the health care systems, manufacturers, distributors, and individual providers*
Vaccine hesitancy	*1-* Misinformation *2-* Pandemic fatigue *3-* Fear of getting COVID-19 *4-* Belief in the ineffectiveness of the vaccine *5-* Fear of vaccine side effects	*1- Public outreach and communication* *2- campaigns* *3- Working with community leaders to disseminate factual information and educational materials* *4- Population education*
Concerns about vaccine effectiveness	*1-* Misinformation	*1- Public outreach and communication* *2- campaigns* *3- Working with community leaders to disseminate factual information and educational materials* *4- Population education*
Concerns about vaccine safety	*1-* Misinformation *2-* Fear of getting COVID-19 *3-* Fear of vaccine side effects	*1- multimedia* *2- Population education* *3- campaigns*

action between COVID-19 vaccination in the past months and flu season in the coming days, nonpharmaceutical protection measures, such as hand hygiene and social-physical distancing, are the interventions that can be continued with the lowest cost. In addition to strict vaccination recommendations for influenza, ensuring routine childhood vaccination and pneumococcal and pertussis immunization for elderly and pregnant women is equally important.

LIST OF ABBREVIATIONS

COVID-19 = Coronavirus Disease 2019

SARS-CoV-2 = Severe Acute Respiratory Syndrome Coronavirus 2

VPDs = Vaccine-Preventable Diseases

CONSENT FOR PUBLICATION

Not applicable.

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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