

COVID-19: implementing sustainable low cost physical distancing and enhanced hygiene

The maintenance of sustainable low cost physical distancing and enhanced hygiene may decrease the number and severity of cases

It is estimated that about two-thirds of cases of coronavirus disease 2019 (COVID-19) exported from China between 1 and 13 January 2020 were undetected globally.¹ Most of these exported cases were mild and were only detected after several hundred cases had accumulated and severe or fatal cases were recognised 5–8 weeks later, as likely occurred in the COVID-19 outbreaks in Iran, South Korea, Italy and Seattle, United States.²

The spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) transmission globally has been very rapid. The basic reproduction number (R_0) is estimated at between 2 and 3.^{3,4} The mode of transmission is thought to be droplet and contact infection, although opportunistic or close range airborne infection may be involved.⁴

The transmission dynamics of the early cases of COVID-19 were significantly different to those during the severe acute respiratory syndrome (SARS) epidemic in 2003. In particular, the proportion of COVID-19 cases from health care settings was low and the proportion with no known risk exposures was high.⁴ Another significant factor is that viral loads in nasopharyngeal and respiratory secretions are highest soon after symptom onset in patients with COVID-19⁵ compared with a peak of around 10 days in patients with SARS,⁶ making transmission before entering health care facilities and in the pre-symptomatic phase more likely.⁷

Even though the understanding of transmission dynamics is at an early stage, they do suggest that the stepwise introduction of stringent measures will be necessary to control this epidemic and highlight the importance of early community control. Australia and other countries have experienced a first wave of disease and managed to effect a decline in cases.⁸

Quarantine; city lockdowns; complete childcare, school, university and workplace closures; and cancellation of mass gatherings and events have a significant social and economic impact and were not often implemented until significant transmission was confirmed — when they may be less effective. Countries are now challenged with identifying which of these various controls can be relaxed to allow some routine societal and economic activities to return. However, there are low cost, sustainable interventions that may be maintained over what may be many years of continued mitigation⁹ (Box 1). These low cost enhanced hygiene and physical distancing measures are applicable pre-emptively before confirmation of local community transmission or where transmission of SARS-CoV-2 appears to be under control.

The purpose of these interventions is to slow the transmission of disease and limit the impact on health services, particularly on hospitals and intensive care units, to ensure access to high level care when needed.

The interventions are based on the following assumptions, which require further exploration:

- community-wide SARS-CoV-2 transmission may be occurring undetected or may only be recognised after containment is no longer feasible;
- interventions implemented after community-wide transmission is detected will be less effective;
- reduction of the force of infection, particularly early, will delay the epidemic peak, blunt the epidemic peak, spread cases over a longer time, and help limit the potential for critical care services to be overwhelmed, which may be lifesaving,^{12,13}
- low cost sustainable interventions will assist in the relaxation of more economically costly interventions, and
- enhanced hygiene and physical distancing interventions should:
 - ▶ decrease the total number of cases per week; and
 - ▶ decrease the severity of cases through reducing viral inocula.

Box 2 illustrates the concept of limiting the peak in cases so that health services are less likely to be overwhelmed and there is less unmet health service need. Unmet need may include inability to admit patients to a hospital or to provide hospitalised patients in critical condition access to intensive care. Interventions to reduce infection lead to longer but less peaked epidemics. A slower evolution in the epidemic also allows time for health care staff to provide better care, for recovery of infected health care workers, for learning and adapting to the evolving situation by administrators, and for vaccines and treatments to be developed. This principle is validated in simulations for influenza¹⁴ and appears to be validated with the reduction in COVID-19 cases in Australia and the relative lack of overburden on clinical services.⁸

Measures to decrease the number and severity of cases

Pre-emptive and ongoing maintenance of low cost interventions (such as enhanced hygiene and physical distancing measures) (Box 1) may not only decrease the total number of cases but may also decrease the severity of cases.

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1 Low cost hygiene and physical distancing interventions

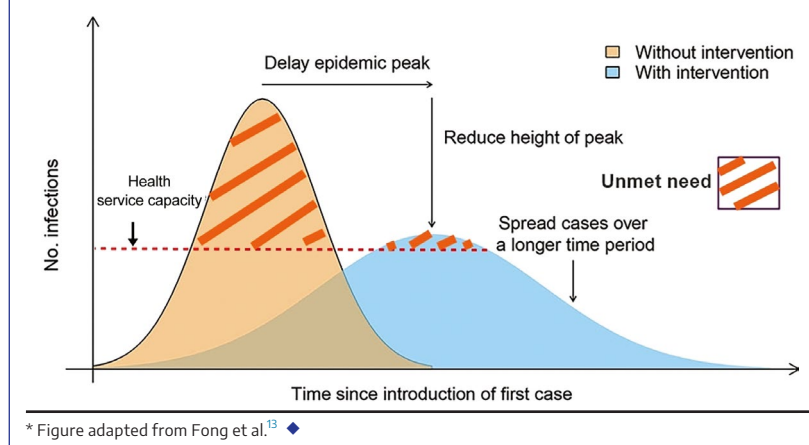
Settings	Interventions
Workplace	<ul style="list-style-type: none"> • No handshaking policy • Promote cough and sneeze etiquette, but focus is on excluding ill staff • Videoconferencing as default for meetings • Defer large meetings • Signage for all offices/meeting rooms advising of maximum occupancy based on 4 m² per person and 2 m distancing • Enforced sanitisation of hands at entrance • Regular hand sanitation schedule reminders via email • Avoid gathering in lunch and break rooms • Gamifying hygiene rules, for example, to discourage touching face • Ill* people should stay at home and ill workers immediately isolated • Hold necessary meetings outside in open air if possible • Staff with ill household contacts should stay at home[†] • Disinfect high touch surfaces regularly and between users • Work from home where possible and consider staggering of staff • Consider opening windows and adjusting air conditioning to increase air flow and maintain warmer more humid environments[‡] • Limit food handling and sharing of food in the workplace • Assess staff business travel risks[§] • Enhance hygiene and screening for illness among food preparation (canteen) staff and their close contacts • Analyse the root cause of crowding events on site and prevent through rescheduling, staggering or cancelling • Mark floor areas to indicate 2 m distancing points in areas where staff spontaneously gather to prompt distancing • Minimise the number of employees in a work vehicle at any one time
School	<ul style="list-style-type: none"> • Supervised sanitisation of hands at entrance and at regular intervals • Defer activities that lead to mixing between classes and years • Promote cough and sneeze etiquette, but focus on excluding ill persons • Strict stay at home policy if ill • Gamifying hygiene rules, for example, to discourage touching face • Regular handwashing schedule • Disinfect high touch surfaces regularly and between users • Outdoor lessons where possible • Consider opening windows and adjusting air conditioning • Enhance hygiene and screening for illness among food preparation (canteen) staff and their close contacts • Review after-school care arrangements that lead to mixing of children from multiple classes and ages
Commercial, entertainment and transport	<ul style="list-style-type: none"> • Sanitisation of hands at building entrance encouraged • Tap and pay preferred to limit handling of money • Disinfect high touch surfaces regularly • Avoid crowding through booking and scheduling, online pre-purchasing, limiting attendance numbers • Enhance hygiene and screening for illness among food preparation staff and their close contacts • Enhance airflow and adjust air conditioning to increase air flow and maintain warmer more humid environments • Public transport workers, taxi and ride share drivers — vehicle windows opened where possible, increased air flow, high touch surfaces disinfected
Household	
All households	<ul style="list-style-type: none"> • Enhanced hand sanitisation • Gamifying hygiene rules, for example, to discourage touching face • Disinfect high touch surfaces regularly • "Welcome if you are well" signs on front door • Increase ventilation rates in the home by opening windows or adjusting air conditioning • Promote cough and sneeze etiquette
Households with ill members	<ul style="list-style-type: none"> • Measures listed above • Confirmed cases of COVID-19 should be isolated away from susceptible household members if there are not completely separate bedroom, bathroom and kitchen facilities • If care must be provided at home, ill household members are given their own room and only one person cares for them • The door to the ill person's room is kept closed¹⁰ • Wearing simple surgical or dust masks by both infected persons and other family members caring for the patient if needing to be in the same room • Consider extra protection or alternative accommodation for household members aged over 65 years or with underlying illness

COVID-19 = coronavirus disease 2019. * Ill person refers to someone with symptoms of respiratory illness or fever, who is not yet under investigation for COVID-19 but could be an unrecognised case. † This could be costly unless used judiciously while awaiting exclusion of COVID-19 in the suspected case and should be introduced based on likelihood of local transmission. ‡ Evidence that low temperature and low humidity in air-conditioned environments may enhance the survival of coronaviruses such as severe acute respiratory syndrome (SARS).¹¹ § When international travel restrictions are lifted, sites such as the Centers for Disease Control and Prevention travel risk assessment site may be useful (<https://www.cdc.gov/coronavirus/2019-ncov/travelers/map-and-travel-notice.html>). ◆

The R_0 is the average number of secondary cases of an infectious disease that arise from cases in a totally susceptible population and reflects the epidemic potential

of a pathogen.¹⁵ R_0 is a function of the number of contacts an infectious person has, the risk of transmission per contact, and the duration of infectiousness.

2 Intended impact of enhanced hygiene and physical distancing measures on the coronavirus disease 2019 (COVID-19) pandemic*



Physical distancing mostly acts on the first factor by reducing the number of contacts each person makes. Hygiene measures mostly act on the second factor, as they reduce the risk of transmission if a contact occurs. It is difficult to disentangle the effectiveness of the multiple control measures implemented in pandemic-affected areas. The World Health Organization–China Joint Mission on COVID-19 determined that widespread community transmission and outbreaks occurred in Wuhan before the implementation of comprehensive control measures.⁴ However, in other parts of China, community transmission has been limited and after public gatherings were cancelled and people were restricted to their homes, most transmission occurred in families. For example, among 344 clusters involving 1308 cases (out of a total 1836 cases reported) in Guangdong Province and Sichuan Province, 78–85% have occurred in families.⁴

Community-wide interventions may decrease the average viral exposure dose encountered in the community. People exposed to a higher viral dose (inoculum) are more likely to become infected and have more severe disease. Animal models for other coronavirus infections demonstrate that increased viral inocula lead to more severe disease and higher viral loads in the lungs and other organs and fluids.¹⁶ The SARS outbreak in Amoy Gardens, Hong Kong, in 2003 provided evidence that patients with presumed higher exposure to the index case had higher nasopharyngeal viral loads and more severe

illness.¹⁷ SARS-CoV-2 cases with more severe disease have been found to have around 60 times higher viral load than those with mild disease.¹⁸ Modelling of the 2009 influenza pandemic also supported a hypothesis that severe illness was due to a higher infectious dose of the virus mediated by the number of simultaneous infectious contacts.¹⁹ Viral loads in severe patients with Middle East respiratory syndrome (MERS) were higher than those in a mild group, and the patients in the severe group had more prolonged viral shedding in respiratory secretions, beyond 21 days after the onset of symptoms,

whereas viral RNA was no longer detected by 21 days in the mild group.²⁰

Therefore, it is proposed that early measures that lower the number of contacts, the likelihood of transmission, and average viral infective dose in an area of transmission may have a multiplier effect leading to fewer cases and fewer severe cases that are less infectious. Maintaining the early reduction of the R_0 would result in fewer cases overall and have a significant negative multiplier effect on the overall impact of the epidemic, including the number of deaths (Box 3). The higher case fatality rate in Wuhan, compared with other provinces in China, may partially relate to health care resource availability and shortages in the face of overwhelming community transmission as well as greater severity of disease due to higher infection doses.^{12,17} These interventions will be particularly important for people over 60 years of age and those with underlying medical conditions.

The costs of intervention

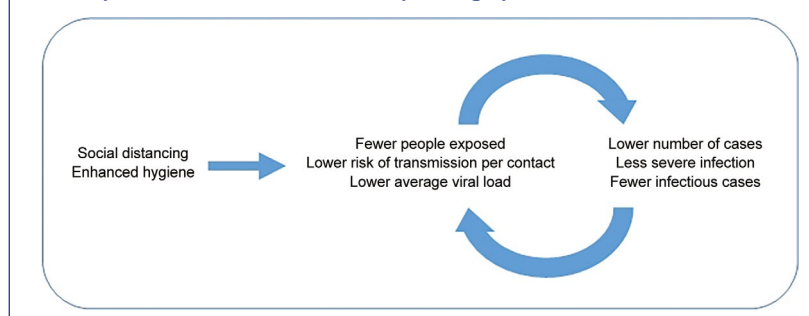
The suite of low cost interventions, other than a working from home policy, is unlikely to affect work productivity and may provide the community with some reassurance that all is being done to prevent the epidemic and that maintenance of the low cost measures may allow earlier opening of some workplaces. WHO is supportive of pre-emptive interventions to prevent COVID-19 in workplaces.²¹

Some may see it as being overreaching, but thus far, communities seem to voluntarily adopt low cost interventions, and acceptance may be enhanced through consultation and trust building.^{22,23}

Influenza co-benefits

For regions approaching their influenza season, optimal prevention and control of seasonal influenza, such as

3 Conceptual model of how pre-emptive interventions with a negative multiplier effect could affect an impending epidemic



vaccination, in the face of potential COVID-19 cocirculation is also crucial to minimise the double burden on health services. The measures discussed here (enhanced hygiene and physical distancing) are also effective against influenza, resulting in potential co-benefits for both pathogens. Early indications from Flutracking.net (<https://info.flutracking.net/reports-2/australia-reports>) indicate that physical distancing and hygiene enhancements have markedly decreased influenza-like illness in Australia.

Limitations

While physical distancing and enhanced hygiene interventions in Australia appear to be working, the evidence on the effectiveness of individual interventions in preventing COVID-19 is not yet available. However, there is evidence from observational and simulation studies for the effectiveness of physical distancing measures in controlling seasonal influenza.¹³ Other measures, such as hand hygiene and cleaning surfaces, have a long history of use in infection prevention and control.²⁴ Despite the lack of robust evidence of effectiveness for these measures, their relative low cost means that there is little harm and much potential benefit in maintaining and optimising them.

We have made no recommendations in regard to masks. The use of masks outside of health settings is controversial and it is important that medical grade masks not be diverted from health care supplies. Nevertheless, surgical masks are protective of large droplet spread, have about half the effectiveness of N95 masks for small droplet transmission, and are suggested to be cost-saving in some modelled pandemic influenza scenarios.²⁵ The use of masks may have a role in the community setting if there are adequate supplies.¹⁰ There is evidence suggesting that community use of masks may have reduced the risk of contracting SARS.²⁶ It is clear that masks

should be used in households caring for patients with COVID-19 at home. Policy development and scientific review of the literature on community use of masks is very dynamic at this time. The US Centers for Disease Control and Prevention has made a recent recommendation that cloth masks be used at the community level and many recent reviews have come to divergent conclusions about the usefulness and risks of community mask use.^{27–30} Coherent policy development in this space will rely on transparently articulating the scientific evidence on community mask use with a public conversation on the potential risks in implementation.

The interventions discussed here should be tailored to individual settings and communities, in partnership with members of those communities. In particular, these interventions should be adapted to the unique circumstances of groups, such as Indigenous communities; vulnerable groups, including homeless populations; and culturally and linguistic diverse communities.

Conclusion

SARS-CoV-2 continues to disseminate globally and there are likely to be recurrent waves of infection into the foreseeable future. We would argue that these low cost interventions, although formulated at an earlier stage of the epidemic, have increasing relevance. They will protect against the emerging concern for pre-symptomatic transmission and their optimisation will better enable the more restrictive and economically damaging constraints to be relaxed.⁷

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