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Review Article

A Critical Glance to Non-Pharmacological Management of Novel COVID-19 Infection

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ABSTRACT

Our study aim was to enhance awareness about the management of COVID-19 infection. Human health and way of life have been severely disrupted by corona virus disease-19 (COVID-19), a severe global public health emergency. While vaccines and cures are still being developed, the pandemic is still spreading. The main tools used to combat the COVID-19 infection are known as non-pharmacological interventions (NPIs), which have an impact on almost every aspect of social functioning. This review concentrated on identifying successful NPIs. Effective NPIs include isolation and quarantine, physical separation, and good hand hygiene. They should also be put into practice in light of the socioeconomic and cultural makeup of the population. UV light and public spraying of the outdoors are examples of ineffective NPIs. The optimum way to apply these measures is to apply them simultaneously or in combination. According to the findings, they have to be implemented early in the pandemic and for extended periods. The least amount of morbidity and mortality was achieved when vaccination was paired with strict NPI adherence. It has also been noticed that closing schools only work to contain COVID-19 when it is combined with thorough contact tracking. Determining how limiting NPIs will affect the number of cases and the categorization of COVID-19-related deaths is difficult. The design of the evidence for hygiene precautions like face masks is more solid and offers reliable information on COVID-19 infection prevention. These findings provide proof to support policy decisions about NPIs to prevent the COVID-19 pandemic from spreading.

INTRODUCTION

Nearly 250 million confirmed cases and 5 million deaths associated with SARS-CoV-2 infection have been reported globally as of November 2021 [1]. To stop the pandemic, numerous non-pharmacological interventions (NPIs) were used worldwide [1, 2]. NPIS was advised for usage in influenza pandemics at any degree of severity by the World Health Organization (WHO), which included hand washing, face masks for symptomatic and asymptomatic people, isolation of ill people, travel guidance, and surface or object cleaning [2]. School closures and the public wearing face masks are advised as additional measures when the severity is high [3]. In the event of symptomatic individuals isolating themselves, we predicted that these interventions would have an impact on the frequency of interpersonal interaction as well as the relative infectiousness of those who are clinically ill (but not those who are preclinically or sub clinically infected). Based on survey information gathered in Great Britain in 2006, distinct contact matrices were created for encounters made at home, at work, at school, and in other situations

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(such as leisure, transportation, and other places)[4]. Even if people do not exhibit any symptoms, practicing social distancing in both indoor and outdoor settings is crucial to prevent the spread of COVID-19. It is vital to note the distinction between quarantine and isolation, even if the public press frequently uses the terms interchangeably. While isolation is appropriate for someone who has been diagnosed with the virus, quarantine keeps someone who may have been exposed to the virus away from other people. Self-quarantine and self-isolation, as the terms are used, can take place at the person's house [5]. The participants who always wore masks, practiced social distancing and used hand sanitizer or hand washing were represented by 47.1%, 37.8%, and 68.8%, respectively. Only less than 10% of the population does not follow non-pharmacological therapies [6]. These combined therapies have been demonstrated to be beneficial and have an enormous impact on reducing the transmission of the disease, preventing the collapse of the healthcare system, and preventing death as shown in figure 1.

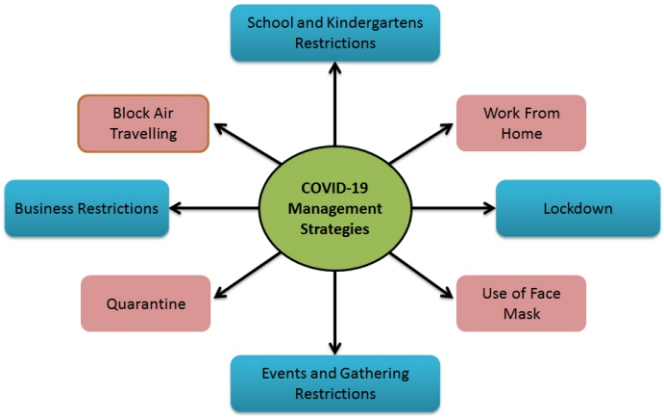

Figure 1: Elaborating the non-pharmacological management of COVID-19 infection

Restriction on school and kindergartens

Both observational and modeling studies have demonstrated that school closure can reduce the rate of seasonal influenza transmission [7]. However, for COVID-19, children and adults both have assault rates. Therefore, it is unknown if closing schools would reduce the transmission, given that most children with COVID-19 either experience moderate symptoms or show no symptoms at all [8]. Contrarily, a study conducted in the USA found that closure was linked to a considerable drop in SARS-CoV-2 circulation and associated clinical issues [9]. The opening of schools for specific grade levels, staggered timetables, an alternation between remote and on-site teaching modes, limiting class sizes, improved hand hygiene, wearing face masks, keeping distance from people, ventilation of rooms, as well as respiratory etiquette and policies for sick students and staff to stay at home, were among the non-pharmaceutical interventions and hygiene measures implemented after the reopening of schools [10]. Students from low-income families sometimes lack the financial means to purchase necessary infection prevention and control (IPC) supplies like face masks and hand sanitizers [11]. For instance, the government of Uganda has promised to give all residents older than six years old free masks [12]. The spread of numerous infections in these facilities would be significantly, positively, and over time reduced in all school restrooms and hand washing locations with enough soap dispensers and paper towels [13]. In Australia, testing of contacts linked to 12 children and 15 adults in 15 schools (students aged six and older) and ten kindergartens/nurseries (students aged six weeks to 5 years) revealed an attack rate of 0.3% between children, 1% between children and adults, 1.5% between adults and children, and 4.4% between adults and adults. Out of 35 contact cases, only one suffered an epidemic, which resulted in six adults and seven children getting sick [1]. Greater community transmission, inadequate physical separation, poor ventilation, and a lack of masking are all linked to larger school epidemics. Schools that used transmission mitigation strategies (even in European nations) do not appear to have significantly increased the virus's ability to spread within the surrounding area [14]. School closures have major negative consequences, including harm to children's learning and mental health, a heavy load on parents, and decreased economic productivity, even though they may help control the epidemic [15]. However, many schools have continued to impose food prohibitions, either voluntarily or due to accommodations made under the federal disability statute, in response to requests from parents of children with food allergies and to avoid spreading infection [16].

Businesses restrictions

Business closures result in job losses and economic damage, which may therefore harm health. Almost all states have restricted or shut down the functioning of establishments like bars, restaurants, theatres, gyms, and shopping centers [17]. From March 14 to August 8, 2020, over 52 million Americans filed unemployment insurance claims. As of August 22, 2020, more than 15 million Americans filed for Pandemic Unemployment Assistance, which is available to workers in the unorganized sector who are self-employed, looking for part-time work, or otherwise would not be eligible for regular unemployment compensation [18]. Ontario initially generated a binary variable to represent whether non-essential firms were closed on each day of the timeline owing to limitations before constructing the business closure variable [19]. Due to the decline in demand, disruptions in the supply chain,

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and production slowdowns brought on by unsafe workplaces, the COVID-19 pandemic has presented small businesses and their owners with hitherto unheard-of obstacles [20]. Small firms are the most vulnerable in Russia, especially those in the service industry, where the danger of "contact" infection is greatest [21]. The impact of company closings on the COVID-19 fatalities in Italy. They compile a sizable dataset from 222 local labor markets across 4,000 Italian towns. The percentage of employees who are not performing any critical tasks as a result of COVID-19 is how they define a business shutdown. Additional controls include factors like the percentage of women of working age, the percentage of high school graduates, and population density. According to their research, business closure, particularly in the retail and hotel industries, dramatically lowers the COVID-19 death rate. The outcomes also show that implementing closure limitations one week sooner could prevent 25% of the fatalities in Italy [22]. The workers whose jobs could not be performed remotely (e.g., by working from home) may have suffered disproportionate employment and health losses as a result of the COVID-19 epidemic. In non-remote jobs, it is more difficult to avoid social contact [23]. According to statistics, 75% of companies without a continuity strategy fail three years after a tragedy or crisis [24].

Restriction on events and gatherings

The COVID-19 pandemic has had a significant effect on the events sector [25]. Canceling public activities is the most efficient sort of containment technique for reducing COVID-19 infections and has the least negative effects on the economy [26]. According to many super-spreading occurrences, including the Austrian ski resort of Ischgl, the number of confirmed cases soon doubled globally. Through community transmission, the infection rate increased from there, and by April 15, confirmed cases had surpassed 2 million (with over 125,000 deaths) in more than 200 countries [27]. The almost 10 million Muslims who congregate in Makkah and Medina during the Umrah and Hajj seasons are anticipated to have an impact on the epidemiology of respiratory viruses in KSA [28]. In June 2020, Saudi Arabia declared that it would ban foreign travelers for the 2020 Hajj pilgrimage to Mecca and the domestic population with chronic ailments and those 65 years of age and older to contain the COVID-19 pandemic and prevent super spreader events [29]. In general, many factors, such as the type of event and anticipated size, duration, and spatial distribution; expected origin and recent travel patterns of participants; level of infectious disease activity or pressure in the host country at the time of the event; level of public attention; and event-related activities during, before, and after the event, may have an impact on the risk of disease spreading and outbreaks during an event [30]. The definition of MG events includes public and private celebrations, religious meetings and pilgrimages, sporting and tourism events, political events, and festivals. Travel and movement patterns on a local, national, or international scale linked to MGs may worsen the spread of infectious diseases in a variety of geographic situations [31]. The Sri Petaling mass gathering, which took place from February 27 to March 1, 2020, is directly responsible for more than 35% of the COVID instances in Malaysia. More than 19,000 individuals, including 1500 visitors from India, South Korea, Brunei, China, Japan, and Thailand, are present at the Sri Petaling gathering, a Muslim missionary activity [32]. A community in Barnstable County, Massachusetts, hosted numerous summer activities and sizable public gatherings from July 3–17, 2021, drawing thousands of visitors from all around the country. On July 10, reports of a spike in COVID-19 cases among residents of or recent visitors to Barnstable County— including those who are fully immunized—were sent to the Massachusetts Department of Public Health (MA DPH). People with COVID-19 reported going to indoor and outdoor events that were quite crowded in places like pubs, restaurants, lodging facilities, and rental homes [33]. Scenarios aboard large cruise ships also fulfill the concept of mass gatherings because there are more people there than is typical in other settlements on land. With 2000 to 4000 passengers, large cruise ships like the Diamond Princess, which was quarantined in Japan owing to the COVID-19 epidemic, make it nearly impossible to maintain social distancing [34]. Since the beginning of March 2020, all significant sports leagues and competitions have been postponed or canceled because of COVID-19 [35]. The study on the Prevention of SARS-CoV-2 Transmission in a large Indoor Gathering (SPRING) trial was designed to test the hypothesis that a method that included medical mask use, systematic antigen screening within three days of the event, and optimized ventilation could stop SARS-CoV-2 from spreading during a sizable indoor gathering without requiring physical separation [36].

Restriction on movement of people or lockdown

Lockdown measures have helped the pandemic and have been successful in lowering the number of COVID-19 cases in the nations where they have been used. Looking at the European example in particular, its Effectiveness starts to lower COVID-19 infections about three weeks after the lockout and continues for another 20 days [37]. As a first step in containing the spread of the disease, the Indian government enforced the Janata Curfew for 24 hours. This was followed by a lockdown under the Disaster Management Act 2005 for 21 days beginning on March 24, 2020 [38]. The United Nations Educational, Scientific, and Cultural Organization (UNESCO) has calculated that 1.6

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billion (90.2%) students are currently not enrolled in primary, secondary, or tertiary education (henceforth schools) as a result of the global COVID-19 lockdown, with nationwide school closures currently in effect in 191 countries [39]. The limitation of inter-individual physical interaction is known as social lockdown. To avoid interaction with (asymptomatic) infected individuals in the outside world, it is advised not to leave the house [40]. The onset of COVID-19 was estimated to occur on December 4. Wuhan City and the major cities in Hubei, China, were put under lockdown on the 23rd and 24th of January, respectively [41]. On March 23, 2020, the province of Sindh in Pakistan ordered a lockdown, which was then followed by the other provinces and towns in the nation. Unquestionably, the pandemic-driven lockdown has resulted in significant losses on a global scale in terms of both money and lives, in addition to ongoing hardships and a wide range of challenges [42]. On March 23, the South African government ordered a rigorous lockdown that would last for three weeks, beginning on March 26. At that point, there were officially 554 positive cases but no fatalities [43]. Greece was the nation that implemented the COVID-19 lockdown at the earliest [44]. As a result, Greece had the third-lowest 30-day mortality rate per million people, trailing only Norway and Finland, which had made significant investments in the growth of their public health systems [45]. Numerous service sectors were severely impacted by the COVID-19 epidemic and the lockdown, with healthcare services being one of them. Following the lockdown, many locations closed their outpatient clinics, and patients with COVID-19 infections could only access emergency services or clinics designed explicitly for them [44]. The people stayed at home, which has resulted in a dramatic improvement in air quality over the past several months, especially in hard-hit locations like Wuhan, northern Italy, and many American metropolises [46]. A more extended period of total lockdown has unknown consequences for the number of people infected with COVID-19 and the number of fatalities. Comparing countries with different lockdown lengths, those with a shorter lockdown period (about 15 days) are related to lower average levels of confirmed cases per population (%) but with a higher average variation of confirmed cases per population (%) [47]. The issues relating to "long-covid" and other non-mortality expenditures that lockdown can minimize [48]. Global economic activity ceased as nations went into lockdown. Due to the lockdown, among many other industries, the transport industry has been hardest hit. Due to travel restrictions or reluctance, air and ground transit has ceased [49]. Since the lockdown that completely shut down all activity in response to the COVID-19 pandemic, anthropogenic air pollution has been seen to decrease. NO2 concentrations in eastern and central China at the beginning of 2020 were 10–30% lower than those in comparable periods in 2019, according to NASA Earth Observatory satellite data [50]. Lockdown procedures have caused extraordinarily pure air in urban areas in many parts of the world, and news is rife with accounts of exceptionally blue skies and excellent visibility [51]. The primary sources of carbon emissions are the use of fossil fuels by industry, thermal power plants, air travel, and vehicle traffic. Since industrial sectors were closed during the lockdown, the level of carbon concentration decreased [52].

Restriction on international air traveling

The fast expansion of cases throughout the world, notably in the United States, Europe, and Asian nations, was expedited by domestic and international human migration [53]. Affected the most by the advent of SARS-CoV-2/COVID-19 is the travel industry. Millions of people worldwide were impacted by the abrupt enactment of domestic and international travel prohibitions. In addition to travelers, airline firms also suffered a rapid decline in revenue. Travelers are thought to have spread COVID-19 cases throughout the world, mostly via air travel [54]. The results of Wuhan's travel ban and the international travel restrictions enacted by many nations in early February 2020 [55]. The United States government shut the border with Canada on March 18 and banned inbound planes from Europe (the Schengen Area) on March 14 [56]. Between January and June 2020, COVID-19 importations into Australia were reduced by 87.68% (83.39-91.35) as a result of international travel restrictions [57]. When travel restrictions were put in place for a group of 120 countries, three out of every four of those nations had more than 50 confirmed cases [58]. As countries apply limitations on international travel to stem the sudden spread of the novel Coronavirus disease 2019 or COVID-19, cross-border population mobility has largely ceased. More than 90% of the world's population, or over 7.1 billion people, will be living in nations that impose entry restrictions on travelers who are neither citizens nor residents as of March 31, 2020 [59]. The flight restrictions into and out of China have further decreased the quantity of exported cases [60]. When assuming no reduction in travel volumes (i.e., with 2019 travel volumes), imported cases are likely to have contributed more than 10% of total incidence in 102 (95% credible interval 63-129) of 136 countries in May 2020 and 74 countries (33-114) when assuming estimated 2020 travel volumes. When assuming no decreases in travel numbers, imported cases in September 2020 would have made up little more than 10% of overall incidence in 106 (50-140) of 162 countries and less than 1% in 21 countries (4-71) [61]. According to a study that evaluated the impact of human

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mobility and control measures in China, travel limitations are more helpful in the early stages of an outbreak before the disease spreads widely [62]. The importation of COVID-19 depends heavily on mass transportation (such as buses and trains). The frequency of buses, trains, and planes from affected cities is positively correlated with the importation of cases [63]. All travel arrangements, including tourist excursions departing from China (to other countries), were canceled, and non-urgent corporate travel for both inbound and outbound journeys was drastically limited [64]. The Chinese government's COVID-19 travel restriction rules, which included a complete ban on travel outside of the province, restricted the movement of more than five million people in Hubei Province, including during the 2020 Spring Festival [65]. Some nations have implemented travel restrictions akin to a cordon sanitaire, either to stop the spread of diseases from a primary disease epicenter (like Wuhan in January 2020) or both [66]. The travelers are required to abide by any safety precautions that are deemed necessary by the country of origin, the country of destination, and the transporter, particularly airlines. Concerning the possibility of SARS-CoV-2 transmission, there needs to be more clarity. Airlines take precautions against the danger of infection during flights or at the airport, including the use of filters, surveillance, and passenger testing. Governments implement policies like travel restrictions and quarantine to reduce the risk of bringing infectious passengers into the country from abroad or within [67]. In the 135 study nations or territories, we calculated that as of May 31, 2020, there were 15 million (IQR (11-20) million) COVID-19 cases undergoing travel and physical distancing therapies. By June 30, 2020, we predicted that 983 million (808-1169) infections would have been avoided and only 20 million (15-27) cases may have arisen if levels of travel and contact restrictions remained constant [68].

Work from home

Decreasing infection rates while working from home is immensely effective [69]. A home office is a very effective tool for lowering infection rates: Regions with fewer workers who can work from home due to the nature of their occupation and industry composition have seen higher COVID-19 infection rates and fatalities; the financial costs of confinement are also significantly higher in regions where a smaller percentage of jobs can be done in a home office [70]. The widespread use of WFH practices is shown in the US, where studies reveal that in May 2020, 35.2% of the workforce did so, up from 8.2% in February. Additionally, 71.7% of the workers whom WFH assessed could perform their jobs well [71]. The ability to work from home (WFH) has gained ample significance because it allows workers to continue earning a living, employers to continue providing services and income, and overall reduces the danger of virus spread and pandemic recessive effects [72]. In COVID-19, schools switched to online instruction. The change to online adoption of online learning and teachers' level of comfort with working in a virtual classroom are closely related [73].

Quarantine and self–isolation or physical distancing:

Twenty-four hours following the commencement of symptoms, self-isolation was put into place. Social distancing techniques include wearing masks, maintaining a safe distance from other people, and forbidding trips to hospitals or other facilities [74]. The pandemic curve has been flattened by governments all over the world issuing rules and directives to establish physical distance [75]. Physical separation is a key component of control strategies for COVID-19, although it is uncertain in which situations and for how long physical separation and contact are safe. Regulations that call for a fixed physical separation of 1 or 2 meters between people to minimize the spread of the COVID-19-causing virus SARS-CoV-2 are founded on an outmoded, binary understanding of respiratory droplet size [76]. Physical separation effectively halted the exponential spread of COVID-19 at its inception, avoiding the oversaturation of healthcare personnel and saving many lives, according to multiple studies [77]. Although strictness in policy interventions has gained widespread acceptance, there are differences in how governments respond to policies that call for phased implementation and a reduction in physical distance. Sweden moved quite slowly in its pursuit of voluntarily separating its populations physically. However, stricter guidelines for physical separation were implemented by countries like Germany, South Korea, and Hong Kong, among others [78]. With just over 6,000 confirmed cases as of March 23, the UK Government enacted stringent physical separation policies, ordering people to stay inside and refrain from leaving the house aside from necessary tasks, engage in one form of exercise each day, and purchase necessities like food and medications. This came after the previous week's cancellation of athletic events, schools, restaurants, pubs, gyms, and other places of entertainment or hospitality, as well as a rise in social isolation among the populace that had been going on for a few days before the announcement [79]. MMR vaccination numbers were 19.8% lower (95% CI: 20.7 to 18.9) in the first three weeks of physical separation in England compared to the same time in 2019 [80]. Physical distance can lower the pandemic's death toll. However, it can also come at a high cost to society, as evidenced by the US's sharp declines in GDP and employment in the months after physical distance measures were implemented. This shows that adjusting the degree and timing of physical distance constraints

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might result in significant benefits [81]. Even though physical distancing has significantly disrupted society and economies, it is essential to limit the resurgence in the absence of a viable vaccine [82]. The breathing and coughing simulations indicate a physical distance of 1-2 m to be effective when there is no wind. The physical distance suggestion of 2 m was shown to be ineffective when sneezing was present; rather, a distance of 2.8 m and larger was found to be more beneficial in lowering the exposure to respiratory droplets. In each case, the assessment of the ambient wind conditions called for a greater degree of physical separation. The advice for physical separation was changed from 2 meters to 4.5 meters or more in the situation where respiration was recorded with a soft wind, yielding a gap of 1.1 meters. It was thought to be unhealthy to sneeze when there was a light breeze [83]. The term "self-quarantine" refers to the prohibition on travel for those who are deemed to have been exposed to a contagious disease but are not ill, either because they did not contract the illness or because it is still in the incubation period, which is generally 6.4 days but can range from 2.1 to 11.1 days [84]. A worsened COVID-19 prognosis might result from weight gain via COVID-19 self-quarantine [85]. Being in quarantine is frequently a miserable experience since it can have negative impacts on one's independence, health, and level of boredom. The potential advantages of mandated mass quarantine must be carefully evaluated against any potential long-term detrimental consequences for the burden of cardiovascular risk [86]. Additionally, it might be unpleasant to hear or read about the epidemic nonstop while under quarantine. As a result, stress causes people to overeat, usually turning to sweet "comfort foods [87].

Use of face masks

Face masks are now routinely used in China and other Asian nations, including South Korea and Japan, following the emergence of the Coronavirus disease 2019 (COVID-19), also known as the severe acute respiratory syndrome Coronavirus 2 (SARS-CoV-2). In several Chinese provinces and towns, wearing a face mask in public is required [88]. Many specialists cautioned against the general population using facemasks at the start of the pandemic because they believed that there would be hazards associated with doing so, such as the possibility of self-contamination, that outweighed any possible advantages and that widespread usage would deplete the supply needed for healthcare personnel. Then, experts changed their perspective on the possible advantages of masks to include safeguarding people against SARS-CoV-2 infection (source control), much like surgical masks safeguard patients in operating rooms [89]. The use of masks to reduce the transmission of illness has been the subject of several investigations by various academics, technicians, and scientists. The light-scattering experiment is one such investigation that was conducted by scientists from the National Institutes of Health (NIH). In this experiment, researchers illuminated the droplets using lasers and counted them. They also counted the quantities of spit droplets released into the air by people wearing and not wearing face masks [90]. This study shows how the virus spreads through droplets. The fact that a piece of fabric is obstructing the drops is obvious. About half of COVID-19 is spread by people who have no symptoms and are unaware that they are ill. According to this study, COVID-19 can be transmitted by asymptomatic and pre-symptomatic people. These studies highlight the fact that people can spread the virus before they even feel unwell and that donning a mask in public may prevent an infected person from dispersing contagious droplets. The epidemic had an especially big impact on face-to-face contact. Face masks were required as a vital precaution to stop the virus's transmission, but this had a significant negative impact on how people interacted with one another. Facial expressions and gestures greatly aid the conveyance of desired messages and interpersonal communication. Face masks reduced the effect of conveyed content because they made it harder to observe and comprehend others' facial expressions during interactions [91]. Under tidal breathing and coughing situations, medical masks were potentially very successful as both source control and primary prevention in manikin experiments, with better grade masks (such as an N95 respirator vs. a surgical mask) providing more protection [92]. According to research, masks serve two crucial purposes. First, they reduce the amount of quick, turbulent aerosol jets that are directed at people or the environment by preventing the creation of gas clouds during coughing and sneezing. Second, the aerosol is filtered by the layer in the mask, which keeps it from reaching the nasopharynx [93]. When persons are unable to maintain a distance of two meters between them or when they are in an enclosed environment, the Department of Health suggests the use of a cloth face covering and releases patterns so that anyone may make face masks at home and utilize them [94]. A surgical mask is intended to be used just once. Consider the circumstances of usage and integrity, and replace it as soon as it gets wet and no later than every 4 hours at most. The CE (Conformity Europe) certification is required for surgical mask packaging [95]. Regardless of the COVID-19 epidemic, individuals in Japan have a cultural tradition of using surgical masks. Every day, many individuals in Japan use medical masks, especially when the flu is prevalent [96].

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Personnel hygiene

In a medical context, hand hygiene, which includes washing hands with soap and water or using alcohol-based hand sanitizers, is widely acknowledged as the cornerstone of infection control [97]. It is crucial to practice good hand hygiene, and one of the finest suggestions from the WHO is too often wash and sanitize your hands with soap or >60% alcoholic hand sanitizer, respectively. To sensitize hands and lessen coronavirus dissemination and infectivity, which recommended two alcohol-based formulations for hand hygiene in healthcare [98]. When compared to conventional soaps, the use of antibacterial hand soaps results in a quicker decrease in the number of microorganisms. Additionally, alcohol-based sanitizers limit the spread of viruses by precipitating the coronavirus surface proteins that break the chain of transmission. The WHO also advises healthcare workers (HCWs) to use gloves when providing direct patient care during the COVID-19 pandemic. Various polymers, such as latex, nitrile rubber, polyvinyl chloride, polyurethane, and neoprene, are used to make medical gloves [99]. Even in the absence of a worldwide pandemic, the danger of contacting surfaces or items that might recontaminate hands after hand rubbing or washing is often disregarded. This is true whether gloves are used or not. During this pandemic, infection control is crucial, and preventing hand recontamination is crucial to maintaining the safety of patients and HCWs at all times [100].

CONCLUSIONS

In this review paper, we discovered that school closures were the most successful NPIs for preventing the spread of COVID-19, followed by workplace closures, company and venue closures, and public event prohibitions. The number of COVID-19 instances and fatalities can be decreased with an immediate response and a combination of particular social isolation techniques. At the individual level, hygiene precautions like wearing a face mask seem more successful at preventing infection spread. Mass vaccination to achieve herd immunity represents the only long-term intervention to keep illness and mortality rates low because the adverse socioeconomic effects of limiting NPIs at the community level are ultimately unsustainable. Even after receiving the immunization, wearing a face mask is still recommended for personal protection against COVID-19. To adjust decision-making, NPI effectiveness must be continuously monitored.

Authors Contribution

Conceptualization: AS, SM, AQ
Writing-review and editing: MD, SR, AQ, MNA

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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REFERENCES

[1] Macartney K, Quinn HE, Pillsbury AJ, Koirala A, Deng L, Winkler N, *et al*. Transmission of SARS-CoV-2 in Australian educational settings: a prospective cohort study. The Lancet Child & Adolescent Health. 2020 Nov; 4(11): 807-16. doi: 10.1016/S2352-4642(20)30251-0.

[2] Lordan R, FitzGerald GA, Grosser T. Reopening schools during COVID-19. Science. 2020 Sep; 369(6508): 1146-. doi: 10.1126/science.abe5765.

[3] Yuan P, Aruffo E, Gatov E, Tan Y, Li Q, Ogden N, *et al*. School and community reopening during the COVID-19 pandemic: a mathematical modelling study. Royal Society Open Science. 2022 Feb; 9(2): 211883. doi: 10.1098/rsos.211883.

[4] Starr M. Back to school: safe for children with underlying medical conditions. Australian Journal of General Practice. 2020 May; 49(21):1-2. doi: 10.31128/AJGP-COVID-21.

[5] Hirt J, Janiaud P, Hemkens LG. Randomized trials on non-pharmaceutical interventions for COVID-19: a scoping review. BMJ Evidence-Based Medicine. 2022 Dec; 27(6): 334-44. doi: 10.1136/bmjebm-2021-111825.

[6] World Health Organization. Non-pharmaceutical public health measures for mitigating the risk and impact of epidemic and pandemic influenza: annex: report of systematic literature reviews. World Health Organization. 2019. Available at: https://apps.who.int/iris/bitstream/handle/10665/329439/WHO-WHE-IHM-GIP-2019.1-eng.pdf.

[7] Copeland DL, Basurto-Davila R, Chung W, Kurian A, Fishbein DB, Szymanowski P, *et al*. Effectiveness of a school district closure for pandemic influenza A (H1N1) on acute respiratory illnesses in the community: a natural experiment. Clinical Infectious Diseases. 2013 Feb; 56(4): 509-16. doi: 10.1093/cid/cis890.

[8] Esposito S, Cotugno N, Principi N. Comprehensive and safe school strategy during COVID-19 pandemic. Italian Journal of Pediatrics. 2021 Jan; 47(1). doi: 10.1186/s13052-021-00960-6.

[9] Chaabane S, Doraiswamy S, Chaabna K, Mamtani R, Cheema S. The impact of COVID-19 school closure on child and adolescent health: a rapid systematic review. Children. 2021 May; 8(5): 415. doi: 10.3390/children8050415.

DOI: https://doi.org/10.54393/pjhs.v4i11.821

[10] Lo Moro G, Sinigaglia T, Bert F, Savatteri A, Gualano MR, Siliquini R. Reopening schools during the COVID-19 pandemic: Overview and rapid systematic review of guidelines and recommendations on preventive measures and the management of cases. International Journal Of Environmental Research And Public Health. 2020 Dec; 17(23): 8839. doi: 10.3390/ijerph17238839.

[11] Walker PGT, Whittaker C, Watson OJ, Baguelin M, Winskill P, Hamlet A, *et al*. The impact of COVID-19 and strategies for mitigation and suppression in low- and middle-income countries. Science. 2020 Jul; 369(6502): 413-22. doi: 10.1126/science.abc0035.

[12] Sikakulya FK, Ssebuufu R, Mambo SB, Pius T, Kabanyoro A, Kamahoro E, *et al*. Use of face masks to limit the spread of the COVID-19 among western Ugandans: Knowledge, attitude and practices. PLoS One. 2021 Mar; 16(3): e0248706. doi: 10.1371/journal.pone.0248706.

[13] Vardoulakis S, Oyarce DA, Donner E. Transmission of COVID-19 and other infectious diseases in public washrooms: A systematic review. Science of The Total Environment. 2022 Jan; 803: 149932. doi: 10.1016/j.scitotenv.2021.149932.

[14] World Health Organization WHO. Key messages and actions for COVID-19 prevention and control in schools. 2020. [Last Cited: 12th Jun 2023]. Available at: https://www.who.int/docs/default-source/coronaviruse/key-messages-and-actions-for-covid-19-prevention-and-control-in-schools-march-2020.pdf.

[15] Kumar V, Alshazly H, Idris SA, Bourouis S. Evaluating the impact of covid-19 on society, environment, economy, and education. Sustainability. 2021 Dec; 13(24): 13642. doi: 10.3390/su132413642.

[16] Walger P, Heininger U, Knuf M, Exner M, Popp W, Fischbach T, *et al*. Children and adolescents in the CoVid-19 pandemic: Schools and daycare centers are to be opened again without restrictions. The protection of teachers, educators, carers and parents and the general hygiene rules do not conflict with this. GMS Hygiene and Infection Control. 2020 Dec; 15: 1-18.

[17] Gostin LO and Wiley LF. Governmental public health powers during the COVID-19 pandemic: stay-at-home orders, business closures, and travel restrictions. Jama. 2020 Jun; 323(21): 2137-8. doi: 10.1001/jama.2020.5460.

[18] Song H, McKenna R, Chen AT, David G, Smith-McLallen A. The impact of the non-essential business closure policy on Covid-19 infection rates. International Journal of Health Economics and Management. 2021 Dec; 21: 1-40. doi: 10.3386/w28374.

[19] Chum A, Nielsen A, Bellows Z, Farrell E, Durette PN, Banda JM, *et al*. Changes in public response associated with various COVID-19 restrictions in Ontario, Canada: observational infoveillance study using social media time series data. Journal of Medical Internet Research. 2021 Aug; 23(8): e28716. doi: 10.2196/28716.

[20] Kim OS, Parker JA, Schoar A. Revenue collapses and the consumption of small business owners in the early stages of the COVID-19 pandemic. National Bureau of Economic Research. 2020 Nov: 1-56. doi: 10.3386/w28151.

[21] Tkach DV, Kurpayanidi KI. Some Questions About The Impact Of The Covid-19 Pandemic On The Development Of Business Entities. Theoretical & Applied Science. 2020 Nov; 11(91): 1-4. doi: 10.15863/TAS.2020.11.91.1.

[22] Zamanzadeh A and Cavoli T. The effect of nonpharmaceutical interventions on COVID-19 infections for lower and middle-income countries: A debiased LASSO approach. PLoS One. 2022 Jul; 17(7): e0271586. doi: 10.1371/journal.pone.0271586.

[23] Angelucci M, Angrisani M, Bennett DM, Kapteyn A, Schaner SG. Remote work and the heterogeneous impact of COVID-19 on employment and health. National Bureau of Economic Research; 2020 Aug: 1-34. doi: 10.3386/w27749.

[24] Fabeil NF, Pazim KH, Langgat J. The impact of Covid-19 pandemic crisis on micro-enterprises: Entrepreneurs' perspective on business continuity and recovery strategy. Journal of Economics and Business. 2020 May 28;3(2): 1-9. doi: 10.31014/aior.1992.03.02.241.

[25] Janiszewska D, Hannevik Lien V, Kloskowski D, Ossowska L, Dragin-Jensen C, Strzelecka M, *et al*. Effects of COVID-19 infection control measures on the festival and event sector in Poland and Norway. Sustainability. 2021 Nov; 13(23): 13265. doi: 10.3390/su132313265.

[26] Deb P, Furceri D, Ostry JD, Tawk N. The economic effects of COVID-19 containment measures. Open Economies Review. 2022 Feb; 33(1): 1-32. doi: 10.1007/s11079-021-09638-2.

[27] Gössling S, Scott D, Hall CM. Pandemics, tourism and global change: a rapid assessment of COVID-19. Journal of Sustainable Tourism. 2020 Oct; 29(1): 1-20. doi: 10.1080/09669582.2020.1758708.

[28] Hoang VT, Gautret P, Memish ZA, Al-Tawfiq JA. Hajj and Umrah mass gatherings and COVID-19 infection. Current Tropical Medicine Reports. 2020 Dec; 7: 133-

DOI: https://doi.org/10.54393/pjhs.v4i11.821

40. doi: 10.1007/s40475-020-00218-x.
[29] Memish ZA, Ahmed Y, Alqahtani SA, Ebrahim SH. Pausing superspreader events for COVID-19 mitigation: International Hajj pilgrimage cancellation. Travel Medicine and Infectious Disease. 2020 Jul; 36: 101817. doi: 10.1016/j.tmaid.2020.101817.
[30] Heese H, Marquis A, Diercke M, Markus I, Böhm S, Metz J, *et al*. Results of the enhanced COVID-19 surveillance during UEFA EURO 2020 in Germany. Epidemiology & Infection. 2022 Mar; 150:1-. doi: 10.1017/S0950268822000449.
[31] Alahmari AA, Khan AA, Alamri FA, Almuzaini YS, Habash AK, Jokhdar H. Healthcare policies, precautionary measures and outcomes of mass gathering events in the era of COVID-19 pandemic: Expedited review. Journal of Infection and Public Health. 2023 Mar: 1-7. doi: 10.1016/j.jiph.2023.03.026.
[32] Che Mat NF, Edinur HA, Abdul Razab MK, Safuan S. A single mass gathering resulted in massive transmission of COVID-19 infections in Malaysia with further international spread. Journal of Travel Medicine. 2020 Apr; 27(3): taaa059. doi: 10.1093/jtm/taaa059.
[33] Brown CM, Vostok J, Johnson H, Burns M, Gharpure R, Sami S, *et al*. Outbreak of SARS-CoV-2 infections, including COVID-19 vaccine breakthrough infections, associated with large public gatherings—Barnstable County, Massachusetts, July 2021. Morbidity and Mortality Weekly Report. 2021 Aug; 70(31): 1059. doi: 10.15585/mmwr.mm7031e2.
[34] Ebrahim SH and Memish ZA. COVID-19–the role of mass gatherings. Travel Medicine and Infectious Disease. 2020 Mar; 34: 101617. doi: 10.1016/j.tmaid.2020.101617.
[35] Toresdahl BG and Asif IM. Coronavirus Disease 2019 (COVID-19): Considerations for the Competitive Athlete. Sports Health. 2020 May; 12(3): 221-4. doi: 10.1177/1941738120918876.
[36] Delaugerre C, Foissac F, Abdoul H, Masson G, Choupeaux L, Dufour E, *et al*. Prevention of SARS-CoV-2 transmission during a large, live, indoor gathering (SPRING): a non-inferiority, randomised, controlled trial. The Lancet Infectious Diseases. 2022 Mar; 22(3): 341-8. doi: 10.1016/S1473-3099(21)00673-3.
[37] Alfano V and Ercolano S. The efficacy of lockdown against COVID-19: a cross-country panel analysis. Applied Health Economics and Health Policy. 2020 Aug; 18: 509-17. doi: 10.1007/s40258-020-00596-3.
[38] Ambikapathy B and Krishnamurthy K. Mathematical modelling to assess the impact of lockdown on COVID-19 transmission in India: Model development and validation. JMIR Public Health and Surveillance. 2020 May; 6(2): e19368. doi: 10.2196/19368.
[39] Sheikh A, Sheikh A, Sheikh Z, Dhami S. Reopening schools after the COVID-19 lockdown. Journal of Global Health. 2020 Jun; 10(1): 010376. doi: 10.7189/jogh.10.010376.
[40] Paital B, Das K, Parida SK. Inter nation social lockdown versus medical care against COVID-19, a mild environmental insight with special reference to India. Science of the Total Environment. 2020 Aug;728: 138914. doi: 10.1016/j.scitotenv.2020.138914.
[41] Lau H, Khosrawipour V, Kocbach P, Mikolajczyk A, Schubert J, Bania J, *et al*. The positive impact of lockdown in Wuhan on containing the COVID-19 outbreak in China. Journal of travel medicine. 2020 May; 27(3): 1-7. doi: 10.1093/jtm/taaa037.
[42] Ali G, Abbas S, Qamer FM, Wong MS, Rasul G, Irteza SM, *et al*. Environmental impacts of shifts in energy, emissions, and urban heat island during the COVID-19 lockdown across Pakistan. Journal of Cleaner Production. 2021 Apr; 291: 125806. doi: 10.1016/j.jclepro.2021.125806.
[43] Stiegler N and Bouchard JP. South Africa: Challenges and successes of the COVID-19 lockdown. InAnnales Médico-psychologiques, revue psychiatrique. Elsevier Masson. 2020 Sep; 178(7): 695-8. doi: 10.1016/j.amp.2020.05.006.
[44] Moris D and Schizas D. Lockdown during COVID-19: the Greek success. in vivo. 2020 Jun; 34(3 suppl): 1695-9. doi: 10.21873/invivo.11963.
[45] Grover S, Mehra A, Sahoo S, Avasthi A, Tripathi A, D'Souza A, *et al*. State of mental health services in various training centers in India during the lockdown and COVID-19 pandemic. Indian Journal of Psychiatry. 2020 Jul; 62(4): 363. doi: 10.4103/psychiatry.IndianJPsychiatry_567_20.
[46] Khan I, Shah D, Shah SS. COVID-19 pandemic and its positive impacts on environment: an updated review. International Journal of Environmental Science and Technology. 2021 Feb; 18: 521-30. doi: 10.1007/s13762-020-03021-3.
[47] Coccia M. The relation between length of lockdown, numbers of infected people and deaths of Covid-19, and economic growth of countries: Lessons learned to cope with future pandemics similar to Covid-19 and to constrain the deterioration of economic system. Science of The Total Environment. 2021 Jun; 775: 145801. doi: 10.1016/j.scitotenv.2021.145801.
[48] Allen DW. Covid-19 lockdown cost/benefits: A critical assessment of the literature. International Journal of the Economics of Business. 2022 Jan; 29(1): 1-32. doi:

DOI: https://doi.org/10.54393/pjhs.v4i11.821

10.1080/13571516.2021.1976051.

[49] Muhammad S, Long X, Salman M. COVID-19 pandemic and environmental pollution: A blessing in disguise?. Science of the Total Environment. 2020 Aug; 728: 138820. doi: 10.1016/j.scitotenv.2020.138820.

[50] Vultaggio M, Varrica D, Alaimo MG. Impact on air quality of the covid-19 lockdown in the urban area of palermo (Italy). International Journal of Environmental Research and Public Health. 2020 Oct; 17(20): 7375.0 doi: 10.3390/ijerph17207375.

[51] Baldasano JM. COVID-19 lockdown effects on air quality by NO2 in the cities of Barcelona and Madrid (Spain). Science of the Total Environment. 2020 Nov; 741: 140353. doi: 10.1016/j.scitotenv.2020.140353.

[52] Mzoughi H, Urom C, Uddin GS, Guesmi K. The effects of COVID-19 pandemic on oil prices, CO 2 emissions and the stock market: Evidence from a VAR model. 2020 Apr: 1-8. doi: 10.2139/ssrn.3587906.

[53] Murano Y, Ueno R, Shi S, Kawashima T, Tanoue Y, Tanaka S, *et al*. Impact of domestic travel restrictions on transmission of COVID-19 infection using public transportation network approach. Scientific Reports. 2021 Feb; 11(1): 1-9. doi: 10.1038/s41598-021-81806-3.

[54] Sharun K, Tiwari R, Natesan S, Yatoo MI, Malik YS, Dhama K. International travel during the COVID-19 pandemic: implications and risks associated with 'travel bubbles'. Journal of Travel Medicine. 2020 Dec; 27(8): taaa184. doi: 10.1093/jtm/taaa184.

[55] Chinazzi M, Davis JT, Ajelli M, Gioannini C, Litvinova M, Merler S, *et al*. The effect of travel restrictions on the spread of the 2019 novel coronavirus (COVID-19) outbreak. Science. 2020 Apr; 368(6489): 395-400. doi: 10.1126/science.aba9757.

[56] Suzumura T, Kanezashi H, Dholakia M, Ishii E, Napagao SA, Pérez-Arnal R, *et al*. The impact of COVID-19 on flight networks. In2020 ieee international conference on big data (big data). IEEE. 2020 Dec: pp. 2443-52. doi: 10.1109/BigData50022.2020.9378218.

[57] Liebig J, Najeebullah K, Jurdak R, Shoghri AE, Paini D. Should international borders re-open? The impact of travel restrictions on COVID-19 importation risk. BMC Public Health. 2021 Dec; 21: 1-9. doi: 10.1186/s12889-021-11616-9.

[58] Keita S. Air passenger mobility, travel restrictions, and the transmission of the covid-19 pandemic between countries. Covid Economics. 2020 Apr; 9: 77-96.

[59] Zhu P and Tan X. Evaluating the effectiveness of Hong Kong's border restriction policy in reducing COVID-19 infections. BMC Public Health. 2022 Dec; 22(1): 1-9. doi: 10.1186/s12889-022-13234-5.

[60] Grépin KA, Ho TL, Liu Z, Marion S, Piper J, Worsnop CZ, *et al*. Evidence of the effectiveness of travel-related measures during the early phase of the COVID-19 pandemic: a rapid systematic review. BMJ Global Health. 2021 Mar; 6(3): e004537. doi: 10.1136/bmjgh-2020-004537.

[61] Russell TW, Wu JT, Clifford S, Edmunds WJ, Kucharski AJ, Jit M. Effect of internationally imported cases on internal spread of COVID-19: a mathematical modelling study. The Lancet Public Health. 2021 Jan; 6(1): e12-20. doi: 10.1016/S2468-2667(20)30263-2.

[62] Girum T, Lentiro K, Geremew M, Migora B, Shewamare S, Shimbre MS. Optimal strategies for COVID-19 prevention from global evidence achieved through social distancing, stay at home, travel restriction and lockdown: a systematic review. Archives of Public Health. 2021 Aug; 79(1): 150. doi: 10.1186/s13690-021-00663-8.

[63] Rahman MM, Thill JC, Paul KC. COVID-19 pandemic severity, lockdown regimes, and people's mobility: Early evidence from 88 countries. Sustainability. 2020 Nov; 12(21): 9101. doi: 10.3390/su12219101.

[64] Anzai A, Kobayashi T, Linton NM, Kinoshita R, Hayashi K, Suzuki A, *et al*. Assessing the impact of reduced travel on exportation dynamics of novel coronavirus infection (COVID-19). Journal of Clinical Medicine. 2020 Feb; 9(2): 601. doi: 10.3390/jcm9020601.

[65] Zhang Z, Fu D, Liu F, Wang J, Xiao K, Wolshon B. COVID-19, traffic demand, and activity restriction in China: A national assessment. Travel Behaviour and Society. 2023 Apr; 31: 10-23. doi: 10.1016/j.tbs.2022.11.001.

[66] Quilty BJ, Diamond C, Liu Y, Gibbs H, Russell TW, Jarvis CI, *et al*. The effect of travel restrictions on the geographical spread of COVID-19 between large cities in China: a modelling study. BMC Medicine. 2020 Aug; 18(1): 259. doi: 10.1101/2020.04.16.20067504.

[67] Bielecki M, Patel D, Hinkelbein J, Komorowski M, Kester J, Ebrahim S, *et al*. Reprint of: Air travel and COVID-19 prevention in the pandemic and peri-pandemic period: A narrative review. Travel Medicine and Infectious Disease. 2020 Nov; 38: 101939. doi: 10.1016/j.tmaid.2020.101939.

[68] Lai S, Ruktanonchai NW, Carioli A, Ruktanonchai CW, Floyd JR, Prosper O, *et al*. Assessing the effect of global travel and contact restrictions on mitigating the COVID-19 pandemic. Engineering. 2021 Jul; 7(7): 914-23. doi: 10.1016/j.eng.2021.03.017.

[69] Fadinger H and Schymik J. The effects of working

DOI: https://doi.org/10.54393/pjhs.v4i11.821

from home on covid-19 infections and production a macroeconomic analysis for germany. Covid Economics. 2020 Apr; 9(24): 107-39.

[70] Morikawa M. Productivity of working from home during the COVID-19 pandemic: Evidence from an employee survey. Covid Economics. 2020 Sep; 49: 123-39.

[71] Vyas L and Butakhieo N. The impact of working from home during COVID-19 on work and life domains: an exploratory study on Hong Kong. Policy Design and Practice. 2021 Jan; 4(1): 59-76. doi: 10.1080/25741292.2020.1863560.

[72] Bonacini L, Gallo G, Scicchitano S. Working from home and income inequality: risks of a 'new normal'with COVID-19. Journal of Population Economics. 2021 Jan; 34(1): 303-60. doi: 10.1007/s00148-020-00800-7.

[73] Almazova N, Krylova E, Rubtsova A, Odinokaya M. Challenges and opportunities for Russian higher education amid COVID-19: Teachers' perspective. Education Sciences. 2020 Dec; 10(12): 368. doi: 10.3390/educsci10120368.

[74] Nader IW, Zeilinger EL, Jomar D, Zauchner C. Onset of effects of non-pharmaceutical interventions on COVID-19 infection rates in 176 countries. BMC Public Health. 2021 Dec; 21(1): 1-7. doi: 10.1186/s12889-021-11530-0.

[75] Tria JZ. The COVID-19 pandemic through the lens of education in the Philippines: The new normal. International Journal of Pedagogical Development and Lifelong Learning. 2020 May; 1(1): 2-4. doi: 10.30935/ijpdll/8311.

[76] Jones NR, Qureshi ZU, Temple RJ, Larwood JP, Greenhalgh T, Bourouiba L. Two metres or one: what is the evidence for physical distancing in covid-19? BMJ. 2020 Aug; 370: m3223. doi: 10.1136/bmj.m3223.

[77] Gollwitzer A, Martel C, Brady WJ, Pärnamets P, Freedman IG, Knowles ED, *et al*. Partisan differences in physical distancing are linked to health outcomes during the COVID-19 pandemic. Nature Human Behaviour. 2020 Nov; 4(11): 1186-97. doi: 10.1038/s41562-020-00977-7.

[78] Vaid S, McAdie A, Kremer R, Khanduja V, Bhandari M. Risk of a second wave of Covid-19 infections: using artificial intelligence to investigate stringency of physical distancing policies in North America. International Orthopaedics. 2020 Aug; 44: 1581-9. doi: 10.1007/s00264-020-04653-3.

[79] Jarvis CI, Van Zandvoort K, Gimma A, Prem K, Klepac P, Rubin GJ, *et al*. Quantifying the impact of physical distance measures on the transmission of COVID-19 in the UK. BMC Medicine. 2020 Dec; 18(1): 1-10. doi: 10.1186/s12916-020-01597-8.

[80] McDonald HI, Tessier E, White JM, Woodruff M, Knowles C, Bates C, *et al*. Early impact of the coronavirus disease (COVID-19) pandemic and physical distancing measures on routine childhood vaccinations in England, January to April 2020. Eurosurveillance. 2020 May; 25(19): 2000848. doi: 10.2807/1560-7917.ES.2020.25.19.2000848.

[81] Newbold SC, Finnoff D, Thunström L, Ashworth M, Shogren JF. Effects of physical distancing to control COVID-19 on public health, the economy, and the environment. Environmental and Resource Economics. 2020 Aug; 76: 705-29. doi: 10.1007/s10640-020-00440-1.

[82] Huang B, Wang J, Cai J, Yao S, Chan PK, Tam TH, *et al*. Integrated vaccination and physical distancing interventions to prevent future COVID-19 waves in Chinese cities. Nature Human Behaviour. 2021 Jun; 5(6): 695-705. doi: 10.1038/s41562-021-01063-2.

[83] Chea B, Bolt A, Agelin-Chaab M, Dincer I. Assessment of effectiveness of optimum physical distancing phenomena for COVID-19. Physics of Fluids. 2021 May; 33(5): 051903. doi: 10.1063/5.0046429.

[84] Suppawittaya P, Yiemphat P, Yasri P. Effects of social distancing, self-quarantine and self-isolation during the COVID-19 pandemic on people's well-being, and how to cope with it. International Journal of Science and Healthcare Research. 2020 Jun; 5(2): 12-20.

[85] Zeigler Z. COVID-19 self-quarantine and weight gain risk factors in adults. Current Obesity Reports. 2021 Sep; 10: 423-33. doi: 10.1007/s13679-021-00449-7.

[86] Mattioli AV, Ballerini Puviani M, Nasi M, Farinetti A. COVID-19 pandemic: the effects of quarantine on cardiovascular risk. European Journal of Clinical Nutrition. 2020 Jun; 74(6): 852-5. doi: 10.1038/s41430-020-0646-z.

[87] Wang Y, Shi L, Que J, Lu Q, Liu L, Lu Z, *et al*. The impact of quarantine on mental health status among general population in China during the COVID-19 pandemic. Molecular Psychiatry. 2021 Sep; 26(9): 4813-22. doi: 10.1038/s41380-021-01019-y.

[88] Feng S, Shen C, Xia N, Song W, Fan M, Cowling BJ. Rational use of face masks in the COVID-19 pandemic. The Lancet Respiratory Medicine. 2020 May; 8(5): 434-6. doi: 10.1016/S2213-2600(20)30134-X.

[89] Schünemann HJ, Akl EA, Chou R, Chu DK, Loeb M, Lotfi T, *et al*. Use of facemasks during the COVID-19 pandemic. The Lancet Respiratory Medicine. 2020 Oct; 8(10): 954-5. doi: 10.1016/S2213-2600(20)30352-0.

[90] Kantrowitz-Gordon I. A New Normal After the COVID-19 Pandemic. Journal of Midwifery & Women's

DOI: https://doi.org/10.54393/pjhs.v4i11.821

Health. 2021 May; 66(3): 293. doi: 10.1111/jmwh.13247.
[91] Mheidly N, Fares MY, Zalzale H, Fares J. Effect of face masks on interpersonal communication during the COVID-19 pandemic. Frontiers in Public Health. 2020 Dec; 8: 582191. doi: 10.3389/fpubh.2020.582191.
[92] Eikenberry SE, Mancuso M, Iboi E, Phan T, Eikenberry K, Kuang Y, *et al.* To mask or not to mask: Modeling the potential for face mask use by the general public to curtail the COVID-19 pandemic. Infectious Disease Modelling. 2020 Jan; 5: 293-308. doi: 10.1016/j.idm.2020.04.001.
[93] Karmacharya M, Kumar S, Gulenko O, Cho YK. Advances in facemasks during the COVID-19 pandemic era. ACS Applied Bio Materials. 2021 Jan; 4(5): 3891-908. doi: 10.1021/acsabm.0c01329.
[94] O'Dowd K, Nair KM, Forouzandeh P, Mathew S, Grant J, Moran R, *et al.* Face masks and respirators in the fight against the COVID-19 pandemic: A review of current materials, advances and future perspectives. Materials. 2020 Jul; 13(15): 3363. doi: 10.3390/ma13153363.
[95] Lepelletier D, Grandbastien B, Romano-Bertrand S, Aho S, Chidiac C, Géhanno JF, *et al.* What face mask for what use in the context of the COVID-19 pandemic? The French guidelines. Journal of Hospital Infection. 2020 Jul; 105(3): 414-8. doi: 10.1016/j.jhin.2020.04.036.
[96] Matusiak Ł, Szepietowska M, Krajewski P, Białynicki-Birula R, Szepietowski JC. Inconveniences due to the use of face masks during the COVID-19 pandemic: a survey study of 876 young people. Dermatologic Therapy. 2020 Jul; 33(4): e13567. doi: 10.1111/dth.13567.
[97] Roshan R, Feroz AS, Rafique Z, Virani N. Rigorous hand hygiene practices among health care workers reduce hospital-associated infections during the COVID-19 pandemic. Journal of Primary Care & Community Health. 2020 Jul; 11: 2150132720943331. doi: 10.1177/2150132720943331.
[98] Mahmood A, Eqan M, Pervez S, Alghamdi HA, Tabinda AB, Yasar A, *et al.* COVID-19 and frequent use of hand sanitizers; human health and environmental hazards by exposure pathways. Science of the Total Environment. 2020 Nov; 742: 140561. doi: 10.1016/j.scitotenv.2020.140561.
[99] Tabary M, Araghi F, Nasiri S, Dadkhahfar S. Dealing with skin reactions to gloves during the COVID-19 pandemic. Infection Control & Hospital Epidemiology. 2021 Feb; 42(2): 247-8. doi: 10.1017/ice.2020.212.
[100] Gon G, Dancer S, Dreibelbis R, Graham WJ, Kilpatrick C. Reducing hand recontamination of healthcare workers during COVID-19. Infection Control & Hospital Epidemiology. 2020 Jul; 41(7): 870-1. doi: 10.1017/ice.2020.111.