WORKING GROUP TWO: **Public health interventions**

Background

Vaccines and, to a lesser extent, antivirals are the principal medical tools for mitigating the consequences of an influenza pandemic. Once a pandemic is fully under way, mass use of an effective vaccine is central to strategies for reducing morbidity and mortality. In addition, a wide range of non-medical interventions – from personal hygiene and the wearing of masks to quarantine and the screening of travellers – can potentially reduce opportunities for transmission and slow international spread. Although many of these non-medical interventions were tested during the emergency response to SARS, their use during the different conditions of an influenza pandemic has not been systematically evaluated. Consideration of their use during a pandemic is particularly important, as non-medical interventions will be the principal protective tools so long as supplies of effective vaccines and antivirals remain scarce. In countries unable to secure adequate supplies, non-medical measures may be the main line of defence throughout the course of a pandemic.

An influenza pandemic is a public health emergency that rapidly takes on significant political, social, and economic dimensions. As with other emerging infectious diseases, the course of its evolution is governed by factors – including the properties of a new causative agent – that cannot be known in advance and require some time to understand. In the phases moving from the pre-pandemic period to a full-fledged pandemic, health authorities will need to make a series of emergency decisions in an atmosphere of considerable scientific uncertainty and fragile public confidence. Prior guidance on which interventions are most likely to be effective and feasible at different phases is therefore greatly needed as part of preparedness planning. In addition, mathematical modelling suggests that early detection of the first chains of human-to-human transmission might provide a unique opportunity to prevent or at least delay further national and international spread. As this window of opportunity is expected to close quickly, prior guidance on the most appropriate interventions is particularly important.

The effectiveness of many interventions will depend on the behaviour of the virus as determined by its pathogenicity, principal mode of transmission (droplet or aerosol), attack rate in different age groups, duration of virus shedding, and susceptibility to antivirals. If, for example, it is known that children are the most severely affected age group, or play a major role in transmission, health authorities will be in a better position to make decisions about the effectiveness of school closure, travel measures (children travel less frequently than adults), and quarantine (children cannot be separated from their parents). Apart from questions of effectiveness, the selection of appropriate measures will be driven by questions of feasibility closely linked to costs, available resources, ease of implementation within existing infrastructures, the broader impact of possible interventions and likely acceptability to the public.

The many uncertainties surrounding the effectiveness and feasibility of interventions cannot be entirely resolved in advance, but they can be reduced in ways that facilitate rational preparedness planning. This was the task of the working group on public health interventions.

Assumptions and guiding principles

The working group assessed more than 30 public health interventions in terms of their feasibility and likely effectiveness in meeting different public health objectives. Interventions were considered separately for use at national and international levels during each of four phases in the progression from a pre-pandemic situation to the declaration of a pandemic. In developing recommendations, the group evaluated the likely protective effect of specific measures, but also considered the resource implications and the social and economic disruption they might cause. Although the emphasis was firmly placed on the use of non-medical interventions, the role of antivirals at different phases was also considered. The results of these assessments are set out in the tables below. Where appropriate, explanatory notes have been included to help health authorities assess the evidence base and decide whether a given measure will be suitable in a particular national setting.

Participants recognized that the effectiveness of specific interventions will vary according to epidemiological conditions at the different phases. Public health objectives will also shift in line with the evolving epidemiological situation, and these objectives should likewise guide the selection of interventions. Three objectives were identified:

- To prevent further human cases caused by a virus that has not yet established efficient human-to-human transmission
- To slow pandemic spread and thus gain time for strengthening preparedness measures, including the augmentation of vaccine supplies
- To reduce the impact of the first wave of a pandemic.

Particular attention was given to the confirmation of human-to-human transmissions as the epidemiological trigger for aggressive measures aimed at averting a pandemic (provided transmission is not yet efficient and sustained) or at least slowing further spread. Intense efforts, combined with vigilant surveillance for influenza viruses in animal and human populations, would be needed to prevent an emerging virus from improving its transmissibility. At this phase, local measures targeting settings where transmission is occurring were considered a more effective use of resources than more extensive measures in distant areas not yet experiencing cases.

Adapting measures to the epidemiological context. Participants agreed that opportunities for averting a pandemic or appreciably slowing its spread would end once efficient and sustained human-to-human transmission was established, as the containment of influenza at this stage is considered virtually impossible. At some point, efforts to prevent international spread through travel-related measures would also become ineffective. As levels of morbidity and mortality mount during a pandemic, measures that made good sense at earlier phases – such as isolation of patients, contact tracing, and voluntary quarantine of contacts – would cease to be effective or feasible

because of the large number of cases. The prophylactic treatment of contacts with antivirals, which are expected to be extremely scarce, would likewise be rendered impractical, as noted by the working group on antivirals. These varying phase-specific recommendations are reflected in the tables.

On a more positive note, the group agreed that some measures might be stopped following successful achievement of their objectives. All interventions come at a cost; a phase-wise halt to interventions, whether because of their success or the loss of their effectiveness, is ethically justified to conserve resources for addressing the main public health objective during a full-fledged pandemic: reducing the number of cases and deaths.

The group recommended that interventions be introduced as packages, as it was considered unlikely that any single measure would have sufficient impact on its own. Some interventions are interdependent. For example, the prophylactic use of antivirals as a measure for reducing transmission depends on rapid and efficient case detection and contact tracing. The predictable need to change the recommended mix of interventions over time necessitates careful advance preparation and explanation to the public, policy-makers, and health care staff. The group felt that risk communication would be crucial at all phases, but most especially so following the declaration of a pandemic, as the public would need to understand that certain public health measures were no longer effective and that others could at best delay rather than prevent further spread.

Ethical and legal concerns. In recommending interventions, participants recognized that opportunities for responding to a pandemic have been strengthened by recent research, technological advances, and evidence of the power of international collaboration demonstrated during the SARS outbreak. At the same time, it was recognized that translation of these developments into public health benefits will require the improvement of public health capacity and modernization of public health laws at both national and international levels. Faced with a pandemic, authorities may need to introduce unusual public health measures, for example closing schools or curtailing certain non-essential work and services. The legal authority and procedures for doing so must be established and understood by key personnel, such as those in the public health, judicial, and law enforcement systems, before a pandemic begins. It will also be critical to ensure that, as far as possible, such measures respect fundamental human rights as well as public health ethics.

Changes following the declaration of a pandemic. Participants noted that objectives would shift most dramatically following the declaration of a pandemic, but agreed that several measures would remain beneficial at that phase and would be particularly important in the absence of adequate supplies of vaccines and antivirals. Based on patterns seen in previous pandemics, all parts of the world are unlikely to be affected simultaneously during the first wave of infection; opportunities for protecting geographical areas or population groups will probably remain open even after a pandemic is declared. Even during severe pandemics not everyone is affected, opening opportunities to maximize the proportion who remain uninfected. In this phase, measures such as simple hand washing and the use of masks and voluntary quarantine for symptomatic persons could help reduce transmission, while travel-related measures,

such as exit screening for persons departing from affected areas, might dampen or delay international spread.

When faced with a pandemic situation, the general public would probably be strongly motivated to adopt personal protective measures and behaviours, some of which may have limited effectiveness. The group felt that these measures should be permitted provided they caused no harm and did not have major resource implications. One challenge would be to persuade populations to change behaviours in line with sound public health policy. Some behaviours, such as avoidance of travel to affected areas, would probably take place regardless of official recommendations. The group strongly recommended that authorities openly inform the public whenever new evidence warranted a change of policy.

Judging from past pandemics, a point would likely be reached when the political and economic dimensions of the pandemic become so great that decisions are no longer left to the health sector alone. Members of the group raised the possibility that decisions made by health ministers might be counterbalanced by other considerations. Arguments for reducing internal travel would have to be balanced against the need to move essential goods such as foodstuffs around a country. Entry screening of travellers at international borders, which was not considered effective, provided one example of a resource-intensive intervention that might nonetheless be introduced in response to public and political pressure. Good preparedness plans, agreed on in advance, might protect against this possibility.

Antivirals as an adjunct to public health interventions. The group considered the role of antivirals, in combination with other measures, at each epidemiological phase, giving particular attention to their targeted use when the first instances of human-to-human transmission are confirmed. As supplies would be limited, the group recommended that the use of antivirals be prioritized, as indicated in the tables. The group cited strong ethical reasons for offering antivirals to contacts, but recommended aggressive antiviral prophylaxis of contacts only during the pre-pandemic phase. The use of antivirals without clear objectives and target groups, which could lead to drug resistance, was cited as an example of how the inappropriate use of an intervention can do more harm than good. Good preparedness plans could help prevent this problem from arising.

Sources of guidance

When evaluating measures and making recommendations, the working group took into account lessons from the recent SARS outbreak, historical data from previous pandemics, and experiences during the 1997 outbreak of human cases of H5N1 infection in Hong Kong. The SARS outbreak was considered informative, as it tested the feasibility and to some extent the effectiveness, under emergency conditions, of non-medical public health interventions. In addition, SARS was one of the first severe new diseases to spread rapidly along the routes of international air travel. Compared with pandemics during the previous century, which began in 1918, 1957, and 1968, experiences in the control of SARS may be more relevant to the behaviour of an infectious disease in a world where airlines now carry an estimated 1.6 billion travellers every year.

Recommendations and conclusions

1. An influenza pandemic is a public health emergency that rapidly takes on significant political, social, and economic dimensions. A broad range of government departments apart from public health should be engaged in pandemic preparedness planning and will need to be involved in decisions regarding interventions having potentially broad impact outside the health sector.

2. Emergency decisions will need to be made in an atmosphere of scientific uncertainty. Health authorities may need to change recommended measures as data about the causative agent become available and the epidemiological situation evolves, and as interventions either succeed in containing transmission or lose their effectiveness. The basis for all interventions should be carefully explained to the public and professionals, as well as the fact that changes can be expected.

3. Non-medical interventions will be the principal control measures pending the availability of adequate supplies of an effective vaccine. Many will have their greatest potential impact in pre-pandemic phases while others will have a role after a pandemic has begun. In some resource-poor settings, non-medical interventions will be the only control measures available throughout the course of a pandemic.

4. Non-medical interventions considered by the consultation include public risk communication, isolation of cases, tracing and appropriate management of contacts, measures to "increase social distance" (such as cancellation of mass gatherings and closure of schools), limiting the spread of infection by domestic and international travel, and the targeted use of antiviral drugs. Certain measures are recommended for consideration based on a public health perspective, although it is recognized that other factors (such as availability of health resources, political, economic and social considerations) and a country's special circumstances will legitimately influence national decisions regarding prioritization and implementation of the various options.

5. In general, providing information to domestic and international travellers (risks to avoid, symptoms to look for, when to seek care) is a better use of health resources than formal screening. Entry screening of travellers at international borders will incur considerable expense with a disproportionately small impact on international spread, although exit screening should be considered in some situations.

6. Emerging virus strains with pandemic potential require urgent and aggressive investigation to provide a stronger scientific basis for control recommendations and the strategic use of resources. Confirmation of early episodes of human-to-human transmission is especially important. Biological specimens as well as epidemiological and clinical data must be obtained and shared with extreme urgency, under the leadership of WHO. Advance planning is needed to take advantage of this narrow window of opportunity to contain or slow transmission, which will close quickly once a pandemic begins.

7. Health authorities may need to introduce extraordinary measures under emergency conditions. This is likely to require improvement of public health capacities and modernization of public health laws at national and international levels. The necessary legal authority for implementation of these measures must be in place before a pandemic begins. Respect for public health ethics and fundamental human rights is critical.

Measures at the national level

(for persons living or travelling within an affected country)

Measures	Phases*				Comments
	Pre-pandemic				
	0.1	0.2	0.3	1.0	
Public health information, communication					
Information for public on risks and risk avoidance (tailored to target population)	Y	Y	Y	Y	
Information for professionals	Y	Y	Y	Y	
Advice on universal hygiene behaviour	Y	Y	Y	Y	
Preparatory information on next phase	Y	Y	Y	Y	
Measures to reduce risk that cases transmit infection					
Confinement – Confine cases (mild and severe) as appropriate to local situation; provide medical and social care	Y	Y	Y	Y	Need to plan for large numbers of severe cases.
Face masks[1] – Symptomatic persons	Y	Y	Y	Y	Logistics need to be considered.
– Exposed person: undertake risk assessment considering: evidence of human-to-human transmission; closeness of contact; frequency of exposure	C	C	C	C	Consider recommending masks based on risk assessment.
– Persons seeking care (respiratory illness) in risk area (waiting room)	Y	Y	Y	Y	Need more data, especially on use by well persons.
Measures to reduce risk that contacts transmit infection					
Tracing and follow-up of contacts	Y	Y	Y	N	Not feasible once pandemic starts.
Self-health monitoring and reporting if ill	Y	Y	N	Y	
Voluntary quarantine (home confinement) of healthy contacts; provide medical and social care	N	N	Y	N	Home confinement should also apply to persons undergoing antiviral prophylaxis, as efficacy not known.
Advise contacts to reduce social interaction	N	N	NR	N	Not relevant for contacts in quarantine; see also measures to increase social distance.
Advise contacts to defer travel to unaffected areas	N	Y	NR	Y	Precautionary principle when unclear whether human-to-human transmission is occurring; see also travel measures.

Y = Yes, should be done at this phase; N = No, not necessary at this phase; C = Should be considered; NR = Not relevant

[1]Quality and type of mask depend on risk group. Cases: surgical mask; health care workers: N95 or equivalent; others: depends on risk.

Measures	**Phases***				**Comments**
	0.1	0.2	0.3	1.0	
Provide contacts with antiviral prophylaxis[2]	Y	Y	Y	N	Principle of early aggressive measures to avert pandemic.
Measures to increase social distance					
Voluntary home confinement of symptomatic persons	Y	Y	Y	Y	Measures needed to reduce risk of transmission to other household members.
Closure of schools (including pre-school, higher education) in conjunction with other measures (limiting after-school activities) to reduce mixing of children	N	N	C	C	Depends on epidemiological context – extent to which these settings contribute to transmission.
Population-wide measures to reduce mixing of adults (furlough non-essential workers, close workplaces, discourage mass gatherings)[3]	N	N	C	C	Consider in certain circumstances – extent to which unlinked community transmission and transmission in workplaces occurs.
Masks in public places	N	N	N	N	Not known to be effective; permitted but not encouraged.
Measures to decrease interval between symptom onset and patient isolation					
Public campaign to encourage prompt self-diagnosis	Y	Y	Y	Y	
Urge entire population (affected area) to check for fever at least once daily	N	N	N	N	
Set up fever telephone hotlines with ambulance response	N	N	C	N	
Set up fever clinics with appropriate infection control	N	N	C	N	
Introduce thermal scanning in public places	N	N	N	N	Not effective based on experience; also requires individual and public health action for identified febrile persons.
Disinfection measures					
Hand washing	Y	Y	Y	Y	
Household disinfection of potentially contaminated surfaces	Y	Y	Y	Y	
Widespread environmental disinfection	N	N	N	N	
Air disinfection	N	N	N	N	

[2]Implementation depends on adequate supplies and may require a global stockpile with a pre-negotiated targeting and delivery strategy to ensure availability in the area where a potential pandemic virus emerges. Prophylactic use will depend on evidence of effectiveness. Targeted use required because of potential for drug resistance, side effects and limited supplies. Targeted use might consider: public prevention; protection of health care workers; protection of other essential service providers; individual treatment.

[3]Given a pandemic strain causing significant morbidity and mortality in all age groups and the absence of a vaccine, authorities should seriously consider introducing population-wide measures to reduce the number of cases and deaths. Decisions can be guided by mathematical and economic modelling. If modelling indicates a reduction in the absolute numbers of cases and deaths, decisions to introduce measures, involving multiple government sectors, will then need to balance the protection of priority functions against the risk of social and economic disruption.

Measures	**Phases***				**Comments**
	0.1	0.2	0.3	1.0	
Measures for persons entering or exiting an infected area within the country					
Advise to avoid contact with high-risk environments (infected poultry farms, live poultry markets)	Y	Y	Y	Y	
Recommended deference of non-essential travel to affected areas	N	N	Y	Y	If significant areas of country remain unaffected.
Restrict travel to and from affected areas	N	N	N	N	Enforcement of travel restrictions considered impractical in most countries but likely to occur voluntarily when risk appreciated by the public.
Cordon sanitaire	N	N	N	N	Enforcement considered impractical.
Disinfection of clothing, shoes, or other objects of persons exiting affected areas	N	N	N	N	Not recommended for public health purposes, but may be required by veterinary authorities to prevent spread of infection in animals.

*Phases
0.1 = A novel virus subtype is isolated from a single human case. No evidence of further spread or outbreak activity.
0.2 = Two or more human infections with the novel virus subtype are confirmed. No evidence of human-to-human transmission.
0.3 = Human-to-human transmission is confirmed.
1.0 = Onset of pandemic. The new virus subtype causes several outbreaks in at least one country, shows international spread, and causes serious morbidity and mortality in at least one segment of the population.

Measures at the international level

Measures	**Phases***				**Comments**
	Pre-pandemic				
	0.1	0.2	0.3	1.0	
Measures at borders for persons entering or exiting a country					Message must be tailored to phase. While travel would remain matter of personal choice, transparency must be assured in order to allow for informed decision-making. Consequences for the traveller may include personal risk to health and economic harm.
Information to travellers – Outbreak notice	Y	Y	Y	Y	
– Recommend that travellers to areas experiencing outbreaks of highly pathogenic avian influenza avoid contact with poultry farms and live animal markets	Y	Y	N	N	
– Recommend deference of non-essential international travel to affected areas	N	N	Y	Y	
– Recommend deference of non-essential international travel from affected areas	*See screening measures.*				
Measures at borders for international travellers coming from or going to affected areas					
Health alert notices to travellers to and from affected areas	N	N	Y	Y	WHO negotiates with IATA to ensure that airlines distribute health alert notices; WHO facilitates shared notice formats among countries.
Medical surveillance					
– Daily self-checking for fever					
Travellers from affected area	N	N	Y	Y	
Travellers to affected area	N	N	N	Y	
– Self-reporting if symptoms appear in travellers from affected areas	Y	Y	Y	Y	Contacts of confirmed cases should be encouraged to monitor health. Quarantine may be indicated. Persons on affected conveyance should be traced and similarly advised.
– Advice on how to behave if ill after travel in affected areas (seek health care, give travel history, receive influenza lab test); if pandemic virus detected, patient should be isolated and public health officials, including WHO, notified.	Y	Y	Y	Y	
Entry screening for travellers coming from affected areas					Due to lack of proven health benefit, practice should be permitted (for political reasons, to promote public confidence) but not encouraged. Travellers should receive health alert notices instead.
– Screening for symptoms (visual detection of symptoms)	N	N	N	N	Entry screening may be considered where host country suspects exit screening (see below) at traveller's point of embarkation is suboptimal.
– Screening for at-risk travellers (health declaration, questionnaire)	N	N	N	N	

Y = Yes, should be done at this phase; N = No, not necessary at this phase; C = Should be considered; NR = Not relevant

– Thermal screening	N	N	N	N	
– Medical examination	N	N	N	N	
Entry screening options for geographically isolated infection-free areas (islands)	N	N	Y	Y	Feasible, may prevent entrance of pandemic virus. May also be relevant where country's internal surveillance capacity is limited.
Exit screening for all travellers from areas with human infection	N	N	Y	Y	More feasible than entry screening for detecting early cases.
– Screening for symptoms (visual detection of symptoms)	N	N	N	N	Not feasible due to passenger volume.
– Screening for at-risk travellers (health declaration, questioinnaire)	N	N	Y	Y	
– Thermal scanning or ear-temperature measurement	N	N	Y	Y	Thermal scanning less sensitive and specific but may be more practical than ear-temperature scanning.
– Stop list of isolated or quarantined persons	N	N	N	N	May be feasible in certain countries, but generally not encouraged.
– Recommend that ill persons postpone travel	Y	Y	Y	Y	
– Medical examination for travellers at risk or with fever	N	N	N	N	Not feasible to implement at borders.
Measures for countries with porous borders (including informal or illegal crossing points) adjoining affected areas					
Raise awareness among health care providers and general public to facilitate "informal" surveillance and response measures, such as social distancing, quarantine or isolation	N	N	Y	Y	WHO to post relevant guidelines on web for use by countries in developing posters, mass media messages, and similar measures. Possible benefits include rumour control.
Measures for travellers on board international conveyances from affected areas					
Recommend self-reporting if influenza-like symptoms appear	N	N	Y	Y	
Separate sick travellers (if possible) on board	N	N	Y	Y	On flights from affected areas, masks should be offered to all passengers upon boarding.
Advise health authority at countries of traveller's embarkation, destination and transit that a person on board is ill (airline is responsible for destination only)	Y	Y	Y	Y	Established requirement for destination, but not uniformly observed in practice.
Share epidemiological information for contact tracing with national public health authorities	N	N	Y	Y	Countries to share this information directly with others, as appropriate.

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