Evidence note

Effective measures to control transmission of COVID-19

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The "Pandemic"

On 31 December 2019, cases of pneumonia originating from an unknown cause which were detected in Wuhan, a city in China's Hubei Province were reported to the World Health Organization (WHO) China Country Office (WHO, 2020a). By 30 January, WHO declared the outbreak a Public Health Emergency of International Concern (WHO, 2020b). By then, globally 7,818 laboratory-confirmed cases of Novel Coronavirus had been reported (WHO, 2020c). The disease was named "**COVID-19**", a short form for coronavirus disease 2019, on 11 February 2020 (WHO, 2020d). On 11 March, WHO characterised the COVID-19 outbreak as a "**pandemic**": by then there were 118,319 confirmed cases of COVID-19 globally (WHO, 2020e).

Globally, it took exactly 67 days (31 December 2019 to 7 March 2020) to reach the first 100,000 confirmed cases of the virus (WHO, 2020f). However, it took 12 days (8-19 March) to exceed 200,000 and just about four days (20-23 March) pass 300,000 (WHO, 2020g, 2020h). On 31 January, for the first time, Italy reported two confirmed cases of COVID-19 and 24 days later, on 24 February the total number of reported cases exceeded 100 (WHO, 2020i, 2020b). It took Italy only six days to report first 1,000 cases (25 February-1 March), and a mere four days (1-5 March) to triple to 3,000 (WHO, 2020j, 2020k).

The Republic of Korea after reporting its first 100 cases on 20 February exceeded 1,000 and 3,000 cases in six days (21-26 February) and three days (27-29 February) respectively (WHO, 2020l, 2020m, 2020n). Therefore, after the first 100 cases the number of cases had risen aggressively, calling for equally aggressive public health measures to overcome the rate of infection. Since January 2020, countries around the world have put in place measures to prevent importation of cases in their countries as well as measures to reduce transmission of the virus in the population. The document considers some evidence of the effective measures adopted during the current and past outbreaks.

Nepal is no exception to the global pandemic, a student returnee from China was confirmed as a case of COVID-19 on 25 January but then cleared the virus and was no longer infected (Shrestha et al., 2020). A returnee from France on 22 March was the second confirmed case. Meanwhile, in response to the pandemic, the Ministry of Health and Population (MoHP) through Policy, Planning and Monitoring Division organised a Knowledge Café – a platform for promoting use of evidence - on 5 March. The purpose of the meeting was to discuss how available evidence on measures to control the transmission of COVID-19 can be used to inform MoHP's recommendation and decisions to protect the Nepalese population. This evidence note is a product of discussions from the Knowledge Café discussion and presentation.

Highlights

- Airport screening is likely to miss out on identifying anywhere between 36% to 58% of the infected cases, therefore, it should be linked with effective contact tracing measures.
- Screening activities are useful to educate travellers obtaining information that will be useful for contact tracing and maintaining the confidence of the general public.
- Travel restrictions combined with measures to reduce local transmission i.e. social distancing and community wide quarantine reduce incidence of COVID-19 along with reduced importation of cases.
- Non pharmaceutical interventions (NPIs) are useful in delaying the epidemic but not stopping it.
- Lack of PPEs compromises ability of the health workers to respond.

Effectiveness of screening measures

- Considering the sensitivity of exit and entry screening, the incubation period, and the proportion of cases who do not manifest any symptoms, airport screening is likely to miss out on identifying anywhere between 36% to 58% of the infected cases (Gostic et al., 2020; Quilty et al., 2020).
- Body temperature measurement of the infected person traveling during the incubation period of

the disease and travellers concealing fever using antipyretic drugs is likely to compromise the effectiveness of such screening measures (Bwire & Paulo, 2020; Samaan et al., 2004).

- Use of screening measures at the point of entry has often been limited to the aviation sector, excluding land crossing, which is likely to undermine efforts to prevent importation of cases (WHO, 2011).
- A report from the Centres for Disease Control and Prevention in the United States reveals that the temperature measurement tools are, in part, responsible for some of the inefficiencies in case detection (Center for Disease Control and Prevention (U.S.), 2014). The overall performance of the non-contact infrared thermometers states that depending on the products, anywhere between 1 and 20% of the infected cases, are likely to go undetected.
- A meta-analysis on the clinical characteristics of COVID-19 patients featuring 1,995 cases from 10 studies reports that fever is the most common symptom observed in almost nine in ten cases (88.5%). Meanwhile, cough was observed in 68.6%, myalgia or fatigue in 35.8%, expectoration in 28.2%, and dyspnoea in 21.9%. Likewise, minor symptoms such as headache or dizziness were observed in about one in ten cases (12.1%). (Li et al., 2020)
- Besides case detection, screening activities are found to be useful to educate travellers about the infection including providing contact details of health authorities in case they manifest symptoms later, obtaining information from travellers which will be useful for contact tracing when required, providing confidence in air travel and maintaining the confidence of the general public (Bell & WHO Working Group on Prevention of International and Community Transmission of SARS, 2004; Brown et al., 2014; Wilder-Smith et al., 2003).
- Learnings from the SARS outbreak suggest that effective active case detection methods, such as screening measures at border crossings, should be associated with effective contact tracing measures (Selvey et al., 2015).
- Once local transmission has started, at the early stages, arrival screening could continue to become useful to minimise the number of concurrent chains of transmission. However, once the transmission is widespread i.e. it has outperformed efforts to contain the spread through contact tracing, measures to screen at the point of departure will become more important to prevent the exportation of cases. (Gostic et al., 2020)

Asymptomatic cases

- According to WHO, "the main way the disease spreads is through respiratory droplets expelled by someone who is coughing. The risk of catching COVID-19 from someone with no symptoms at all is very low" (WHO, 2020o). Hence, symptomatic cases are more likely to transmit the disease than those cases who do not present any symptoms.
- A study which reported clinical characteristics of 55 asymptomatic cases found that close to one-third (30.9%) of all cases were adults 30 to 49 years old. In 16 of the 55 cases, initial chest computed tomography (CT) did not show any abnormality and they also did not present any symptoms during hospitalisation (Wang et al., 2020). Similarly, in another study which involved 24 asymptomatic cases, seven COVID-19 confirmed cases also had normal chest CT and did not manifest any symptoms during hospitalisation (Hu et al., 2020). However, there was one difference with the former study i.e. all these cases were children under 15 years of age. Hence, such cases are less likely to be detected at the point of entry.

Learning on case detection at the point of entry from SARS and Influenza A(H1N1) pdm09

- During the SARS outbreak, countries such as Australia, Canada, and Singapore that applied screening measures were unable to identify any confirmed cases at the point of entry (Lee et al., 2006; Petrosillo et al., 2004; Samaan et al., 2004; Tan, 2006).
- In 2009, during the outbreak of Influenza A (H1N1) pdm09 virus, border screening measures to detect the influenza cases proved unsuccessful because infected travellers were asymptomatic yet infectious (Fraser et al., 2004).
- A multi-country survey from the WHO revealed that on average for everyone million travellers screened during the influenza pandemic (H1N1) four confirmed cases may have been identified at the point of entry. However, the aggregate rate of case detection suggested by the survey is limited to 10 countries and the rate of detection is likely to be influenced by scale and modality of screening, phase of the outbreak i.e. cases are

likely to go undetected at the initial stage of epidemic when infected cases may not have presented any symptoms. (WHO, 2010)

Effectiveness of non-pharmaceutical interventions (NPIs)

- NPIs such as restrictions on travel, closing schools and offices, contact tracing and isolation of infected individuals, preventing mass gatherings, and quarantine of people exposed to infected cases, have proved to be useful to reduce transmission of infections during an outbreak (Min et al., 2020).
- Estimates from a modelling study from China show that in the absence of such interventions, as of 29 February the number of cases in Wuhan, Hubei province would have increased 51 times. Likewise, other cities in the province and other provinces of China would have witnessed a 92-fold and 125-fold spike in the number of infected cases. (Lai et al., 2020)
- Historical data suggests that cities in the United States which implemented multiple NPIs to curb the transmission of the influenza pandemic of 1918 during the initial stages had nearly 50% lower death rates than those who did not act quickly. Nevertheless, most NPIs lasted 2 to 8 weeks and once relaxed the number of cases rose once again in absence of measures to increase immunity (i.e. vaccination). (Hatchett et al., 2007)

Travel restrictions

- On 23 January, the Government of China in an effort to abruptly disrupt the rapid spread of the COVID-19 placed Wuhan in Hubei Province in 'lockdown' by suspending all modes of travel to and from the city (BBC News, 2020).
- All cross-border movement to and from Wenzhou in Zhejiang Province and Shenzhen in Guangdong Province was stopped (Anzai et al., 2020).
- Estimates suggest that as a result of such radical measures to restrict travel in January and February within mainland China, the number of exported cases outside China reduced by about 80% by the end of February (Anzai et al., 2020; Chinazzi et al., 2020).
- Estimates also reveal that before the travel ban was implemented, Wuhan was the source of nearly 86% of imported cases internationally (Chinazzi et al., 2020).
- In Japan, which receives some of the largest number of visitors from China, the travel restrictions delayed a major epidemic in Japan by a maximum of 2 days to a minimum of less than a day (Anzai et al., 2020). However, within China, the measures delayed a major epidemic in other major cities by approximately 3 to 5 days (Chinazzi et al., 2020; Tian et al., 2020).
- Modelling results indicate that without disrupting the transmission of the virus even a 90% reduction in reduction in all forms of travel the epidemic is "delayed by no more than 2 weeks" in mainland China (Chinazzi et al., 2020).
- The simulation indicates that the travel restrictions combined with measures to reduce local transmission, such as social distancing measures such as school closures, cancellation of gatherings, shut down of local markets and closing offices or "community wide quarantine" which minimises human interaction by restricting movement of every individual within a community, city, district or an entire region, quickly reduce the incidence to 1 case per 1,000 in mainland China and case importation to other countries in the world also comes down to a single digit (Chinazzi et al., 2020).

School closures

- Proactive closure of schools in the 1918 influenza pandemic helped save lives in the United States. During the pandemic, the city of St. Louis went ahead with school closure a day before the peak in the number of cases and closed schools for 143 days. Likewise, Pittsburgh carried out school closures a week after the peak, but the duration that schools were closed for was less than half than that of St. Louis (53 days). The death rate of St. Louis was one-third of Pittsburgh. Likewise, during the influenza A(H1N1) pandemic in 2009, high transmissibility and low severity of the infection provided room for divergent views; as a result, school closure was either reactive i.e. decision on school closures were based on student absenteeism, or proactive i.e. based on a standard policy. (Cauchemez et al., 2014)

- A systematic review on the impact of school closings on influenza outbreaks stated that high attack rates among school children and young adults were one of the reasons for school closure during the influenza A (H1N1) 2009 pandemic (Glatman-Freedman et al., 2012; WHO, 2011). Therefore, measures such as school closures may be less effective in the context of those disease outbreaks in which children are less likely to become affected (Jackson et al., 2013).
- The report of the WHO-China Joint Mission on COVID-19 suggested that only 2.4% of all the cases were 18 years and below (WHO, 2020p). However, the report also suggests that the majority of the clusters responsible for the transmission of the virus were family clusters which means that despite the low attack rate among children they are likely to contract the infection through household transmission and affect their peers in school. Further, "asymptomatic cases" have been found to be less than 15 years of age and likely source of infection and transmission (Hu et al., 2020).

Contact tracing and isolation

- Transmission within a population can be brought down through "early detection and isolation of cases, as well as behavioural changes and awareness of the disease in the population" (Chinazzi et al., 2020).
- Simulation of outbreaks across a varying number of initial cases of COVID-19 suggests that if the basic reproductive number (R_o) i.e. the average number of individuals that a typical case can transmit the infection to in a susceptible population is 1.5, outbreaks, in all possible scenarios, can be controlled with less than 50% successful contact tracing and isolation (Guerra et al., 2017). Likewise, when the R_o is 2.5 and 15% of the transmission has occurred from infected individuals before the manifestation of symptoms coupled with delayed isolation, at a minimum, four-in-five contacts (80%) will require to be traced and isolated to take control of 90% of outbreaks (Hellewell et al., 2020).
- In the context of Wuhan, there were delays in isolation at the early stages of the outbreak. (Hellewell et al., 2020) In South Korea records of medical facilities, card transactions, closed-circuit television and global positioning system via. phone was used to overcome any recall, improving the accuracy of contact tracing efforts ("Contact Transmission of COVID-19 in South Korea: Novel Investigation Techniques for Tracing Contacts," 2020).
- Health workers are at the forefront of the battle against COVID-19 but lack of personal protective equipment (PPE) is compromising their ability to cure those in isolation. Italy is reported to have been facing a short supply of PPE. As per a press note released by International Council of Nurses on 19 March 2020, health workers make up 9% of the total COVID-19 cases in Italy, which has depleted the number of health workforce available to treat infected cases.("High proportion of healthcare workers with COVID-19 in Italy is a stark warning to the world: protecting nurses and their colleagues must bevthe number one priority," 2020) Similarly, doctors in Spain are reported to have complained about the lack of PPE. More than 13% of all cases in Spain are health workers (Jones, 2020).

Mass gathering

- One of the most common infections that can spread during a mass gathering is a respiratory disease (Benkouiten et al., 2019). The reports of the first case of COVID-19 in Latin America came along the side-lines of an annual mass gathering that attracted millions of tourists (Ebrahim & Memish, 2020). In South Korea, the swift transmission of COVID-19 has been attributed to Church congregations. In the city of Daegu, the epicentre of the COVID-19 outbreak, Church gathering has been associated with more than half of the total cases (52%).
- As per a systematic review, when restrictions are imposed on mass gatherings in addition to other interventions such as closing schools, social distancing, and isolation, there is a statistically significant reduction in influenza transmission (Ishola & Phin, 2011).
- Hospitals have also been seen to be the sources of transmission. In mid-February 1,700 cases of COVID-19 resulting from a hospital-based transmission were reported in China (Boseley, 2020). To minimise this risk in Singapore, the Ministry of Health restricted movement across hospitals for patients and staff alike (Lim, 2020).

Recommendations for effective measures in Nepal

- Screening measures at the point of entry, airports, and land crossing alike, should be prioritised to prevent importation of cases.
- Interventions such as travel restrictions, closing schools and offices, preventing mass gatherings can reduce the number of cases and reduce the number of patients that need to be treated at a time in hospital. Along with such restrictions, contact tracing and quarantine of people exposed to cases and isolation treatment of infected individuals, should be implemented proactively, as part of an integrated strategy, which amplifies the effectiveness of NPIs.
- Provision of PPE to health workers including training on correct usage of PPE.
- Effective treatment measures should go alongside implementation of NPIs, especially when the virus has already spread, to minimise the chances of another peak in number of cases after NPIs have been lifted.

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