Evidence note

Breaking the transmission chain of COVID-19

Government of Nepal
Ministry of Health and Population
Policy, Planning and Monitoring Division

Background

As a part of sharing evidence to support the health sector response to the coronavirus disease 19 (COVID-19) pandemic, the Ministry of Health and Population (MoHP) through the knowledge café secretariat at the Policy, Planning and Monitoring Division (PPMD) has been organising Knowledge Cafés – a platform for promoting the use of evidence. A knowledge café on breaking the transmission chain of COVID-19 was planned and preparation was being made by gathering latest evidence. Though the Knowledge Café could not be organised due to high work pressure on MoHP officials due to COVID-19 pandemic, this evidence note has been prepared based on the rapid evidence synthesis. As the outbreaks are frequently characterized by uncertainty, early detection and timely response mechanisms to break the chains of transmission are critical to protect the entire population, especially the vulnerable and most-at-risk populations.

COVID-19

COVID-19 is viral infection caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). SARS-CoV-2 is phylogenetically related to severe acute respiratory syndrome-like (SARS-like) bat viruses (Shereen et al., 2020); however, its transfer to humans could not yet be explained. World Health Organisation has declared COVID-19 outbreak as a global pandemic(Cucinotta & Vanelli, 2020). A high rate and prevalence of human-to-human transmission has led to the pandemicity (Ralph et al., 2020). A rapid human to human transfer has been confirmed widely It is highly pathogenic and resulted in high deaths, adversely affected health and livelihood of people and economy of countries worldwide.

Transmission of COVID-19

Frequent and accepted transmission routes for the pandemic potential viral threats such as influenza virus, MERS-CoV and SARS-CoV include 'droplet transmission', 'direct contact transmission' (not involving contaminated surfaces) and 'indirect contact transmission' (involving contaminated surfaces) (Otter et al., 2016) as shown in figure 1. As far as SARS-CoV-2 is concerned, the transmission may be expected to be similar to figure 1. This virus causing COVID-19 seems to spread from person to person through direct, indirect, or close contact with infected people. Commonly, virus transmission occurs through the infected respiratory secretions or droplets and infected saliva, where an individual could potentially be infected when they inhale aerosols produced when an infected person exhales, speaks, shouts, sings, sneezes, or coughs (Baghizadeh Fini, 2020; Greenhalgh et al., 2021; Jayaweera et al., 2020; Li et al., 2020).

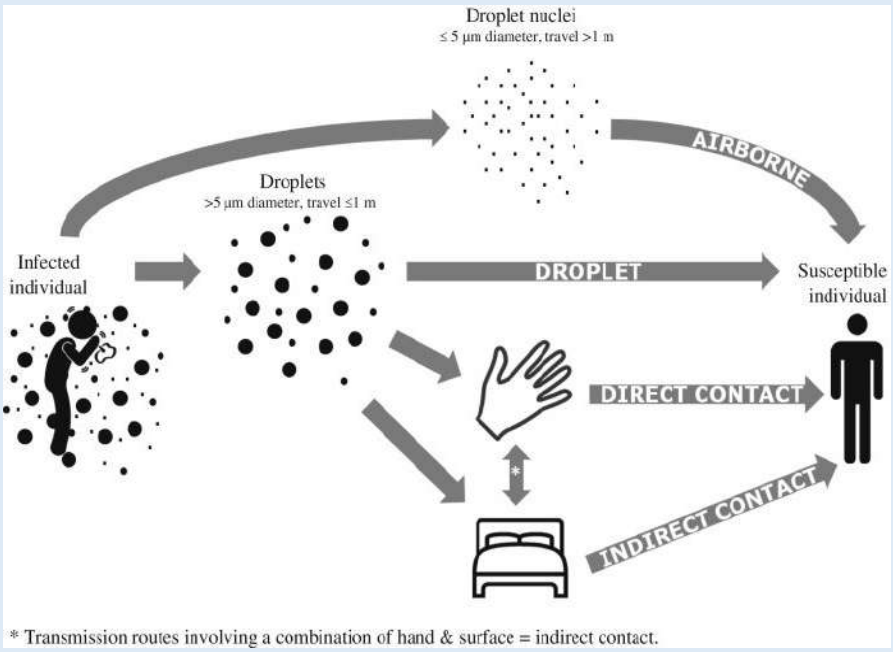

Figure 1: Routes of Transmission of Influenza virus, MERS-CoV and SARS-CoV (Otter et al., 2016)

Close proximity with the infected also increases the probability of infection and disease spread. A closed room with little to no facility for ventilation, where there is at least one diseased individual, also increases the risk for disease transmission to others in the room. A primary case transmitting COVID-19 in a closed environment is 18.7 times more likely when compared to an open-air environment. Therefore, closed environments seem to promote superspreading events (Nishiura et al., 2020).

Despite identification of the virus on inanimate surfaces; there is no sufficient evidence suggesting that the recovered viruses are viable ones. Thus, the risk of transmission of SARS-CoV-2 through fomites is low. However, robust study designs, uniformity across studies and standardized guidelines for reporting the findings are warranted for strong conclusive evidence (Onakpoya et al., 2021).

A decision analytical model assessing multiple scenarios for the infectious period and the proportion of transmission from asymptomatic individuals, transmission from these asymptomatic individuals was estimated to account for more than half of all transmission indicating that the identification and isolation of persons with COVID-19 symptoms will not be adequate to control the spread of SARS-CoV-2 (Johansson et al., 2021).

Breaking the chain of transmission

Based on the routes of transmission; strategies are suggested for breaking the chain of transmission. Some of these strategies are discussed below:

1. Social/Physical distancing

Social/Physical distancing is an important strategy to prevent the spread of disease through droplets. A systematic review with 9 adjusted and 29 unadjusted studies showed that the risk of infection is considerably lowered when a distance of at least 1 metre is maintained between the infected and healthy individuals. For 1 meter further away in distancing, the relative effect might increase by 2.02 times (Chu et al., 2020).

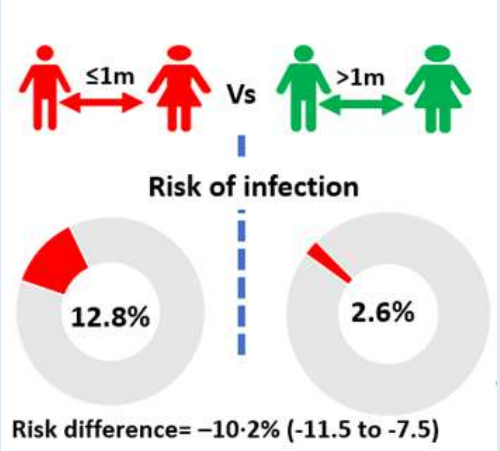

Figure 2: Increased protection with increased distance(Chu et al., 2020)

Amid confusions that exist at the agreement of a standard safe distance, with the WHO suggesting 1 metre and the CDC and the UK's NHS suggesting 2 metres, Chu et al (2020) showed that increased protection with increasing distance, with a change in relative risk of 2.02 per metre. Different countries have adopted different standard for safe distance, within the range of 1-2 metres. Table 1 shows the safe distance standard implemented by some countries for social distancing.

Table 1: Safe distance standard adopted by different countries (Shukman, 2020)

Distance in metres	Countries
1	China, Denmark, France, Hongkong, Lithuania, Singapore
1.4	South Korea
1.5	Australia, Belgium, Germany, Greece, Italy, Netherlands, Portugal, Spain
1.8	United States of America
2	Canada, United Kingdom

Effectiveness of different physical distance strategies

An interrupted time series analysis involving 149 countries, that assessed the effectiveness of different physical distancing policies, showed that physical distancing interventions led to reductions in the incidence of COVID-19 worldwide. The physical distancing strategies analysed included school closure, workplace closure, restriction on mass gathering, lock down and closure of public transport together(Islam et al., 2020).

The analysis showed that implementing any physical distancing intervention was associated with an overall reduction in COVID-19 incidence of 13%. Implementation of multiple strategies at the same time was found to be more effective than single strategy. Earlier implementation of lockdown was associated with a larger reduction in COVID-19 incidence compared with a delayed implementation of lockdown after other physical distancing interventions were in place. Closure of public transport was not associated with any additional reduction in COVID-19 incidence when the other four physical distancing interventions were in place(Islam et al., 2020).

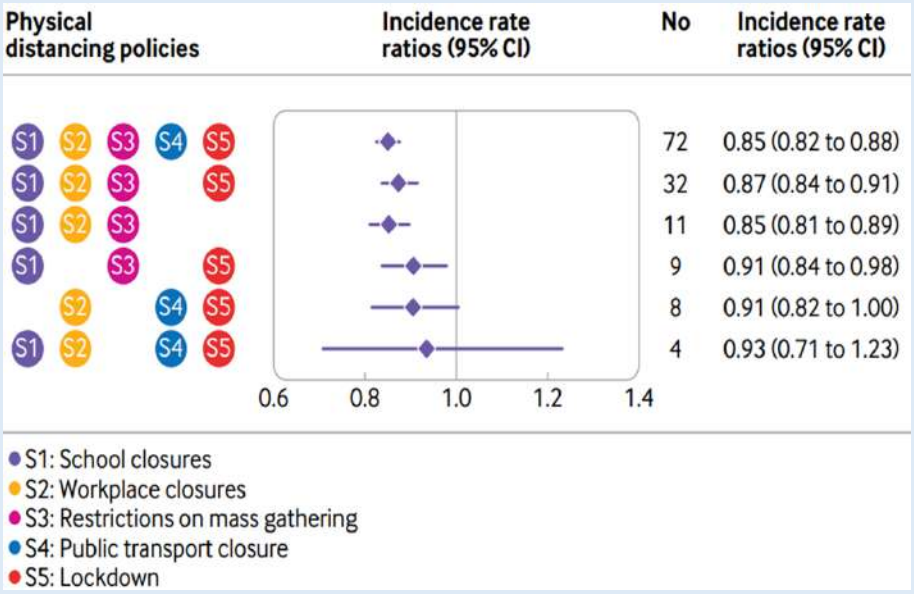

Figure 3: Association between physical distance interventions and change in the incidence of COVID-19 (Islam et al., 2020)

Government Stringency Index:

Government Stringency Index (GSI) is a measure of strictness of government response, calculated with nine metrics related to physical distance, a composite measure of nine of the response metrics. These metrics include school closures; workplace closures; cancellation of public events; restrictions on public gatherings; closures of public transport; stay-at-home requirements; public information campaigns; restrictions on internal movements; and international travel controls. GSI ranges

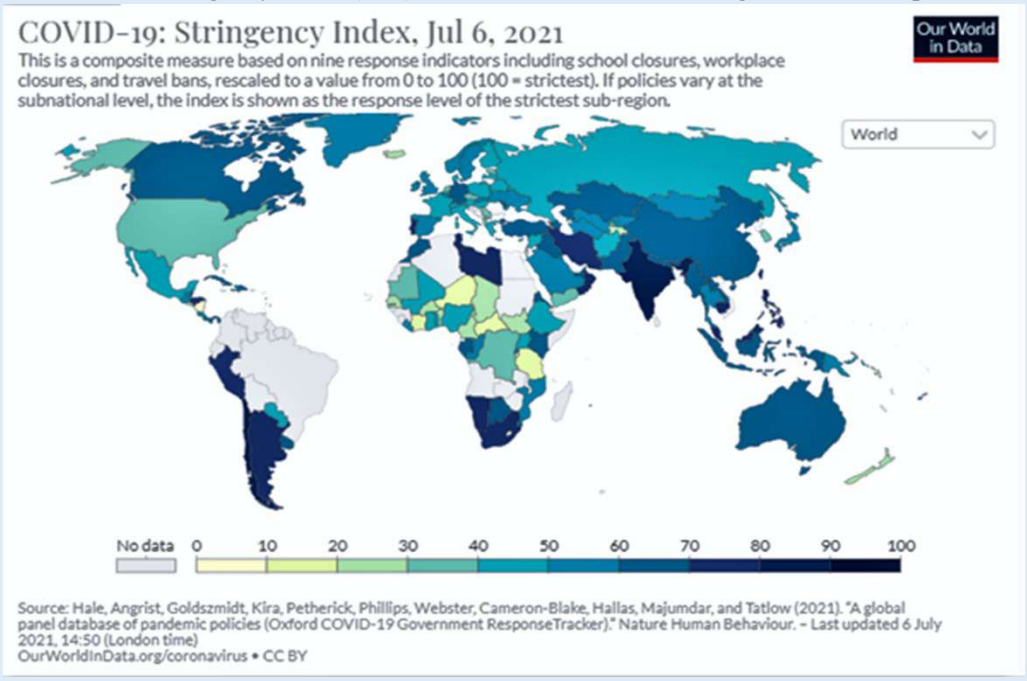

Figure 4: Government Stringency Index across the world (Our World in Data, 2021)

from 0-100, where 100 corresponds to the strictest response. However, it does not measure the effectiveness of the response(Our World in Data, 2021). As of 6 Jul 2021, the country with the highest GSI is Venezuela, followed by Bangladesh, Sri Lanka, Chile, and India securing the top 5 positions. Nepal has implemented all the nine strategies used in the GSI calculation and achieved a score of 68.52 (Our World in Data, 2021).

2. Mask use

Wearing masks in the public is one of the most crucial measures for control of COVID-19. A Systematic review including 10 adjusted and 29 unadjusted studies suggested that use of face mask could result in a large reduction in risk of infection as shown in figure 5. While medical or surgical face masks might result in a large reduction in virus infection, N95 respirators might be associated with a larger reduction in risk compared with surgical or similar masks showing that N95 respirators are more effective than surgical masks. The same study also indicated that eye protection was associated with less infection as well. The risk of infection was reduced to 5.5% from 16% with use of eye protection goggles or face shield (Chu et al., 2020).

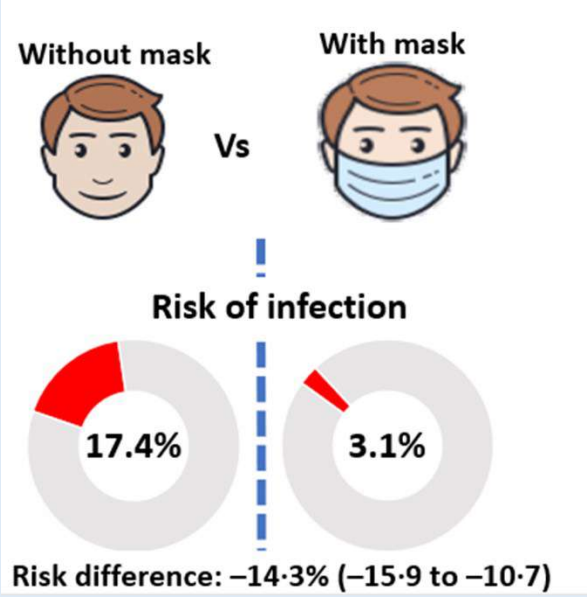

Figure 5: Risk of infection with and without mask (Chu et al., 2020)

To interrupt the transmission of infectious diseases in both hospital settings and community settings, the use of mask needs to be emphasized (Wang et al., 2020). The community-wide benefits are likely to be the greatest when face masks are used in conjunction with other non-pharmaceutical practices (such as social-distancing), and when adoption is nearly universal (nation-wide) and compliance is high(Eikenberry et al., 2020). Even before Wuhan lockdown and first level response of public emergency in Guangdong and Sanghai, infection curve came to the reflection point, indicating the mask wearing by the public was key measure to cut off the transmission. However, amid the shortage of surgical masks and N95 respirators across the globe, lessons from china showed that the N95 respirators should be saved for healthcare workers whilst disposable medical masks should be worn by the general public when going to crowded public places, seeking medical treatment or taking public transport (Zeng et al., 2020).

A study showed that N95 masks blocked nearly all the mock viruses (avian influenza virus), followed by medical masks and the homemade mask (Ma et al., 2020) as shown in the table 2. Studies have supported the use of homemade mask as a simple, economic, and sustainable alternative to medical masks in low risk settings (Esposito et al., 2020; Jain et al., 2020; Ma et al., 2020).

Table 2 Types of masks and their effectiveness (Ma et al., 2020)

Mask Type	Findings on bloacking of mock virus (Avian Influenza Virus)
N95	Blocked 99.98% (99.98%-99.99%) of virus
Medical mask	Blocked 97% (94.36%-98.55%) of virus
Homemade mask *(Four-layer kitchen paper and one-layer cloth)*	Bloacked 95% (90.97%-97.39%) of virus

WHO has recommended the use of mask as part of a comprehensive strategy of measures to suppress transmission and save lives as the use of a mask alone is not sufficient to provide an adequate level of protection against COVID-19 (WHO, 2020b).

3. Hand Hygiene/Sanitation

The COVID-19 pandemic has re-established the need to focus on handwashing, aimed at people working within the health sector as well as the general public (Alzyood et al., 2020). Practicing hand washing and use of alcohol-based hand rub with at least 60% alcohol concentration, where required or where water or soap is unavailable, is a simple yet effective way to prevent the spread of pathogens and infections in healthcare settings and elsewhere. When hands are heavily soiled or greasy, hand sanitizers may not work well. Handwashing with soap and water is recommended in such circumstances. Though the exact contribution of hand hygiene to the reduction of direct and indirect spread of coronaviruses is uncertain, it is well-established that hand washing mechanically removes pathogens (CDC, 2020).

SAVE LIVES: Clean Your Hands global campaign was launched by WHO in 2009 with an aim to emphasise the importance of hand hygiene in health care and to 'bring people together' in support of hand hygiene improvement globally (Kilpatrick & Pittet, 2011; WHO, 2021).

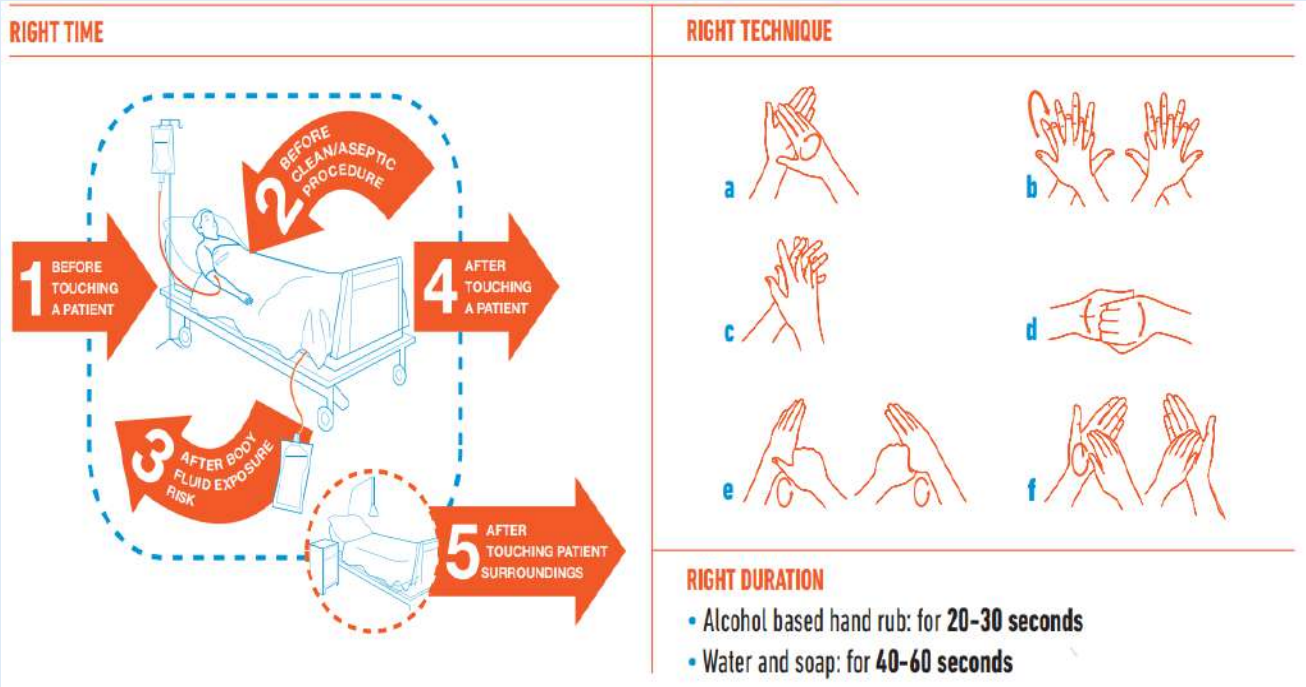

Figure 6: Hand hygiene: right time and technique (WHO, 2020a)

To stop the spread of COVID-19, in addition to other COVID-19 appropriate behaviours, WHO emphasised on the practice of handwashing using right technique at regular intervals such as, after coughing or sneezing, when caring for the sick, after using the toilet, before eating, while preparing food and after handling animals or animal waste. Handwashing after touching common surfaces such as doorknobs or handles, or after one comes back home from visiting a public place will keep ourselves and others around us safe (WHO, 2020a).

Hand Hygiene best practices for COVID-19

As hand hygiene is important in both community and health care settings to protect the health of general public and health care professionals, WHO has suggested following guidance (WHO, 2020a).

Table 3: Hand Hygiene best practices for COVID-19 (WHO, 2020a)

Importance of Handwashing in health care setting and community	Guidance on best practices
• Evidence from both the SARS and COVID-19 epidemics, shows that hand hygiene is very important to protect health care workers from getting infected. • Hand washing in the community is highly effective to prevent both diarrhoeal diseases and respiratory illness. Thus, it is one of the most important measures that can be used to prevent COVID-19 infection.	• Alcohol-based hand rub products should contain at least 60% alcohol, should be certified and where supplies are limited or cost prohibitive can be made locally by carefully following WHO Guide. • Plain soap is effective at inactivating enveloped viruses such as the SARS-CoV-2 due to the oily surface membrane that is dissolved by soap, killing the virus. In addition, hand washing removes germs through mechanical action. • Chlorinated water at 0.05% is not recommended for routine hand hygiene as it has adverse effects on skin and other toxic effects, and soap is more easily available and can be effectively used.

It can be concluded that lack of handwashing with soap puts millions at increased risk to COVID-19 and other infectious diseases when hand sanitiser is also not available. UNICEF revealed that 40% of world's population and nearly three quarters of people in the least developed countries do not have basic handwashing facility with water and soap at home (UNICEF, 2020).

The latest demographic and health survey data suggests that basic handwashing facilities with soap and water need to be improved in most countries of South Asia (USAID, 2021) as shown in figure 7. Hand hygiene can be an important strategy to control COVID-19 pandemic in South Asia.

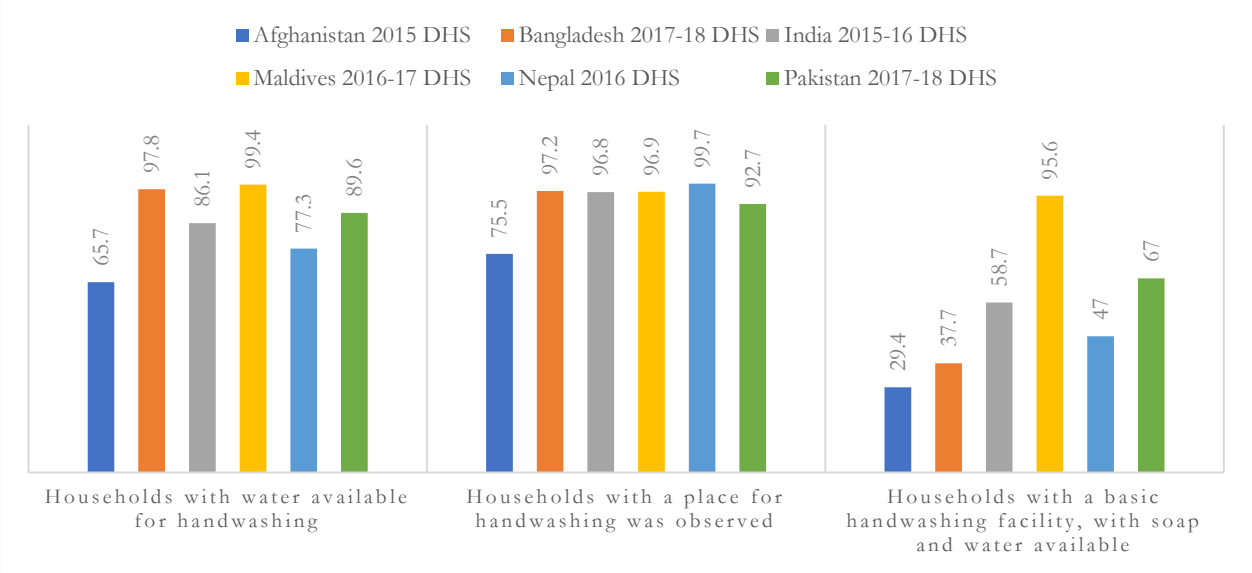

Figure 7: Availability of handwashing facilities based on demographic and health survey data (USAID, 2021)

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