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TESTING AND CROSS-BORDER RISK MANAGEMENT MEASURES MANUAL

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FOREWORD

This manual has been prepared by aviation health experts led by the International Civil Aviation Organization (ICAO) with support from the United States Centers for Disease Control and Prevention (CDC), European Centre for Disease Prevention and Control (ECDC), Aerospace Medical Association (AsMA), and others, and it has been reviewed by the World Health Organization (WHO). Contributions from other United Nations organizations, governments and industry stakeholders ensured the practical applicability of this guidance in the aviation sector, no matter how big or small the State and no matter what scale of COVID-19challenge they face. Together these experts and stakeholders form the ICAO Collaborative Arrangement for the Prevention and Management of Public Health Events in Civil Aviation (CAPSCA) program. CAPSCA brings together international, regional, national and local organizations to work together to improve preparedness planning and response to public health events that affect the aviation sector.

CAPSCA developed this guidance in close collaboration with the ICAO Council Aviation Recovery Task Force (CART), which requested updated guidance on the inclusion of COVID-19 testing, vaccination and its interdependencies with other risk mitigation tools for those States that choose to include testing and vaccination as elements of their overall COVID-19 risk management process.

The CART has published updated recommendations to States in the High-Level Cover Document (HLCD) including Recommendations 13 and 17 on testing, respectively quoted below:

> "While testing is not universally recommended by public health authorities as a routine health screening method, States contemplating testing in their COVID-19 risk management strategy should apply the approach outlined in the ICAO *Testing and Cross-Border Risk Management Measures Manual.*"
>
> "Member States should implement testing certificates based on the protocol, minimum dataset and implementation approaches outlined in the *Manual on Testing and Cross-Border Risk Management Measures* (Doc 10152) to facilitate air travel. States are encouraged to request evidence of testing that is secure, trustworthy, verifiable, convenient to use, compliant with data protection legislation and internationally/globally interoperable. Existing solutions should be considered and could incorporate a visible digital seal. This may be applicable to vaccination certificates."

The CART has also published new Recommendations 18 and 19 in the HLCD concerning vaccination, as follows:

> "Member States should facilitate access for air crew to vaccination as quickly as possible within the World Health Organization (WHO) Strategic Advisory Group of Experts on Immunization (SAGE) Stage III recommendations."
>
> "Vaccination should not be a prerequisite for international travel. If and at such time as evidence shows that vaccinated persons would not transmit the SARS-CoV-2 virus or would present a reduced risk of transmitting the virus, Member States could consider exempting such persons from testing and/or quarantine measures, in accordance with a State's accepted risk threshold, national framework, the COVID-19 situation and the multilayered risk mitigation framework described in the *Take-off: Guidance for Air Travel through the COVID-19 Public Health Crisis."*

In addition, the CART revised Recommendation 14 in the HLCD concerning Public Health Corridors (PHC) as follows:

> "States considering the formation of a Public Health Corridor (PHC) should actively share information with each other to implement PHCs in a harmonized manner. To facilitate the implementation, the ICAO Implementation

Package (iPack) on establishing a PHC is available to States, in addition to PHC-specific tools published on the ICAO website and the App providing a template PHC arrangement between States."

As part of its CART endeavors, CART has updated the third edition of the Take-off: Guidance for Air Travel through the COVID-19 Public Health Crisis (TOGD), originally issued in June 2020 and revised in November 2020. The third edition of the TOGD reflects technological and medical advancements and provides the latest operational and public health guidance related to air travel reflecting technological and medical advancements. The recommended multi-layer risk management strategy has been supplemented with considerations on testing protocols and proof-of-results certification interoperability, crew considerations for testing and vaccination as well as including evidence of vaccination for crew and passengers. Guidance on the establishment of PHCs as well as guidance on the need for appropriate masks during air travel, were also updated.

The second edition of this manual was revised in close collaboration with CAPSCA. It provides updated detailed guidance on risk management, PHCs, information on recent scientific developments regarding COVID-19 testing, as well as a new section on vaccination and its interdependencies with other tools of a State's multilayer risk management framework. This guidance supplements the measures already outlined in the CART HLCD and TOGD and provides a risk management process to facilitate States' assessment of the applicability of a combination of measures available today.

COVID-19 testing, and in the future, vaccinations, if applied according to the guidance contained in this manual, could reduce reliance on measures that restrict air travel and the movement of persons arriving in a country, such as quarantine, which evidence suggests is a disincentive to several important categories of travel of which the following list is non-exhaustive: pilot certification, pilot simulator training, essential business flights and tourism for some States which are dependent on inbound tourism for economic sustainability. Restoring confidence in aviation is a key priority. Quarantine may still apply for persons with symptoms consistent with COVID-19 and known close contacts of persons diagnosed with COVID-19, while self-isolation or other measures could be applied for non-symptomatic persons in accordance with a State's assessed risk tolerance.

In implementing testing as a component of their overall COVID-19 multi-layered risk management strategy, States are advised that an effective application of a multi-layered risk strategy, including testing, is one in which:

a) States perform a risk assessment[1] using epidemiologic criteria including but not limited to disease prevalence, new variants, disease trajectory, national testing strategy[2], screening capabilities, hospital capacity and robustness of contact tracing and (potentially) status of national vaccination strategy;

b) States share the results of the risk assessments, the local epidemiology and transmission scenarios in the departure and destination countries or areas as well as the public health and health system capacity and performance to detect and care for returning travellers and their contacts; with other States to facilitate the opening of air routes;

c) States consider their risk tolerance, and issues such as socio-economic and human rights issues, as a part of their risk assessment;

d) States use their risk assessment and risk tolerance in determining the application of a multi-layered risk management strategy;

e) States that select to utilize testing for screening purposes in aviation after consideration of national

[1] WHO guidance on Considerations on implementing a risk-based approach to international travel https://www.who.int/publications/i/item/WHO-2019-nCoV-Risk-based-international-travel-2020.1

[2] Scientific brief on COVID-19 diagnostic testing in the context of travel https://apps.who.int/iris/handle/10665/337832?locale-attribute=fr&

testing capacity, apply a cut-off value, based on evidence generated from asymptomatic individuals, for sensitivity and specificity as high as possible (with a minimum of 95 per cent sensitivity and specificity for molecular tests; and a minimum of 80 per cent sensitivity and high specificity (minimum ≥ 97 per cent and ideally > 99 per cent for rapid antigen tests) to reduce inaccurate test results, although these values might change as science matures[3];

f) States, take into account the test result, in the future vaccinations, when considering the need for and duration of isolation or quarantine when addressing higher risk scenarios and applying testing as part of the multi-layer risk management strategy; and

g) States harmonize their procedures to the extent possible.

This manual describes the risk management measures which can be applied; how epidemiology can be used to advise States in developing a risk management strategy; possible testing protocols which might be put in place where there is differential prevalence, and therefore risk; and a series of examples to help States in their decision-making process.

[3]SARS-CoV-2 antigen-detecting rapid diagnostic tests: An implementation guide: https://www.who.int/publications/i/item/9789240017740

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GLOSSARY

LIST OF ACRONYMS AND ABBREVIATIONS

Ab	Antibody
Ab-RDT	Antibody-detecting rapid diagnostic test
Ag	Antigen
Ag-RDT	Antigen-detecting rapid diagnostic test
API	Advance Passenger Information
CAPSCA	Collaborative Arrangement for the Prevention and Management of Public Health Events in Civil Aviation
CART	Council Aviation Recovery Task Force
COVID-19	Coronavirus disease 19
ECDC	European Centre for Disease Prevention and Control
EUL	Emergency Use Listing
FTL	Flight time limitation
HLCD	High-Level Cover Document
ICAO	International Civil Aviation Organization
IHR	International Health Regulations
NAAT	Nucleic acid amplification test
NPV	Negative predictive value
PCR	Polymerase chain reaction
PHC	Public health corridor
RDT	Rapid diagnostic tests
PHC	Public Health Corridor
PNR	Passenger Name Record
PPE	Personal protective equipment
PPV	Positive predictive value
RT-PCR	Reverse-transcription polymerase chain reaction
SAGE	Strategic Advisory Group of Experts on Immunization
SARS-CoV-2	Severe acute respiratory syndrome coronavirus 2
TOGD	Take-off Guidance for Air Travel through the COVID-19 Public Health Crisis
WHO	World Health Organization

DEFINITIONS

Asymptomatic. A person infected with COVID-19 who does not develop symptoms.

Contact. A person in any of the following situations from two days before and up to fourteen days after the onset of symptoms in the confirmed or probable case of COVID-19:

— face-to-face contact with a probable or confirmed case of COVID-19 within one meter and for more than fifteen minutes;

— direct physical contact with a probable or confirmed case of COVID-19;

— direct care for an individual with probable or confirmed COVID-19 without using proper personal protective equipment; or

— other situations, as indicated by local risk assessments.

Refer to WHO for full definition[4].

Contact tracing. An investigative procedure aimed at acquiring contact information to approach contacts that were potentially exposed to the virus, which is a key strategy for interrupting chains of transmission of SARS-CoV-2 and reducing COVID-19-associated mortality.

Diagnostic. Relating to or using the methods for diagnosis.

Emergency use listing procedure. The WHO emergency use listing procedure (EUL) is a risk-based procedure for assessing and listing unlicensed vaccines, therapeutics and in vitro diagnostics with the ultimate aim of expediting the availability of these products to people affected by a public health emergency.

Epidemiology. The branch of medicine which deals with the incidence, distribution and possible control of diseases and other factors related to health.

False negative test. A result that indicates that the disease is not present when the person actually does have the disease.

False positive test. A result that indicates that the disease is present when the person actually does not have the disease.

Genomic sequencing. The process of determining the entirety, or nearly the entirety, of the DNA sequence of an organism's genome, supporting the monitoring of the disease's spread and evolution of the virus.

Incidence. The number of new cases in a specified population during a specified period of time.

Isolation. Separation of ill or contaminated persons in such a manner as to prevent the spread of infection or contamination.

Monte Carlo approach. A broad class of computational algorithms that rely on repeated random sampling to obtain numerical results.

Molecular testing. A type of diagnostic tests such as RT-PCR tests that detect the virus's genetic material.

Negative predictive value (NPV). How likely a negative test is a true negative.

Positive predictive value (PPV). How likely a positive test is a true positive.

Prevalence. Disease burden expressed as a percentage or rate with the total population as the denominator; in this context, the number of existing cases in a defined population at a given point in time.

Point-of-care tests. Tests that provide results within minutes of the test being administered, allowing for rapid decisions.

Quarantine. The restriction of activities and/or separation from others of suspect persons who are not ill ... in such a manner as to prevent the possible spread of infection or contamination.

***Rapid diagnostic antigen tests*.** Tests that detect the presence of viral proteins (antigens) expressed by the COVID-19 virus in a sample from the respiratory tract of a person.

[4] https://www.who.int/publications/i/item/contact-tracing-in-the-context-of-covid-19

***Risk management*.** Identification, evaluation, and prioritization of risks followed by coordinated application measures to minimize, monitor, and control the probability or impact of the risk.

Risk threshold or tolerance. The amount of risk that governments, organizations and stakeholders are willing to accept.

Screening. Medical examination of a person or group to detect disease or abnormality, especially as part of a broad survey rather than as a response to a request for treatment.

Sensitivity. The likelihood that a test will correctly identify a person with the disease; the “true positive” rate.

Serologic test. A test that measure the antibody response in an individual.

Specificity. The likelihood that a test will correctly identify a person without the disease; the “true negative” rate.

Chapter 1

INTRODUCTION

1.1 This guidance is intended for use by State regulators, service providers and other concerned entities, to address cross-border risk management in commercial air transport operations. The objective of the guidance is to inform States about public health risk management strategies, including those that could be applied to aviation personnel to reduce the probability of translocation (transfer) of the disease from one region to another. This document contains guidance for implementing a systematic process to identify risks related to the COVID-19 pandemic and mitigate those risks to an acceptable level as determined by each individual State. The final objective is to create a harmonized and cooperative effort to maintain global connectivity while ensuring public health security. Updates will be provided as new scientific evidence becomes available. In the future, as more States begin to plan their route out of COVID restrictions, this updated manual would offer clear guidance on how best to use public health mitigation measures including (testing and vaccination) to reduce travel restrictions and gradually return to restoring air connectivity in a safer way.

1.2 The guidance provides assessment tools that States can use to evaluate and implement measures as part of their decision-making process. For this purpose, an example of the process is presented and applied to a strategy that utilizes a range of risk mitigation measures. This guidance does not constitute a recommendation for application of any specific measure but rather a guideline on how to assess different mitigation strategies and on how they can contribute to public health risk management. As an example of this approach, the document will provide the description of a strategy based on the assessment of epidemiological indicators, testing and quarantine practices. Additional detailed guidance for States will be included as attachments by ICAO and references to the WHO publications.

1.3 This manual has been developed using the most recent information as of its publication date. The urgency, rapid development, and observed consequences of the current scenario required an expedited approach based on expert consensus and current scientific evidence. Consequently, regular updates will be required as the evidence evolves and as technology advances. Data-driven adjustments to the guidance will be made as the situation evolves.

1.4 Each State will need to conduct its own assessment and is encouraged to use the processes outlined in this manual as the basis for its assessment. Risk tolerance varies between States and depends on many factors. This has an influence on the amount of residual risk a State can accept. The determination of such level cannot be universal as it depends on specific priorities and the sovereignty of each individual State.

Chapter 2

GENERAL RISK MANAGEMENT PRINCIPLES APPLIED TO AIR TRANSPORT

2.1 A multi-layered risk management process is considered appropriate in the context of a public health risk management framework and aligned with the intent of the WHO "Considerations for implementing a risk-based approach to international travel in the context of COVID-19"[5]. The objective of this process is to identify the residual risk, considering various risk mitigation measures in place for unknowingly transporting an infectious passenger or translocating the SARS-CoV-2 virus. This approach is scalable in complexity and considered the baseline for more sophisticated processes e.g. end-to-end risk assessment models (paragraph 2.6 refers).

2.2 The proposed risk assessment process relies on a continuous process that considers risk holistically by defining a risk scenario instead of focusing on a single hazard or threat. The determination of an inherent risk results from evaluating the likelihood of the risk scenario, as well as defining the resulting impact. It is essential to consider risk mitigation measures which are already in place when conducting the initial assessment of the inherent risk. This step of the risk assessment process cannot consider future or potential management measures as it intends to provide the "as is" situational assessment. The result provides States with information relevant to determining if the risk scenario lies within its public health management capacity. As the inherent risk changes, States will need to modify their risk management measures. (Appendix B of this manual illustrates an example of a basic decision-making process to determine such risk). In addition, States should consult the *Safety Management Manual* (Doc 9859) and the *ICAO Handbook for CAAs on the Management of Aviation Safety Risks related to COVID-19* (Doc 10144).

2.3 The modelling of a risk scenario is the starting point in the process, based upon the existing situational assessment but considering multi-agency collaboration within the context of the State. A generic baseline example for such a scenario could be "the risk to be assessed is of an infectious person being on board an international flight" or "the risk of translocation of the virus through air transport". The shape of the risk scenario will need to address a State's view on what it considers as the most critical aspect of public health management. The process then progresses through different available management solutions that affect the overall risk. It is designed in a way that the efficacy of each management measure can be assessed either qualitatively or quantitatively.

Box 1. Risk management terminology

Risk avoidance. It is often the most powerful tool of risk management and aims at reducing the likelihood of risk by avoiding it. It is, however, also the most limiting tool.

Risk mitigation. It aims at reducing the impact of the risk (by addressing the likelihood, magnitude, or both when risk cannot be avoided).

Risk transfer. It aims to move the impact of the risk to a different environment. This is complex and should only be used if the risk can be fully measured, addressed and mitigated by the environment it is transferred to (an example could be to transfer risk to a State with better health care capacity).

Risk tolerance/acceptance. It is the process of accepting the consequence (impact) of a risk. This technique is often advisable only when the risk is small but may need to be considered in complex risk scenarios.

[5] https://www.who.int/publications/i/item/WHO-2019-nCoV-Risk-based-international-travel-2020.1

2.4 Risk mitigation is likely the most appropriate strategy in the context of pandemic risk management in air transport. In the further conduct of the risk assessment process, it will be necessary to employ most or all available and fast-evolving mitigation measures such as requiring masks, passenger locator forms, testing, physical distancing, etc., at airports and during flights. In multi-layered defence models, these mitigation measures are depicted as layers (e.g., James Reason Swiss Cheese Model – see Figure 2-1). There is no completely risk-free travel possible but the risk can be mitigated through the combined application of these mitigation strategies. There may be limited scientific peer-reviewed evidence-based efficacy for these mitigation measures, and the scope of their impact on transforming the inherent risk is based on expert consensus and existing available evidence. As a result, much of the risk assessment is qualitative and, as such, provides the flexibility to be adopted and integrated into existing national public health and aviation plans. The risk assessment process will consider the chosen mitigation measures, and regularly evaluate how they affect the likelihood and impact of the inherent risk. A State can then determine if the residual risk is within public health management capacity.

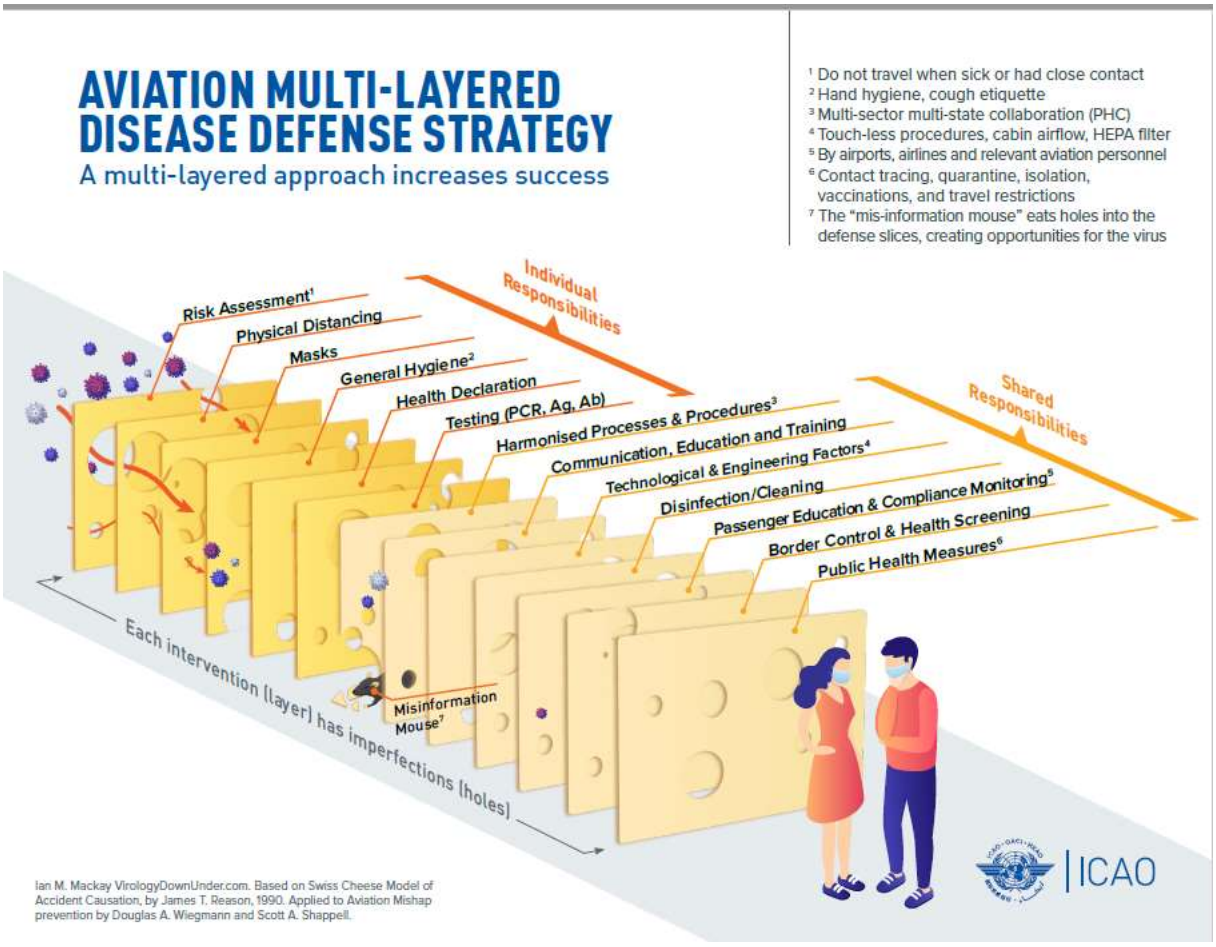

Figure 2-1. James Reason Swiss Cheese Model

2.5 Health risks (as related to air transport) can be approached in a similar way as aircraft safety and must be addressed together. To this end, airplane manufacturers, for example, have created end-to-end risk assessment models which calculate the risk of virus transmission and virus translocation by modelling steps and parameters in the door-to-door, air travel journey. One example leverages an open data platform, considering a variety of airport, aircraft, personal health

and safety considerations, and different testing and quarantine scenarios. The model covers the complete air travel, from entering the departure airport to leaving the arrival airport and relying on internal expertise and safety experience. The model's objective is to support government agencies in making performance-based, data-substantiated decisions when applying and evaluating risk management principles and strategies to secure air travel for the flying public.[6]

2.6 Another such model compares different screening approaches through one or more COVID-19 tests in order to provide safe options that will allow the reopening of international travel. It uses a Monte Carlo approach to simulate a group of COVID-19 infected travellers, each with an individual infection timeline, and model test performance as a function of that timeline to compare the effectiveness of different screening strategies. The model provides an avenue to compare the relative performance of different screening and quarantine strategies and to determine which approaches may be appropriate for country-pair specific travel journeys. It is built as a web-based tool that will provide users a flexible interface to compare multiple screening options for travel between any two selected countries with available COVID-19 prevalence data. The inclusion of prevalence data allows for computation of a “post-screening prevalence” for screened travellers (calculated using the negative predictive value) in order to compare the starting prevalence of the origin country, the post-screening prevalence for a variety of screening options, and the prevalence of the destination country. This allows for comparison of the prevalence among screened travellers to the existing prevalence in the destination country.[7]

2.7 One more model is a multi-disciplinary, adaptive, software-based risk management tool designed to support risk-based decision making that restores safety, confidence and convenience in commercial aviation. The model employs a semi-quantitative, deterministic modular approach with group-structured mixing to demonstrate relative effectiveness of layered disease control measures that protect against airborne and surface borne disease transmission throughout the end-to-end travel journey in global transportation systems.[8]

2.8 The crucial result of an effective risk management process is that the residual risk is within the public health management capacity of the State concerned. This determination needs to be done under the sovereignty and responsibility of each State. Faced with a fast-evolving pandemic, the risk assessment process must be regularly repeated if a State is to be confident that its mitigation measures are keeping the risks within the capacity of its public health system. WHO has developed a suite of health service capacity assessments in the context of the COVID-19 pandemic to support rapid and accurate assessment of the current, surge and future capacities of health facilities throughout the different phases of the COVID-19 pandemic[9].

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[6] AIRBUS: '' End to end risk assessment model”

[7] Boeing CTI passenger screening model

[8] Boeing Travel Risk of Infection Prevention (TRIP);

[9] https://apps.who.int/iris/rest/bitstreams/1313691/retrieve

Chapter 3

TESTING, VACCINATION AND CROSS-BORDER RISK MANAGEMENT MEASURES

3.1 OVERVIEW

3.1.1 Air connectivity will be essential to enable economic recovery. When States endeavour to restart international travel, they will need effective strategies for mitigating the risk of active case importation and disease transmission within the air transport system. States will rely on community accountability and ownership, traveller education, and other collaborative cross-border measures in accordance with international recommendations from health authorities.

3.1.2 Given the high complexity of the current public health crisis, there is no single measure that can be deemed as a definitive solution. Every mitigation measure affects the system in different ways. States should identify and compare levels of risk cognizant that public health risks cannot be eliminated. Therefore, the layered risk-mitigation defence discussed in Chapter 2 is strongly recommended. The following guidelines are meant to assist States in understanding how current mitigation measures can contribute to managing public health risks.

3.1.3 Emerging strategies should be considered and revised as new scientific evidence is published, innovative approaches are tested, and potential outcomes are modelled. As the pandemic dynamics evolve, new approaches such as probabilistic models, innovative testing technologies, air quality improvement, disinfection methods, immunizations and other processes are under rapid development and should be added to the strategies as their efficacy and cost-effectiveness is substantiated.

3.1.4 The layered defence measures against COVID-19 include steps being taken individually, at airports, and on board. Different measures might be applicable to different situations. Measures should be applicable to all passengers, as well as aviation personnel that are required to fly, including for duties, training or certification purposes e.g., flight and cabin crew; maintenance engineers/technicians. Measures should also be applicable to staff that have contact with the travelling public such as ground service agents. Mitigation measures can be categorized into personal and shared responsibilities and may include some or all the measures listed below:

a) temperature testing and/or health declaration (fever, loss of sense of smell or taste, chills, cough, shortness of breath, headaches, muscle pains, etc.);

b) self-awareness orientation including various channels of passenger communication to allow passengers to identify symptoms and complete/submit health declarations or health attestations;

c) enhanced cleaning and disinfection; contactless boarding/baggage processing; use of physical barriers and disinfection in airports;

d) physical distancing at airports and during boarding; use of face masks; separation between passengers on board when feasible[10]

e) adjustment of food and beverage service to reduce contact; control of access to aisles and bathrooms to minimize contact;

[10] WHO: Mask use in the context of COVID-19 (https://www.who.int/publications/i/item/advice-on-the-use-of-masks-in-the-community-during-home-care-and-in-healthcare-settings-in-the-context-of-the-novel-coronavirus-(2019-ncov)-outbreak).

f) facilitation of contact tracing if a passenger or crew member develops infection[11];

g) testing protocols consistent with the State's public health capacity, risk threshold, transmission patterns, scientific evidence and based on multi-sector consultation;

h) requiring vaccination in alignment with the International Health Regulations, WHO recommendations, and national policies, once there is evidence for the reduction of transmissibility from vaccinated persons– current preliminary results are encouraging and are being monitored by ICAO;

i) engineering factors, environmental control systems, such as the optimisation of HVAC systems;

j) hygiene, avoid touching face, covering cough;

k) communication, education and training;

l) State, provincial, local policies and civil aviation procedures;

m) COVID-19 testing, isolation and quarantine, when applicable, with exception of crew in accordance with the CART TOGD; and

n) promoting participation in national vaccination programmes recognising that vaccination offers personal protection from infection.

3.1.5 The following mitigation measures are specifically applicable to crew required on board for the air operator to support the flight, including those that maybe required to position before or after a duty, to facilitate the continued operation of aircraft. The measures outlined below are consistent with the layered approach outlined above and are based on a risk assessment for crew. States should, taking into consideration a State's national framework and situation:

a) recognise crew members as essential personnel to contribute to the continuity of critical transport services during the COVID-19 pandemic;

b) recognise crew members are required to cross international borders as a part of their duties and as such conduct a separate risk assessment and implement minimal requirements to ensure global connectivity

c) not impose quarantine measures on crew who need to layover, or rest, for the purposes of complying with flight time limitation (FTL) rest requirements;

d) not subject crew to screening or restrictions applicable to other travellers, but apply minimal requirements aligned with the crew module in the TOGD;

e) exempt crew from testing measures considering the frequency of travel and use of existing occupational health programs;

f) exempt crew with documented past cases of COVID-19, or who have antibody proven immunity (IgG) and medical clearance of clinical recovery from testing measures;

g) if crew cannot be exempted from testing, apply tests that are minimally invasive and reduce the need for multiple tests on a journey (for example by only requiring testing at the home base immediately prior to and after duty);

[11] https://www.who.int/publications/i/item/contact-tracing-in-the-context-of-covid-19

h) facilitate access for air crew to vaccination as quickly as possible within the WHO SAGE Stage III recommendations[12] and applicable national policies;

i) follow vaccination guidelines for aviation workers described in 3.6.3;

j) expedite security and immigration clearance (e.g., dedicated crew line);

k) provide separate waiting areas from travellers; and

l) provide access to dedicated ground transportation.

3.2 ASSESSMENT OF EPIDEMIOLOGICAL INDICATORS

3.2.1 States could consider implementing testing as part of their COVID-19 risk management strategy, taking into consideration the principles of a "generic risk management process" contained in Chapter 2 and the detailed epidemiology primer (Attachment B).

3.2.2 A critical step in assessing risk for States is understanding the real time epidemiologic indicators of prevalence and the disease trajectory (escalated spread, diminishing cases or emergence of new variants) in addition to the availability of testing, health care system saturation, and robustness of contact tracing. Studying these factors will allow countries to compare disease rates between points of origin and arrival by member States or region, and in some cases by cities depending on the detail of the disease reported by public health authorities and the ability of a State or region to correctly identify and treat ill people. There are several sites reporting rolling averages of new cases per 100 000 people including the WHO (https://covid19.who.int/), the ECDC (https://qap.ecdc.europa.eu/public/extensions/COVID-19/COVID-19.html#global-overview-tab) and Brown School of Public Health (https://globalepidemics.org/key-metrics-for-covid-suppression/). The reliability of the case numbers is affected by the availability of tests, testing intensity, national testing strategy in each phase of the pandemic and the timeliness and accuracy of reporting of data.

3.2.3 Prevalence is the proportion of the population with a disease at a given time. In considering the goal of lowering the risk of disease transmission during travel and disease translocation risk to the destination country, the potential number of persons on board an aircraft who could be infectious during the journey is vital. That data must be inferred as there is no current ability to determine it directly through routine surveillance testing. It can be estimated by multiplying the cases per 100 000 by the infectivity period and then factoring in the asymptomatic rate. This number is then converted to a percent infectious per 100 persons. In this case, prevalence is a better indicator of potentially infectious individuals than incidence (new cases per day); however, an awareness of incidence will influence the shrinking or growth of the disease cases in a given area.

3.2.4 Disease trajectory refers to whether the number of new cases of disease remains stable, increases or decreases over time. An awareness of which way the infection rates are going may assist in monitoring risk. For instance, if a State level of disease is in a moderate range, but there is a doubling of case rates per week, a State may want to rethink requirements or risk mitigation strategy.

3.2.5 To gain a true picture of the prevalence and trajectory of disease, testing should be readily available and utilized routinely when individuals are either displaying symptoms or are identified as close contacts. States may wish to consider the proportion of testing compared to the population, the percentage of positive results, and the proportion of positive tests in symptomatic or close contacts compared to asymptomatic persons. Testing strategy is further detailed in WHO's interim guidance on laboratory testing (https://apps.who.int/iris/bitstream/handle/10665/331509/WHO-COVID-19-lab_testing-2020.1-eng.pdf?sequence=1&isAllowed=y).

[12] WHO: WHO SAGE Roadmap for Prioritising Uses of COVID-19 Vaccines in the context of limited supply https://www.who.int/publications/m/item/who-sage-roadmap-for-prioritizing-uses-of-covid-19-vaccines-in-the-context-of-limited-supply

3.2.6 States may use this information to classify or stratify cities, States, or regions by risk level (see Chapter 4). By developing these benchmarks, States and regions can begin to discuss mitigation strategies necessary between States including potential bilateral, multilateral or regional arrangements to facilitate air transport (i.e. 'Public Health Corridors), or temporarily expanding or liberalizing cargo traffic rights.

3.3 TESTING AS A SCREENING STRATEGY APPLIED TO AVIATION

3.3.1 Testing concepts

3.3.1.1 While testing is not universally recommended by public health authorities as a routine screening method for asymptomatic international travellers, it has been implemented by many States for this purpose. For those States desiring to employ testing as a part of an overall risk mitigation strategy, the following concepts should be considered:

a) Reducing risk to zero is impossible, but testing can be one measure in the multi-layered risk mitigation process.

b) There are four reasons to consider testing:

1) reducing potential transmission during the actual travel;

2) reducing potential introduction of disease in a destination region/country;

3) potentially reducing or eliminating isolation/quarantine for the traveller at their destination; and

4) helping to identify imported cases of new variants through genomic sequencing.

c) States should consider including the concept of limiting the exportation of disease and developing methods to communicate to travellers the need to remain at their residence when ill, when in isolation, when in quarantine, if they have a pending test following the onset of symptoms compatible with COVID-19 and any other relevant measures as recommended by the relevant Public Health Authority.

d) The current approved COVID-19 tests that are recommended by public health authorities are for testing of symptomatic or exposed individuals for diagnostic purposes. Use in an asymptomatic population may yield different test performance than that of symptomatic cases. In Attachment B, Epidemiologic primer, a margin of error is described and used to account for asymptomatic cases in the development of the positive and negative predictive values. The use of antigen testing in low-prevalence settings including asymptomatic individuals is described in detail in 3.3.2.

e) In areas with low test availability, States should balance the diagnostic needs in symptomatic individuals and individuals related to high-risk settings against screening of healthy or asymptomatic potential travellers.

f) Testing requirements should reflect the difference in the epidemiological situation of the point of origin and destination and where the epidemiological situation is equal, there should, in principle, be no testing requirements, in accordance with States' national policies.

g) Testing should be performed by individuals in accordance with the appropriate authorities' policies and procedures. Standards and procedures for presenting test results for traveling purposes is described in 3.3.8 (Standardization and validation of testing certificates) and included as PHC Form 5 in the CART

TOGD to facilitate recognition by different authorities. A positive test regardless of type should be considered positive pending clinical correlation and/or confirmatory testing when appropriate.

h) Exempting travellers/air crew with documented past cases of COVID-19, or who have antibody proven immunity (IgG) and medical clearance of clinical recovery from testing measures. However, other mitigation strategies (wearing masks, physical distancing etc.) should remain in place while studies are underway to determine duration of immunity and until conclusive evidence is available.

3.3.2 Testing methods and performance-based recommendation

3.3.2.1 Robust testing strategies are an essential aspect of preparedness and response to the COVID-19 pandemic, allowing for early detection of potentially infectious individuals[13]. While RT-PCR remains the 'gold standard' for COVID-19 diagnosis, new tests are rapidly entering the market. At the time of publication, molecular testing (e.g. real-time RT-PCR) is recommended by WHO for routine diagnosis.

3.3.2.2 At the same time, the performance of second generation rapid antigen tests has significantly improved. Allowing faster and cheaper ways to detect ongoing infections, rapid antigen tests have increasingly become an important part of the overall response to the pandemic. Some States have for instance included high-performing rapid antigen tests as an option for pre-departure tests. Rapid antigen tests will most often be positive when viral loads are highest and patients are most infectious, typically one to three days prior to the onset of symptoms and during the first five to seven days after the onset of symptoms – and will become negative as the patient clears the infection and recovers.

3.3.2.3 The use of antigen-detecting rapid diagnostic test (Ag-RDTs) is not recommended in settings or populations with low expected prevalence of disease e.g., screening at points of entry, where confirmatory testing by Nucleic acid amplification test (NAAT) is not readily available. In such settings, the rate of false positives compared to true positive results will be high. Rapid diagnostic tests (RDT) in low-prevalence settings without NAAT confirmation will not be advisable until there are significantly more data from high-quality studies confirming very high specificity (> 99 per cent) of Ag-RDT test kits.[14] Conversely, in low-prevalence settings, the negative predictive value (NPV) is high and thus there is a very high probability that patients who test negative do not have COVID-19.[15]

3.3.2.4 Given the relatively low prevalence of active SARS-CoV-2 infections among travellers even in settings with community transmission, WHO recommends high specificity Ag-RDTs (minimum $\geqslant$ 97per cent and ideally > 99 per cent) to avoid many false positive results with a minimum sensitivity of 80 per cent for Ag-RDT tests. For screening purposes, these thresholds should be based on evidence generated from asymptomatic individuals. Sensitivity varies based on patient-specific factors, such as the degree of illness and days since symptom onset, as well as product quality.

3.3.2.5 The real-world examples in Figure3-1 below[9] show how the predictive value of an Ag-RDT with the minimum recommended 80 per cent sensitivity and 97 per cent specificity can vary based on the prevalence of COVID-19.

[13] "COVID-19 diagnostic testing in the context of international travel" (https://www.who.int/publications/i/item/WHO-2019-nCoV-Sci_Brief-international_travel_testing-2020.1)

[14] https://www.who.int/publications/i/item/antigen-detection-in-the-diagnosis-of-sars-cov-2infection-using-rapid-immunoassays

[15] SARS-CoV-2 antigen-detecting rapid diagnostic tests: An implementation guide: https://www.who.int/publications/i/item/9789240017740

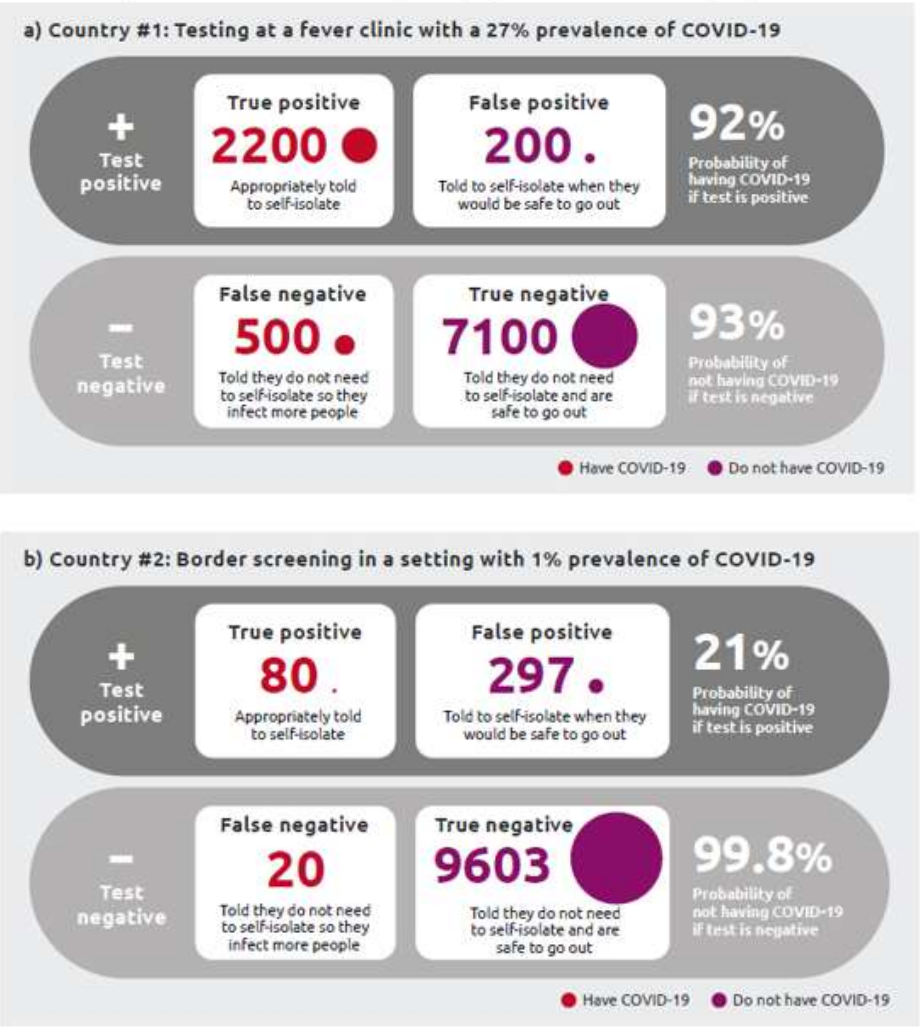

Figure 3-1. Predictive value of Ag-RDT with 80 per cent sensitivity and 97 per cent specificity in a) a fever clinic with a 27 per cent prevalence of COVID-19 and b) at border screening with a 1 per cent prevalence of COVID-19, in a population of 10 000 people.

3.3.2.6 Serological tests should not be utilized as the sole factor for COVID-19 diagnosis. They should be used in conjunction with clinical evaluation and judgement.

3.3.2.7 As more and different tests are approved for emergency use, including some that were previously considered to be less effective, specifying a particular test or set of tests as the “best” regimen to use becomes challenging. Each of these tests has distinct advantages and disadvantages which need to be considered. The table below describes the advantages and disadvantages of different testing methods. More information can be found in the WHO guidance on SARS-CoV-2 antigen detecting rapid diagnostic tests[16].

[16] https://www.who.int/publications/i/item/antigen-detection-in-the-diagnosis-of-sars-cov-2infection-using-rapid-immunoassays

Table 3-1. Advantages and disadvantages of testing methods for SARS-Cov-2

TEST TYPE	ADVANTAGES	DISADVANTAGES
Nucleic acid amplification testing (NAAT)	• Detects active SARS-CoV-2 infection • High sensitivity and specificity	• Turnaround time of hours to days • Labour intensive • Requires laboratory infrastructure and skilled personnel • More expensive than RDTs
Rapid diagnostic tests: Antigen-detecting tests	• Detects active SARS-CoV-2 infection • Can be used at the point of care (outside laboratories) • Easy to perform • Quick results (typically under 30 minutes) enabling rapid implementation of infection control measures, including contact tracing • Less expensive than NAAT, e.g., RT-PCR tests	• Variable sensitivity and specificity, generally lower than NAAT • Lower sensitivity means negative predictive value is lower than for NAAT, especially in settings with high prevalence of SARS-CoV-2 • Confirmatory NAAT testing of RDT positives is advised in all low-prevalence settings and for RDT negatives in high-prevalence settings. • Negative Ag-RDT results cannot be used to remove a contact from quarantine
Rapid diagnostic tests: Antibody-detecting tests	• Ab-RDTs can be used to detect previous infection with SARS-CoV-2 • Can be used at the point of care (outside laboratories) or in higher throughput formats in laboratories • Easy to perform • Quick results (typically under 30 minutes for point-of-care testing) • Less expensive than NAAT, e.g., RT-PCR tests	• Clinical significance of a positive Ab-RDT result is still under investigation • Positive Ab-RDT results do not guarantee presence of neutralizing antibodies or protective immunity • Ab-RDTs should not be used for determining active infections in clinical care or for contact-tracing purposes • Interpretation of Ab-RDT results depends on the timing of the disease, clinical morbidity, the epidemiology and prevalence within the setting, the type of test used, the validation method, and the reliability of the results

3.3.2.8 One of the aims of this guidance is to establish a performance-based recommendation for testing regardless of the methodology that the States could consider if using testing as a part of their risk mitigation measures. This is aligned with the ICAO risk-based approach, supporting State sovereignty to make decisions based on a State's risk assessment and risk tolerance, guided by their own priorities and consideration of epidemiological indicators, practical testing limitations and other relevant considerations.

3.3.2.9 States are advised to:

a) continuously consider and re-evaluate the performance of the tests available in the market and the application for which it is being considered for use (e.g., study population upon which performance data is based, whether the performance data supports screening, diagnosis or monitoring, etc.);

b) implement a strategy to manage positive and false positive test results (e.g., confirmatory testing);

c) record and review testing data on a frequent basis;

d) monitor scientific developments and adjust their testing protocols accordingly; and

e) distinguish between passengers, crew members and other aviation occupations who are covered by occupational health programs i.e. consider the role of existing occupational health programs when assessing crew risk.

3.3.3 Pre-departure testing

3.3.3.1 The goal of pre-departure testing is to limit the potential transmission of COVID-19 during travel and may contribute to the reduction in the risk of translocation of the disease. A single pre-departure test alone is more effective in mitigating on board transmission than translocation of disease. Adding testing as a component to a multi-layered risk mitigation strategy reduces reliance on recognizing and reporting symptoms as a sole means to identify infected travellers. No testing regime can reduce the risk to zero; hence, travellers must continue to employ routine recommended public health measures at all times. The current understanding of COVID-19 allows the assumptions below. The closer the testing is to departure, the more likely the person will remain unable to infect others during the journey. Testing too far in advance of departure results reduces the advantage of the risk reduction allowed by pre-departure screening. The optimum risk reduction results can be achieved by testing within 48 to 72 hours of departure. This conclusion is based upon the following:

a) incubation time: 2 to12 days (95 per cent of cases) with a median of 5 to 6 days;

b) viral shedding can occur 48 hours prior to symptom onset;

c) the most sensitive tests turn positive 1 to 3 days (24 to 72 hours) prior to symptoms; and

d) leaving a 2- to 4-day period where a person could be infected but not contagious while travelling (i.e. a negative test if the median incubation period is used). However, this could miss very short incubation cases.

3.3.3.2 Figure 3-2 below [17] provides an overview of the use of antibody and virus detection tests in relation to transmission of the SARS-CoV-2 with reference to guidance from the Ministry of Health of Spain[18]

[17] "EASA Guidelines for Aero-Medical Centres and Aeromedical Examiners regarding the examination and assessment of applicants" https://www.easa.europa.eu/document-library/general-publications/guidelines-aero-medical-centres-and-aeromedical-examiners

[18] https://www.synlab-sd.com/en/blog/covid-19-tests-everything-you-need-to-know/

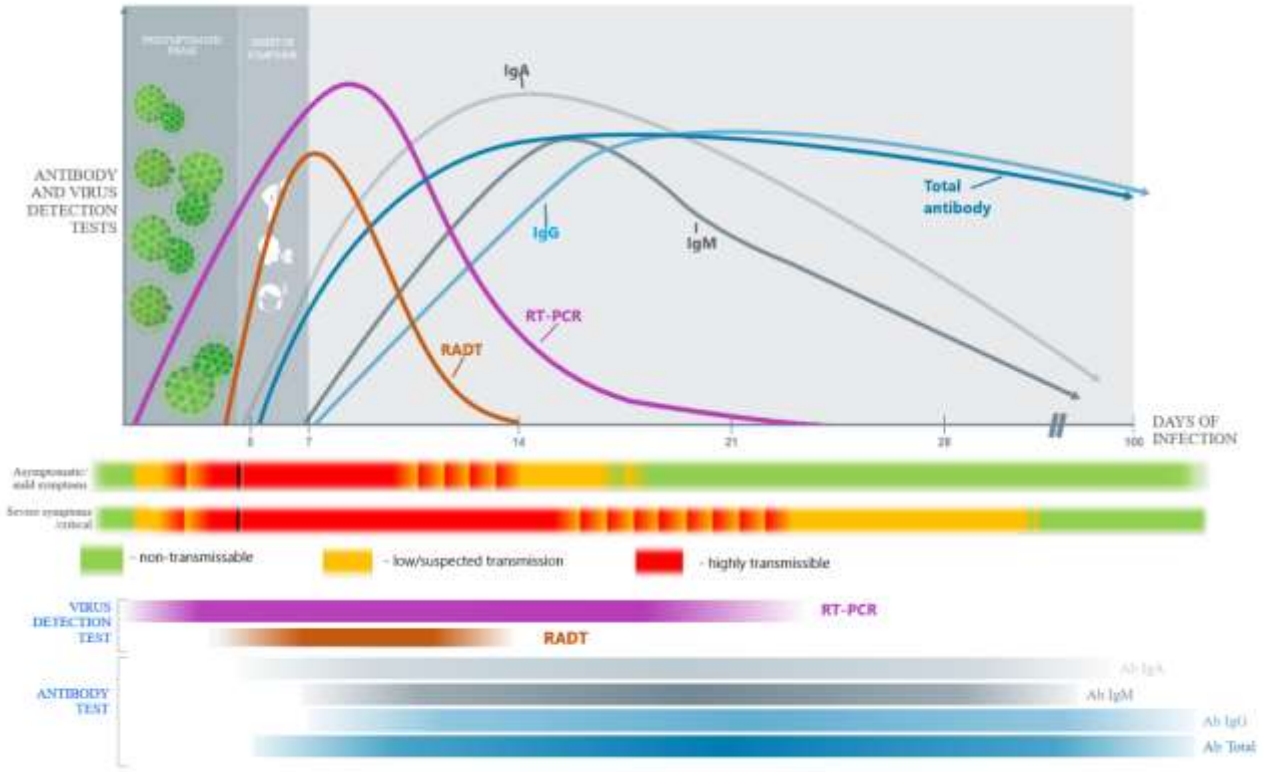

Figure 3-2. Overview of the use of antibody and virus detection tests in relation to transmission of the SARS-CoV-2 with reference to guidance from the Ministry of Health of Spain

3.3.4 Post-arrival testing

Post-arrival testing, in conjunction with pre-departure testing, can result in risk reductions and help identify imported cases of new variants through genomic sequencing. Consequently, as part of a State's risk assessment and determination of risk tolerance, a State may consider reducing quarantine time frames. Additional modelling and close follow up of travellers will further refine when to test moving forward. Refer to Chapter 4, 4.2 for more detailed information.

3.3.5 Combined pre-departure and post-arrival testing

3.3.5.1 Modelling suggests that pre-departure testing, preferably close to departure, in combination with post-arrival testing on day 4 to 5 and a shorter quarantine, may perform as well as a 14-day quarantine alone. These models are currently undergoing further refinement, and updated findings will be included in future revisions.

3.3.5.2 Regarding the study of arrivals in to Toronto Airport there are preliminary results that suggest that a single arrival test will pick up two-thirds of individuals who will become positive, with most of the rest detected on the second test at day 7. The results support strategies from modelling that a reduced quarantine combined with testing can be as effective as a 14 day quarantine.

3.3.6 Selecting test devices based on statistical analysis

Note.— See Attachment B, Epidemiologic primer for definitions and sample equations.

3.3.6.1 With the goal of allowing the greatest number of people to travel without increasing the risk of SARS-Co-V importation and onwards transmission, or exportation, the test device in the prevalence level in the traveller's population should have a high negative predictive value, meaning a negative test is in all likelihood truly negative. While there will be a few false negatives who would enter the system, a significant number of false positives who are not infected and could travel otherwise might be denied travel. A plan to evaluate false positive should be developed.

3.3.6.2 Even tests with relatively low specificity (the ability to correctly identify those who do not have the disease as negative), result in high negative predictive values. Establishing a higher test sensitivity cut-off (i.e. the ability to correctly identify those with the disease) will limit those with the disease but who might enter the travel corridor or be released from quarantine.

3.3.6.3 For those States choosing to utilize testing, it is recommended that the cut-off values for sensitivity and specificity be as high as possible, but with a minimum of 95 per cent19 for molecular tests (sensitivity cut-offs are based on reported sensitivity for cases in the peak contagious period, not for very early or very late-stage infections) and a minimum of 80% sensitivity and 97% specificity for rapid antigen tests based on data generated from asymptomatic individuals. Given the reported test values were from the manufacturers as part of their Emergency Use applications, where possible independently validated sensitivities and specificities should be used. No specific diagnostic test(s) is recommended as the number of fielded test devices are growing too rapidly. Hence, a performance-based approach to the selection of a test device(s) using sensitivity and specificity is preferred. States should use tests that have been authorized for screening by relevant public health authorities or has been listed by WHO as part of their Emergency Use Listing (EUL) procedure.

3.6.3.4 Polymerase chain reaction (PCR) tests are in short supply in some States and typically expensive. Due to short supply, PCR tests are often reserved only for symptomatic individuals. This might cause significant delays in obtaining results. They are usually based on swab techniques which require suitable trained personnel, premises, and equipment for the sampling process. This means they are difficult to apply in an airport setting. Many countries are calling for pre-travel PCR tests, but this creates problems of a window of possible infection after testing, as well as requirements for test approval, identity verification and fraud-proofing of the test results. These have led to interest in using more rapid point-of-care tests including antigen tests that could be used for screening purposes, with consideration of protocols to manage positive test results.

3.3.7 Management of positive tests

3.3.7.1 All positive tests should be referred for clinical diagnosis. Test results should be interpreted in the context of the prevalence of infection or disease, the device's performance characteristics and instructions for use, as well as the patient's clinical signs, symptoms and history.

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19. The recommendation for a minimum sensitivity and specificity level of 95 per cent for molecular tests is based on the following:
    - The minimum values of 95 per cent for sensitivity and specificity will allow for a wider range of test devices to be used that are currently fielded as opposed to forcing States to procure newer models that are frequently hard to obtain.
    - This range also allows for the use of rapid antigen tests as a screening device which are more accessible and practical for application in the aviation environment; and are faster and less expensive to use. In addition, it would reserve the more expensive real-time RT-PCR tests for confirmation of positives in conjunction with clinical correlation.
    - Setting the specificity at 95 per cent reduces the false positives.
    - Setting the sensitivity at 95 per cent will also reduce the risk of false negatives.
    - In low prevalence settings (equating from 10 to 25 cases per 100 000 on a rolling average), the NPV equates to mislabelling an infected person as negative between 1 in 5 000 and 10 000 negative tests. In a higher prevalence setting (equating to over 50 cases per 100 000 on rolling average) the mislabelling rises close to 1 in 300.
    - In the same low prevalence and higher prevalence range, the PPV improves from correctly labelling of positive from approximately 5 to 10 per cent, to slightly better than 1 out of 2 of positive tests.
    - These are minimum recommended values. States should determine their own minimum levels for sensitivity and specificity that they may require to improve test performance.

3.3.7.2 States should ensure their testing regimes include clearly published processes for recovered cases to obtain medical clearance for travel, which should be regularly updated in accordance with current scientific evidence. A positive test in a traveller or crew member with a history of infection and clinical recovery could be considered for travel.

3.3.7.3 Positive antigen tests should be referred for clinical correlation and require confirmatory testing. For positive rapid antigen tests in particular, a confirmative molecular test can be considered when the pre-test probability is low, such as asymptomatic individuals with no known exposure[9]. In symptomatic cases, depending on the symptoms, negative antigen tests should be referred for clinical evaluation and might require confirmatory testing

3.3.7.4 Serology may be used to document recovery (IgG) or response to immunizations. The scientific community continues to monitor emerging data regarding SARS-CoV-2 variants and immunity following recovery.

3.3.7.5 PCR tests can remain positive for weeks to months following infection and depending on severity of disease in some patients. Most patients, who have clinically recovered and who have mounted an antibody response to the virus, are not considered to remain infectious[20], although duration of this immunity is unknown currently. Some authorities do not recommend additional PCR tests within a 90-day period of confirmation of diagnosis. Rapid diagnostic tests detecting viral proteins have the potential to expedite and simplify the detection of active infection. Antigen tests or serology may be considered to separate current infection from past/recovered infections 13.

3.3.8 Standardization and validation of testing certificates:

3.3.8.1 Many States require pre-departure testing for COVID-19 as an entry requirement. Standardizing testing certificates will facilitate mutual acceptance by States. Information should be reported in English (mandatory). Where the certificate is issued in a language other than English, the certificate should include an English translation.

3.3.8.2 ICAO has established a minimum dataset for testing certificates to facilitate States' recognition and harmonization of their use for air travel. The minimum information to be recorded on the certificate incudes:

(1) Personal information of test subject:
  a) full name (surname, given name);
  b) date of birth (YYYYMMDD);
  c) ID document type[21] (mandatory); and
  d) ID document number (mandatory);

(2) Service provider:
  a) name of testing facility or service provider (mandatory);
  b) country of test (mandatory); and
  c) contact details (mandatory);

(3) date and time of test and report:
  a) date and time of specimen collection (mandatory); and
  b) date and time of report issuance (mandatory);

(4) test result:
  a) type of test conducted: molecular (PCR); molecular (other); antigen; antibody (type) (mandatory);
  b) result of test (normal/abnormal or positive/negative) (mandatory); and
  c) sampling method (nasopharyngeal, oropharyngeal, saliva, blood, other (optional);

(5) optional data field: Issued at the discretion of the issuing authority.

[20] WHO: Interim position paper: considerations regarding proof of COVID-19 vaccination for international traveller(link)
[21] Refers to any type of documentation, need not be a travel-specific document

Validation of testing certificates

3.3.8.3 The solutions adopted for the verification of certificates should be secure, trustworthy verifiable, convenient to use, compliant with data protection legislation and internationally/globally interoperable. Certificates may be issued on paper or digitally, depending on capabilities and preferences. ICAO is developing a solution based on Doc 9303 – *Machine Readable Travel Documents* specifications, incorporating the concept of Visible Digital Seals (VDS).

3.3.8.4 solutions and trials on mutually recognised travel and health certificates are also being conducted by the IATA (Travel Pass), World Economic Forum (WEF)/The Commons Project (CommonPass), the ICC (AOK) and others using existing solutions. The OECD is developing a blueprint for the verification of testing certificates in line with the ICAO recommendations.

3.3.9 Guidance on using both testing and vaccination

3.3.9.1 While current vaccination shows promise of achieving widespread immunity, the scientific data is not yet mature enough to make a definitive recommendation regarding the efficacy of vaccination to confer protective immunity, the possible duration of such immunity, the efficacy of vaccination in reducing transmission as well as the effectiveness of available vaccines against the various variants of the virus. This guidance will be amended as evidence becomes available and is validated.

3.3.9.2 States are encouraged to publish evidence related to their vaccinations campaigns as soon as that becomes available, including interim reports to allow for early identification of trends.

3.3.9.3 Vaccination should not be a prerequisite for international travel. However, at such time as evidence shows that vaccinated persons would not transmit the SARS-CoV-2 virus or would present a reduced risk of transmitting the virus, such individuals may be exempted from testing and/ or quarantine measures, in accordance with a State's accepted risk threshold, national framework and COVID-19 situation.

3.4 QUARANTINE PRACTICES

3.4.1 Many States have instituted a period of quarantine for incoming passengers as a measure to prevent importation of new cases. States' implementation of quarantine measures varies and may range from voluntary self-quarantine, to quarantine in their residence and to enforced restrictions at specified locations. Contracting states implementing quarantine for arriving passengers should comply with the IHR article 43. It stipulates that such health additional measures should be based upon scientific principles and supported by available scientific evidence of a risk to human health, while recognising that the IHR do not preclude States implementing health measures, in accordance with their relevant national law and obligations under international law, in response to specific public health risks or public health emergencies of international concern.

3.4.2 The quarantine period typically is 14 days to exceed the usual maximum incubation period; however many States are exploring reducing the quarantine period based upon testing. There can be considerable logistical difficulties and cost in implementing a quarantine regime, and States electing to utilize quarantine need to plan and prepare accordingly. Quarantine should only be implemented following a thorough risk assessment and with respect for travellers' dignity, human rights and fundamental freedoms; and minimize any discomfort or distress associated with the health measures applied to them, as outlined in the IHR (2005)[22]. Depending on the implementation model, States may need to ensure that all needs for transport, accommodation, food, exercise and communication are met and that there is no

[22] Considerations for implementing a risk-based approach to international travel", Interim Guidance, WHO – 16 December 2020

cross-contamination between those in the quarantine facility including the staff. In some cases, given the frequency of asymptomatic infection, the quarantine is now accompanied by COVID-19 testing.

3.4.3 The WHO identifies scenarios in which quarantine could be implemented[23]. In accordance with WHO guidance, contacts of confirmed cases should be quarantined or asked to self-quarantine as part of national response strategy. International travellers should not be categorized as suspected COVID-19 cases and are not considered contacts of COVID-19 in principle unless a traveller meets the definition of a contact. For travellers, the WHO recommends self-monitoring for symptoms on arrival for 14 days, report symptoms to local authorities and follow national protocols, but does note that Countries with no (active) cases, imported/sporadic cases, a small number of clusters of cases, or that have controlled transmission and are striving to maintain this status, or those lacking adequate capacities to cope with an increased burden, may decide to implement restricted movement and quarantine measures for travellers arriving from countries with higher incidence.[24] If States choose to implement quarantine measures for all passengers upon arrival, they should do so based upon a risk assessment and consideration of local circumstances. While quarantine can be an effective means of ensuring any imported cases by asymptomatic passengers do not spread the disease in the community, it can be a disincentive[25] to travel, particularly if required after both (outbound and return) legs of an international journey, as can government advisories recommending against travel. Given the complexities and implications of quarantine, States choosing to implement a quarantine regime should do so after conducting a risk assessment taking into account the local epidemiology in departure and destination countries; travel volumes between countries; the public health and health system capacity; public health and social measures implemented; and contextual factors, assessing all the implications, including non-health related implications, and considering them in accordance with their own national decision-making processes.

3.5 COMBINED TESTING AND QUARANTINE STRATEGIES

3.5.1 For States that choose to apply quarantine measures, such measures should be implemented in conjunction with other public health interventions and in accordance with a risk-based analysis conducted by the destination State, considering the epidemiological situation of both origin and destination country or countries and other possible mitigation measures (see Section 3.2 above). A metric may be chosen to assist in this assessment, such as the test positivity rate.

3.5.2 In applying the risk assessment, States should consider their risk tolerance and the risks posed by the travel, and how different mitigation measures may reduce that risk. If travel is from an area of low prevalence to one of high prevalence, then the value of quarantine as a measure may be diminished. In situations where travel is between two countries with similar levels of transmission in the community, any travellers who had been tested negative for COVID-19, meeting the performance based criteria described in Section 3.3.2, upon departure would be of lower statistical risk than the non-tested members of the surrounding communities in either country. Travellers that have been tested negative for COVID-19 could be subjected to no more restrictions than the others in the community at destination.

3.5.3 While quarantine can be effective in reducing SARS-CoV-2 importation when travelling from an area of high community transmission to an area of low community transmission, the introduction of testing into the measures applied could potentially be used to reduce the risk of translocation and the duration of quarantine. There is evidence to show that tests reduce the risk of an undetected positive case by some degree, and that a second test (in combination with a period of quarantine) further reduces that risk[26].

3.5.4 Public health authorities should make the final decisions about how long quarantine should last, based on local conditions and needs. Options to consider to reduce quarantine are as follows:

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23. “Considerations for quarantine of contact of COVID-19 cases”, Interim Guidance, WHO — 19 August 2020.
24. “Considerations for implementing a risk-based approach to international travel”, Interim Guidance, WHO – 16 December 2020
25. https://www.iata.org/en/iata-repository/publications/economic-reports/travel-impact-of-quarantine2/
26. Animal and Plant Health Agency (APHA), UK. Rachel A. Taylor, et al.; Tropical Medicine, UK, Samuel Clifford, et al and “Investigation into the effectiveness of “double testing” travellers incoming to the UK for signs of COVID-19 infection”, Public Health England Modelling Cell.

— After day 10 without testing or after day 7 after receiving a negative test result (test must occur on day 5 or later)

— After stopping quarantine, a person should:

- monitor for symptoms until 14 days after exposure;
- if symptoms develop, immediately self-isolate and contact the local public health authority or healthcare provider;
- wear a mask, stay at least 6 feet from others, wash hands, avoid crowds, and take other steps to prevent the spread of COVID-19;and
- while a quarantine for 14 days is the general recommended period, a quarantine period shorter than 14 days balances reduced burden against a small possibility of spreading the virus. Public health authorities should continue to evaluate new information and update recommendations as needed.[27]

3.5.4 On a careful analysis of the risks and evidence, as well as the government's risk tolerance, if the prevalence of infection at the point of origin of the passenger is less than (or equal to depending on risk tolerance) to the local prevalence at destination, and the passenger is not ill and/or has a negative test for COVID-19, governments might consider relaxing or avoiding quarantine measures. Alternatively, governments may determine that quarantine measures can be combined with other measures including testing to reduce the duration of quarantine. WHO is conducting modelling studies and regular systematic reviews of the effectiveness and feasibility of implementing risk mitigation measures, including testing and quarantine, in the context of international travel[28] .

3.6 VACCINATION AND VACCINATED PERSONS

3.6.1 Vaccination concepts

3.6.1.1 Vaccination is a critical public health tool to bring the COVID-19 pandemic under control globally. At the time of writing, some vaccines have been recommended by WHO, with additional vaccines being added progressively for assessment for emergency listing/ pre-qualification.[29] States have begun to roll out their vaccination programmes, with the aim to protect their population and stop the spread of the virus.

3.6.1.2 WHO supports the principle that when a substantial proportion of a population is vaccinated, it reduces the overall spread of the virus in the population. WHO's position is based on the preliminary results of some large, phase III clinical trials of COVID-19 vaccine candidates, as well as available data suggesting that most people who recover from COVID-19 develop an immune response that provides at least some period of protection against reinfection.[30]

3.6.1.3 The theoretical basis of how vaccines work is that they elicit antibodies which prevent the SARS-CoV-2 virus from infecting human cells. While clinical trial data shows that COVID-19 vaccination reduces severity of disease, there is as yet insufficient evidence that vaccinated persons will not transmit the SARS-CoV-2 virus. However, preliminary data is encouraging.

[27] https://www.cdc.gov/coronavirus/2019-ncov/if-you-are-sick/quarantine.html
[28] Considerations for implementing a risk-based approach to international travel", Interim Guidance, WHO – 16 December 2020

[29] https://extranet.who.int/pqweb/sites/default/files/documents/Status_COVID_VAX_16Feb2021.pdf.
[30] WHO, *Coronavirus disease (COVID-19): Herd Immunity, Lockdowns and COVID-19,* updated 31 December 2020.

3.6.1.4 Some States that have achieved a significant level of vaccine coverage have started to report declines in infection and hospitalization rates. A number of studies show a high effectiveness in reducing SARS-CoV-2 positive cases and in reducing the incidence of severe cases requiring hospitalizations achieved so far in vaccination campaigns, for example, in Israel. Most significantly the New England Journal published a large study of the Israel vaccination programme – indicating around 90 per cent effectiveness at preventing infection of any severity, from seven days after the second dose, and that there was about 57 per cent effectiveness after a single dose[31].

3.6.1.5 Data analysed by Public Health England (PHE) showed the Pfizer vaccine provided high levels of protection against infection and symptomatic disease from a single dose, and that hospitalization and death from COVID-19 will be reduced by more 75 per cent in elderly people who have had a first dose.[32]

3.6.1.5 Initial data is positive but further scientific evidence is needed, which should include observational studies in vaccinated populations that demonstrate:

a) an association between vaccine coverage and protection from transmission in the population; and

b) an association between vaccination and protection of an individual from asymptomatic infection.

3.6.2 A multi-layered risk management strategy: calibrating testing and quarantine strategies for vaccinated persons

3.6.2.1 Besides its important role in bringing the pandemic under control, vaccination may also play an important role in aviation recovery as the vaccinated proportion of the global population increases over time.

3.6.2.2 Proof of vaccination should not be a precondition for travel[33], given that there are still critical unknowns regarding the efficacy of vaccination in reducing transmission as well as the limited availability of vaccines, which should be used for priority populations considered at high risk of severe COVID-19 disease. WHO does not recommend COVID-19 vaccination of travellers unless they belong to a high-risk group (including older persons or those with underlying medical conditions) or in epidemiological settings identified in the WHO SAGE Roadmap for prioritizing uses of COVID-19 vaccines in the context of limited supply. [34] States should also facilitate access for air crew to vaccination as quickly as possible within the WHO SAGE Stage III recommendations as an important means to recovery of international civil aviation. The SAGE prioritisation roadmap supports countries in planning and suggests public health strategies and targeting priority groups for different levels of vaccine availability and epidemiologic settings. At the time of publication aviation workers would be included in the category of transport workers, falling within Stage III i.e. to be vaccinated when there is moderate vaccine availability and between 21 per cent and 50 per cent of the national population has been vaccinated.

3.6.2.3 The protective effect of vaccination of individuals is another layer of the multilayer risk strategy in the mitigation of the effects of COVID-19. The situation is evolving rapidly considering the emergence of new variants and the efficacy of current vaccines on these variants. It is likely that not all vaccines will offer the same level of protection against the different variants and that different vaccines would be used in various parts of the world. Updated guidance on these issues will be made published in coming months as evidence becomes available and the WHO updates its advice.

[31] https://www.nejm.org/doi/full/10.1056/NEJMoa2101765?query=TOC
[32] https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3790399

[33] WHO, Interim position paper: considerations regarding proof of COVID-19 vaccination for international travellers (5 February 2021)

[34] WHO: WHO SAGE Roadmap for Prioritising Uses of COVID-19 Vaccines in the context of limited supply (link)

3.6.2.4 WHO's interim position as of 5 February 2021 recommends that proof of vaccination should not exempt international travellers from complying with other travel risk reduction measures, as there remain critical unknowns regarding the efficacy of vaccination in reducing transmission and limited availability of vaccines[35].

3.6.2.5 States should also take into consideration other relevant factors such as local incidence rates of the travel origin of the vaccinated person or the potential community transmission of new viral strains against which the existing vaccines may offer a lower level of protection.

3.6.2.6 Recognizing the dynamic evolution of such a diverse scenario, States' assessment of the risk of a vaccinated person carrying the SARS-CoV-2 virus could factor in both the vaccine efficacy against transmission of the virus and the incidence rate of the travel origin. This would help to determine the degree of possible relaxation of testing requirements or quarantine requirements for vaccinated persons in future (if efficacy of vaccines against transmission is proven and sufficient access to vaccination has been ensured).

3.6.3 Vaccination for aviation workers

3.6.3.1 The SAGE prioritisation roadmap supports countries in planning and suggests public health strategies and targeting priority groups for different levels of vaccine availability and epidemiologic settings. States are encouraged to recognize aircrew, front-line aviation workers and aviation workers in critical safety and security positions as essential workers to ensure the availability of air transportation during the COVID-19 pandemic. They should be encouraged to be vaccinated as an added layer of individual protection and follow the recommended vaccination considerations and protocols. States should facilitate the vaccination of these essential air transport workers in accordance with the WHO SAGE Stage III recommendations (when there is moderate vaccine availability and between 21 per cent and 50 per cent of the national population has been vaccinated) and as quickly as possible for air crew.

3.6.3.2 Vaccination considerations and protocols for crew:

a) Air crew vaccination should be administered using vaccines approved for use, including emergency use, by the Health Authority or the Civil Aviation Authority of the State in which the air crew member's license is issued or rendered valid.

b) Dosing intervals for the vaccine should take into account the impact on operations with vaccination being given at different times to different individuals to ensure continuity of service.

c) After vaccination, flight crew may return to duty if they are fit to do so in accordance with national guidelines.

d) ICAO does not recommend a universal mandatory administrative post-vaccination grounding period. However, States may wish to consider post-vaccination grounding periods or other mitigation measures based on their own risk assessments. Considerations include:

1) vaccine side-effect profile;

2) type of vaccine authorization (e.g. licensed or authorized for emergency use);

3) individual reactions after first dose, which could indicate a grounding period after the second dose (If applicable)

[35] WHO, Interim position paper: considerations regarding proof of COVID-19 vaccination for international travellers (5 February 2021)

3.6.3.3 In States where crew have already been vaccinated or where States are considering vaccinating crew, it should be noted that vaccines authorized in one country/region may not be under consideration or may be explicitly unauthorized in others. To this end States should use vaccines considered within the WHO EUL/PQ evaluation process[36] .

3.6.4 Validation of vaccination certificates

3.6.4.1 In view of the current evidence regarding the extent and duration of immunity after infection or vaccination, and in line with WHO recommendations, issuance of an "immunity passport" or "risk-free certificate" is currently not recommended.[37]. While the WHO does not include international travellers in a priority category for vaccination, vaccinated individuals should be given documentations in accordance with national policies.

3.6.4.2 States are encouraged to request that evidence of vaccination status is captured in hardcopy or digital documentation or within an appropriate national registry, as determined by relevant national authorities. As/when vaccination does form part of international travel frameworks, such documentation should be provided in a format that is secure, trustworthy, convenient to use, compliant with data protection legislation, can be globally accepted and for which the authenticity and data integrity can be conveniently and fully verified. States are strongly encouraged to work towards interoperability of such protocols which should to the maximum degree possible be harmonised. Existing solutions should be considered and could incorporate a visible digital seal. WHO has launched a Smart Vaccination Certificate Working Group[38] to inform the development of specifications and guidance for documenting vaccination status.

3.6.4.3 Should the requirement of proof of COVID-19 vaccination for international travellers be introduced in future in accordance with IHR provisions, vaccines would need to be approved by WHO and would need to be recorded through the International Certificate for Vaccination and Prophylaxis based on the model presented in Annex 6 of the IHR. The same format could be adapted once WHO pre-qualified COVID-19 vaccines become available universally and relevant recommendations are provided under the IHR.[39]

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[36] Status_COVID_VAX_16Feb2021.pdf (who.int).

[37] https://www.who.int/news-room/commentaries/detail/immunity-passports-in-the-context-of-covid-19

[38] https://www.who.int/news-room/articles-detail/world-health-organization-open-call-for-nomination-of-experts-to-contribute-to-the-smart-vaccination-certificate-technical-specifications-and-standards-application-deadline-14-december-2020

[39] WHO, Interim position paper: considerations regarding proof of COVID-19 vaccination for international travellers (5 February 2021)

Chapter 4

IMPLEMENTATION — COMBINED STRATEGIES

4.1 OVERVIEW

4.1.1 Many States have implemented risk mitigation strategies such as temperature measurements, traveller symptom questionnaires, COVID-19 testing, vaccinations, and a variety of travel restrictions such as border closures, entry bans from specific States, quarantines, etc. However, these measures are not harmonized across States. Furthermore, there is very limited mutual recognition of mitigation measures even for States with equal COVID-19 prevalence. States should assess their own level of COVID-19 disease burden, health system capacity, availability of testing and vaccines, and level of risk tolerance. Once established, States can share risk assessments with other States and begin to discuss developing bilateral or multilateral agreements to open public health corridors and stimulate the return of air travel. Harmonization of procedures is crucial for facilitating air transport, and new practices should be coordinated with other States and stakeholders. In developing bilateral arrangements, States will need to consider the implications of hub traffic flows, and how they will accommodate third country-originating passengers.

4.1.2 To establish an internal State risk level, States should identify experts from State authorities, including but not limited to aviation (national authorities and industry), public health, customs and immigration, diplomatic organizations and legal departments, who can work collaboratively to assess the State's current status with respect to disease patterns. This collaborative assessment effort should be undertaken in a forum appropriate to a State's system, but can be undertaken by each State's National Air Transport Facilitation Committee (or equivalent) as per CART report Recommendation 6, which urges Member States that have not done so, to immediately establish a National Air Transport Facilitation Committee, as required by Annex 9 — *Facilitation*, in order to increase national level cross-sectoral coordination. The assessment should address the current capabilities to identify, diagnose, and treat COVID cases as well as the status of the health care system and the State's overall willingness and readiness to accommodate increased passenger flows. After reviewing this document and the CART Take-off Guidance available on the ICAO public site (https://www.icao.int/covid/cart/Pages/CART-Take-off.aspx), States should identify the risk tolerance they can accept on a bilateral basis and the mitigation measures that could be employed to meet that target using a safety management system (SMS) approach.

4.1.3 Although data-driven decision making is encouraged, the current scenario may require a qualitative approach, as validated data and information is incomplete. By implementing a combined strategy and assessing if an acceptable residual risk is achieved, States should also evaluate alternatives to reduce or eliminate the burden to the system posed by selected mitigation measures. Some consideration must be given to how those measures should vary according to different stages of the pandemic in accordance with the stages in the CART Take-Off Guidance Document.

4.1.4 Procedures related to each stage and measure should be aligned and consider efficacy, costs and implementation challenges for each State.

4.1.5 Consistency with the State's national COVID-19 response policy and strategy is important, for example, medical masks may be recommended in aviation, but their availability should be prioritized for health workers and the public health response. In considering restrictions on aviation, the State should consider the role that aviation plays in the economy of the State and the public health response itself (such as the distribution of personal protective equipment (PPE), test kits, medicines and vaccines). States should ensure alignment between the various public policies and measures applied across government.

4.2 GENERIC BASELINE MODEL FOR MULIT-LAYERED RISK ASSESSMENT AND DETERMINING MITIGATION MEASURES (FOUR-STEP PROCESS)

4.2.1 Introduction

This model has been developed to illustrate a baseline approach that States could use on a bilateral or multilateral basis to assess risk at the points of origin and destination, and to assist in the selection of available risk mitigation measures. States should scale the process to integrate with other national decision-making processes and to meet available conditions.

4.2.2 Step one — Determine that the following conditions have been met

This model is based upon the following assumptions (refer to CART Take-off guidance):

a) travellers follow appropriate universal precautions at every stage of the travel continuum and:
   1) do not travel when sick;

   2) adhere to hand and respiratory hygiene practices;

   3) use a face mask (with exceptions as appropriate);

   4) practice physical distancing to the extent possible to lower the risk of disease spread; and

   5) adhere to instructions provided by airport and airline personnel;

b) persons who test positive or are diagnosed with COVID-19 pre-travel do not travel and public health authorities are notified;

c) persons who test positive at arrival isolate, and public health authorities are notified;

d) close contacts of persons who test positive or are diagnosed pre-travel should be identified, quarantined, and not travel;

e) close contacts of persons who are positive post travel should be identified (including fellow passengers), and quarantined. Where necessary, international contact tracing operations should be launched; and

f) mechanisms are established to obtain and share complete, accurate and timely contact information to allow public health authorities to execute necessary public health actions.

4.2.3 Step two — Identify the effectiveness of existing measures

There is a range of measures to reduce translocation of disease. The measures vary in their effectiveness and effectiveness, in this context, is defined as the extent to which the measure is estimated to reduce the risk of introducing infectious individuals into the community at the destination. Each measure represents a defence layered in a multi-layered risk management process and will also need to be assessed for its efficacy, and interdependency when implemented in concert with other measures. Multiple models and tools allow States and other interested parties to estimate effectiveness of multi-layered approaches. While a multi-layered risk mitigation process should be followed, the relative merit of individual strategies is provided in Appendix B and will be updated in the future in accordance with scientific evidence.

4.2.4 Step three — Determine relative risks

The risk of translocating (transferring) COVID-19 from one State to another can be determined by looking at three conditions within States: prevalence, test positivity rate and testing rate. The cut-off values associated with each condition below is intended to provide guidance on a possible framework for determining the risk levels in accordance with a colour code:

Potential cut-off values:

1. Prevalence — 7-day cases per 100 000 rate (rolling rate averages) with a cut-off of 25 cases per 100 000.

   Note.— Some States favour using a rolling rate determined over a 14-day period.

2. Test positivity rate — 5 per cent as the cut-off with the goal of being below 5 per cent where tests are widely available for screening.

3. Testing rate — This condition would only be met if a State meets a testing capability of 250 tests per 100 000 people per week.

Possible colour coding based on conditions and cut-off values:

— Green: The origin State/area is below the cut-off values of 1 and 2 above.

— Orange: The origin State/area is below the cut-off value of 1 or 2 above, but not both.

— Red: The origin State/area exceeds the cut-off values of 1 and 2 above.

— Grey: there is insufficient data, or the State/area does not meet item 3.

Note.— This risk assessment framework might be updated in future taking into account different or additional conditions, testing strategies, potential cut-off values or colours as the pandemic continues to evolve.

4.2.5 Step four — Determine measures based upon identified risk levels

4.2.5.1 The model below is given as an example of how relative risk levels could be used in determining the appropriate risk mitigation measures:

- From green to any colour: No restrictions or requirements.

- From orange to any colour: Could require passenger locator forms and/or tests, but no travel restrictions.

- From red or grey to any colour (particularly to green): Could restrict traveller's movements depending on symptoms and exposure and/or test.

4.2.5.2 States should consider the following exemptions subject to a risk assessment: crew members (including those positioning to and from duty), personnel critical for health care delivery and workers essential to maintaining the safety of the airspace should not be made to quarantine unless they are ill or have been in close contact with symptomatic individuals. Should States decide to require testing for such personnel, rapid and non-invasive testing should be given preference.

Note.— Travellers originating outside of the departure State may need to be separately evaluated upon arrival in comparison to people who were in the departure State for over 14 days. Where a suitable legal and administrative framework is in place to allow for such use, Passenger Name Record (PNR) data, Advance Passenger Information (API), border control records and other passenger information tools could be used to assist in identification of some passengers who do not self-declare.

4.3 SAMPLE SCENARIOS

The case scenarios below are provided as practical illustrations of the risk assessment process outlined above. Additional case scenarios will be provided as supplementary attachments as the pandemic continues to evolve.

Scenario 1

State A has a 7-day rolling average of 7.0 cases per 100 000, a downward trajectory of cases, readily available testing, less than 5 per cent positive tests, and over 25 per cent of hospital beds empty. State B has a 7-day rolling average of 7.8 cases per 100 000, a stable trajectory of cases, readily available testing, less than 2 per cent positive tests, and over 20 per cent availability of hospital beds. States A and B could reasonably enter into a discussion to allow free travel between regions and implement minimal risk mitigation measures.

Options:

— As they are both in the "green" category, no intervention is a potential option.

— Providing passenger information on routine public health measures with public health authority contact details, and requiring reporting should someone become ill.

— Electronic-based monitoring for a period of time if a more active approach is desired.

Scenario 2

State C has a 7-day rolling average of 43.4 cases per 100 000, an increasing disease trajectory, testing only for symptomatic cases and close contacts, over 20 per cent positive tests, and less than 10 per cent available hospital beds. State D has a 7-day rolling average of 12.6 per 100 000, readily available tests, and 20 per cent availability of hospital beds. States C and D could negotiate a risk mitigation agreement where citizens of State D could freely travel to State C, but citizens of State C would be subject to enhanced mitigation strategies.

Options:

— Travellers from State D could move freely about State C with a combination of one or all of the following: traveller education on routine public health measures with public health authority contacts and reporting procedures, electronic based monitoring, and/or traveller questionnaires with contact details.

— Travellers from State C to D could be quarantined with testing for early release, utilize serial testing, or

some other active monitoring (smartphone applications, routine call-ins from public health authorities, limited restrictions such as business activities only). Passenger education could be a part of the overarching measures as above. PHC questionnaires could be utilized for rapid contact tracing if necessary.

Scenario 3

Testing details and hospital data are unavailable. State E has a 7-day rolling average of 30.2 per 100 000 and readily available tests. State F has a 7-day rolling average of 23.6 per 100 000 and tests only available for symptomatic cases and close contacts. State F is dependent on tourism.

Options:

— These States could enter an agreement where persons from State F could travel to State E with minimal mitigation strategies similar to travellers from State D to C as above.

— Those from State E to F could have slightly enhanced strategies depending on each State's risk tolerance. Options could include some or all of the following: serial testing with reduced or no quarantine, short periods of isolation with a negative test for release, electronic contact tracing/monitoring with daily reporting of symptoms and a post-arrival test at 5-7 days, and/or the use of "do not board" lists for recalcitrant individuals. Passenger education with public health measures and reporting requirements would be critical.

Chapter 5

PUBLIC HEALTH CORRIDOR

5.1 PRINCIPLES

5.1.1 A PHC is formed when two or more States or regions agree to recognise the public health mitigation measures each has implemented on one or more routes between their States. States are strongly encouraged to consider PHCs as a useful way to structure a collaborative approach to managing cross-border health risks. For example, exchange of information through PHCs will enable States to mutually recognize their respective public health risk management frameworks and to establish temporary and exceptional bilateral or multilateral arrangements within which air travel can be resumed.

5.1.2 To support States in the establishment of PHCs, ICAO has developed:

a) targeted assistance in the ICAO Implementation Package (iPack);

b) general tools published on the ICAO PHC Website; and

c) a new application featuring a PHC arrangement template and online builder to facilitate discussions between two or more States and/or a region .

5.1.3 States are encouraged to actively share information with other States by means of the PHC template on the CRRIC[40]. A PHC arrangement is built on the principles of a stand-alone arrangement in bilateral (or multilateral) State relations due to its exceptional and temporary nature. It would not be considered an amendment to existing air services agreements or a reason for future re-negotiations of air services agreements, and States should use the instrument appropriate to their legal systems, whether treaty- or less-than-treaty-status instruments such as a memorandum of understanding. As with other memoranda of understanding, the inclusion of a provision on registration with ICAO (in reference to Art.83) is up to the Parties' discretion.

5.1.3 In forming a PHC, it is anticipated that participating States would apply a mutually supportive multi-layered risk-based approach to their implementation of public health mitigating risk measures. A combination of risk controls will provide better protection than the implementation of only one or two selected risk controls. By collaborating on the measures implemented, States can establish a risk mitigation strategy that most effectively aligns to their risk tolerance and to their health and safety management systems.

5.1.4 A PHC arrangement should include criteria for suspension (e.g. in case the number of infections raise dramatically in one state in comparison to the other state) and termination (e.g. when the pandemic has been brought under control)

5.2 ELEMENTS OF A PHC

5.2.1 Crew Journey through a PHC

1) Pre-departure testing is conducted based on a risk assessment and requirements of the departure and destination States.

a) Test standards are established taking into consideration recognition of the test by the destination State, avoiding the need for an additional test on arrival.

[40] https://www.icao.int/covid/Pages/crric.aspx

b) Considerations are made for vaccinated crew in accordance with scientific understanding as discussed in Chapter 3, 3.1.5 and 3.6.

c) Considerations should be made for crew who have recovered from a COVID-19 infection and may return a positive test while not being in an infectious phase of the disease, as discussed in Chapter 3, 3.1.5 and 3.3.7.

2) Crews are separated from the general public in the airport, including through the use of dedicated security and immigration facilities as recommended in the CART Take-Off Guidance Airport module.

3) The aircraft is disinfected in accordance with the manufacturer's instructions, as recommended in the CART Take-Off Guidance Aircraft module.

4) In the aircraft, the crew take appropriate precautions against the transmission of COVID-19 as described in the CART Take-Off Guidance Crew module. Operators should provide the necessary procedures, training and equipment.

5) At the destinations where crews disembark from the aircraft:

a) crew are separated from the general public for any necessary immigration, security or health checks;

b) crew are provided with disinfected transport where COVID-safety protocols are able to be applied;

c) where crews are making use of a rest period, a clean hotel room is provided;

d) quarantine of crew members, if required, takes into account the prevalence of the disease and segregation factors;

e) for crew members subjected to quarantine requirements:

i) adequate food is available at times that correspond to the needs of the crew member; and

ii) access to exercise or outdoor space is provided with COVID safety protocols implemented to promote mental wellbeing.

6) On the return to base, crew members who have operated within the PHC with limited exposure to the general population at the destination airport, should be considered to have a similar risk profile as any other resident and should therefore not be subjected to additional testing or quarantine.

5.2.2 Passenger journey through a PHC

(Example of information to be communicated to passengers)

Pre-Departure

— Confirm governments' requirements (departure, transfer, and arrival) at time of booking and close to departure.

— Consult airport / airline website and get acquainted to COVID-19 specific airport / airline recommendations and instructions.

— Obtain a COVID-19 health insurance (if necessary or recommended).

— Book an appointment in a testing facility in time to comply with States requirements.

— Present an identification document during test and collect testing results.

— Obtain authorised test result and upload to Smartphone APP and/or provide relevant information via Government portal (if applicable).

— Ensure all traveling and entry requirements are fulfilled prior to departure to airport.

— Make sure to have a copy of the printed test result or the digital certificates available to present at the airport.

— Prepare own travel kit (sufficient number of face masks for travel, hydro alcoholic gel less than 100ml, etc.).

— Do not travel if you are feeling unwell, have symptoms suggestive of COVID-19 or if you have been in contact with someone with COVID-19 and inform the air carrier in advance.

At the airport

— Arrive within the timeframe as communicated by the airline.

— Check-in online or check-in early to ensure compliance with travel requirements.

— Comply with airport / airline instructions, including completion of any additional forms as requested.

— Respect COVID-19 specific recommendations measures in place including face masks, physical distancing, etc.

— Comply with designated airport pedestrian traffic movement and management indicators in place for COVID-19, including one-way corridors, separation of staff and traveller areas, physical distancing indicators, and hygienic recommendations for the use of touch screens, pens, etc.

Onboard

— Listen and follow crew instructions:

- when to wear or remove face masks;
- how to dispose face masks; and
- how to use lavatories etc.

— Avoid touching other passengers' belonging.

— Occupy only assigned seat.

— Minimize movement in the cabin.

— Complete passenger locator form, health questionnaire or other required documentation as completely as possible.

On arrival

— Comply with airport COVID-19 specific recommendations and instructions.

— If required, ensure health certificates (digital or printed) are readily available to show health or border control authorities.

— Respect measures in place including face masks, physical distancing, etc.

— Complete passenger locator form, health questionnaire, customs declaration and other documents as requested.

5.3 IMPLEMENTATION OF A PHC ARRANGEMENT BETWEEN STATES

Bilateral and/ or multilateral agreements should be based on the following principles:

— Available public health capacity.

— Operational need.

— Implementation of public health measures based on epidemiological situation.

— Testing and vaccination policies.

— Establishment of a robust information exchange system agreed among all participants including:

  • contact points;

  • chain of command; and

  • analysis of the results.

— Obligation to inform participating states immediately if epidemiological situation, risk assessment or public health requirements change

— Decision making framework based on the mutual recognition of acceptable risk thresholds of participating states

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Attachment A

EPIDEMIOLOGIC PRIMER

GOAL: Provide the best testing advice to minimize the risk that a person infectious with SARS-CoV-2 could transmit the virus during travel and propose a testing regimen to minimize quarantine.

TERMINOLOGY:

Disease status

Screening test result	Present	Absent	
+	A	B	Total positive tests
-	C	D	Total negative tests
	Total infected (Ti)	Total not infected (Tni)	Total population (Tp)

A: True Positives
B: False Positives
C: False Negatives
D: True Negatives

Prevalence. Disease burden, expressed as a percentage or rate with the total population as the denominator. Prevalence in this context refers to the number of existing cases of disease in a specified population at a given point in time.

Incidence. Number of new cases of disease in a specified population during a specified period of time.

Sensitivity. The likelihood that a test will correctly identify a person with the disease. A/(A+C) is the mathematical formula.

Specificity. The likelihood that a test will correctly identify a person without the disease. D/(B+D) is the mathematical formula.

Positive predictive value (PPV). How likely a positive test is a true positive. A/(A+B) is the mathematical formula.

Negative predictive value (NPV). How likely a negative test is true negative. D/(C+D) is the mathematical formula.

STEP ONE

Determine test performance requirements to maximize the number of people who could travel with reasonable certainty.
Prevalence assumptions/issues

1. It is important to know who might be infectious during travel as opposed to prevalence since the beginning of the outbreak. This is calculated by multiplying the incidence with the time period of infectiousness.

2. The Brown School of Public Health website, amongst others, tracks the incidence or current new cases per 100 000 people: https://globalepidemics.org/key-metrics-for-covid-suppression/. However, it should be noted that some statistics might not be accurate due to limitations of testing and reporting systems.

3. Among those who are sick, the vast majority of people are infectious from two days prior to symptom onset to nine days following symptom onset; hence, 12 days are used to determine the time period where people could most likely infect others.

4. The asymptomatic rate is assumed to be 40 per cent in accordance with a CDC reference published in Sept 2020: https://www.cdc.gov/coronavirus/2019-ncov/hcp/planning-scenarios.html. This implies that
60 per cent of people are symptomatic. Further assuming that mainly symptomatic people get tested, the number of positive tests represents only 60 per cent of the total number of people who are potentially infectious.

Calculating prevalence

To calculate the prevalence of potentially infectious people with positive tests, use the Brown daily average of new cases per 100 000 people (a 7-day moving average; based on Assumption 2 above) and multiply it by 12 (the number of days a person might be infectious; based on Assumption 3 above).

Prevalence = incidence x duration
= number of people per 100 000 with positive tests x 12
= potentially infectious people with positive tests per 100 000 people

Taking into account that the number of positive tests represents only 60 per cent of the total number of people who are potentially infectious, the total number of potentially infectious people needs to be calculated. Setting the total number of people who might be potentially infectious as “X”, the number of people with positive tests must equal 0.6 times “X” (based on Assumption 3 above).

Potentially infectious people with positive tests = 0.6 x total number of potentially infectious people (“X”);

Total number of potentially infectious people (“X”) = Potentially infectious people with positive tests / 0.6
To calculate the prevalence percentage, divide “X” by 100 000 to get the ratio, then multiply it by 100 to get the percentage.

Prevalence percentage = ratio x 100
= “X” / 100 000 x 100
= x per cent Example:
For State A, using the data from 21 September 2020 with a daily average of 12.6 per 100 000 people, the equations are as follows:

Prevalence = incidence x duration
= number of people per 100 000 with positive tests x 12
= 12.6 per 100 000 x 12
= 151.2 potentially infectious people with positive tests per 100 000 people

Potentially infectious people with positive tests = 0.6 x total number of potentially infectious people

Total number of potentially infectious people (X) = Potentially infectious people with positive tests / 0.6
= 151.2 per 100 000 / 0.6
= 252 per 100 000 people

Ratio = X / 100 000
= 252 / 100 000
= 0.00252

Prevalence percentage = 0.00252 x 100
= 0.252 per cent

Quick calculation of prevalence:
Because the only variable in this calculation that changes is the daily average, while all others are fixed, the whole calculation can be done by simply dividing the daily average per 100 000 people by 50. For example, State A with a daily average of new cases per 100 000 people of 12.6 has a prevalence of 12.6 / 50 = 0.252 per cent. It should be noted that this is only valid if the number of new cases is expressed per 100 000 people.

Performing the same functions for State B (7-day rolling average of 14.6/100 000) and State C (24.6/100 000 and the highest average on the Brown site) yields 0.292 and 0.492 per cent.

Performing 2 x 2 tables

- The tables were developed initially with the sensitivity and specificity of a test with sensitivity of 97.1 per cent and specificity of 98.5 per cent.
- Then, the same prevalence values were run with the worst listed sensitivity (80 per cent) and specificity (92 per cent) on the John Hopkins' compendium of all COVID-19 tests currently approved.
- For additional comparison, the values for the poorest performing test were run using the highest prevalence in the United States County X.
- Finally, the tables were populated using the proposed sensitivity and specificity of 95 per cent.
- PCR testing typically has higher sensitivities and specificities and would have even higher performance.

Calculations used for the 2 x 2 tables

A quick reminder of the 2 x 2 table terminology:

Tp = the total number of people in the population
P = the prevalence as calculated above (daily average of new cases per 100 000 people divided by 50)
Ti = the total number of infected people in the population
Tni = the total number of people in the population who are not infected
A = the total number of people who are true positive
B = the total number of people who are false positive
C = the total number of people who are false negative
D = the total number of people who are true negative

The calculations are as follows:

P = daily average of new cases per 100 000 people / 50
Ti = A + C = Tp x P
Tni = B + D = Tp – Ti
Sensitivity = A / (A + C)
Specificity = D / (B + D)
PPV = A / (A + B)

NPV = D / (C + D)
(Prevalence of 10 per cent, sensitivity of 95 per cent, specificity of 95 per cent)

Step 1 — Using a population of 1 000, calculate the disease burden.

		Disease status: Present	Disease status: Absent		
Screening test result	+				1 000 x 0.10 = 100 with the disease
	-				1 000 - 100 = 900 without the disease
		100	900	1 000	

Step 2 — Using sensitivity, calculate A (true +) and C (false -).

		Disease status: Present	Disease status: Absent		
Screening test result	+	95			100 x 0.95 = 95 true positives
	-	5			100 - 95 = 5 false negatives
		100	900	1 000	

Step 3 — Using specificity, calculate B (false +) and D (true -). Then, add up test positives and negatives.

		Disease status: Present	Disease status: Absent		
Screening test result	+	95	45	140	900 x 0.95 = 855 true negatives
	-	5	855	860	900 - 855 = 45 false positives
		100	900	1 000	

Step 4 — Calculate the positive predictive value (PPV) and the negative predictive value (NPV).

PPV = true positives/test positives = (95/140) x 100 = 67.8 per cent

NPV = true negatives/all negatives = (855/860) x 100 = 99.4 per cent

Examples of calculations
(Varying prevalence, sensitivity and specificity)

Example 1

State A: Prevalence of 0.25 per cent using a test with a sensitivity of 97.1 per cent and a specificity of 98.5 per cent.

Disease status

		Present	Absent	
Screening test result	+	2 428	14 962	17 390
	-	72	982 538	982 610
		2 500	997 500	1 000 000

PPV = (2 428/17 390) x 100 = 14.0 per cent
NPV = (982 538/982 538) x 100 = 99.99 per cent

Example 2

State B: Prevalence of 0.292 per cent using a test with a sensitivity of 97.1 per cent and a specificity of 98.5 per cent.

Disease status

		Present	Absent	
Screening test result	+	2 835	14 956	17 791
	-	85	982 124	982 209
		2 920	997 080	1 000 000

PPV = (2 835/17 791) x 100 = 15.9 per cent
NPV = (982 124/982 209) x 100 = 99.99 per cent

Example 3

State C: Prevalence of 0.492 per cent using a test with a sensitivity of 97.1 per cent and a specificity of 98.5 per cent.

Disease status

		Present	Absent	
Screening test result	+	4 777	14 926	19 703
	-	143	982 154	980 297
		4 920	995 080	1 000 000

PPV = (4 777/19 703) x 100 = 24.2 per cent
NPV = (980 154/980 297) x 100 = 99.98 per cent

Example 4

State A: Prevalence of 0.25 per cent, worst case test with a sensitivity of 80 per cent and a specificity of 92 per cent.

Disease status

Screening test result	Present	Absent	
+	2 000	79 800	81 800
-	500	917 700	918 200
	2 500	997 500	1 000 000

PPV = (2 000/81 800) x 100 = 2.5 per cent
NPV = (917 700/918 200) x 100 = 99.94 per cent

Example 5

State B: Prevalence of 0.292 per cent, worst case test with a sensitivity of 80 per cent and a specificity of 92 per cent.

Disease status

Screening test result	Present	Absent	
+	2 336	79 766	82 108
-	584	917 314	917 898
	2 920	997 080	1 000 000

PPV = (2 336/82 108) x 100 = 2.8 per cent
NPV = (917 314/917 898) x 100 = 99.93 per cent

Example 6

State C: Prevalence of 0.492 per cent, worst case test with a sensitivity of 80 per cent and a specificity of 92 per cent.

Disease status

Screening test result	Present	Absent	
+	3 936	79 606	83 542
-	984	915 474	916 458
	4 920	995 080	1 000 000

PPV = (3 936/83 542) x 100 = 4.7 per cent
NPV = (915 474/916 458) x 100 = 99.89 per cent

Example 7

County X: Prevalence of 5.994 per cent, worst case test with a sensitivity of 80 per cent and a specificity of 92 per cent.

Disease status

Screening test result	Present	Absent	
+	47 952	75 208	123 157
-	11 988	864 855	876 843
	59 940	940 060	1 000 000

PPV = (47 952/123 157) x 100 = 38.9 per cent
NPV = (864 855/876 843) x 100 = 98.6 per cent

Example 8

State A: Prevalence of 0.25 per cent, worst case test with a sensitivity of 95 per cent and a specificity of 95 per cent.

Disease status

Screening test result	Present	Absent	
+	2 375	50 000	52 375
-	125	947 625	947 750
	2 500	997 500	1 000 000

PPV = (2 375/52 375) x 100 = 4.75 per cent, or only 1 out of approximately 20 will be a true positive.
NPV = (947 625/947 750) x 100 = 99.99 per cent, or 1 in approximately 10 000 testing negative might be positive.

Example 9

State B: Prevalence of 0.292 per cent, worst case test with a sensitivity of 95 per cent and a specificity of 95 per cent.

Disease status

Screening test result	Present	Absent	
+	2 774	49 854	52 628
-	146	947 226	947 372
	2 920	997 080	1 000 000

PPV = (2 774/52 628) x 100 = 5.27 per cent, or only 1 out of approximately 20 will be a true positive.

NPV = (947 226/947 372) x 100 = 99.98 per cent, or 1 in approximately 10 000 testing negative might be positive.

Example 10

State C: Prevalence of 0.492 per cent, worst case test with a sensitivity of 95 per cent and a specificity of 95 per cent.

Disease status

		Present	Absent	
Screening test result	+	4 674	49 754	54 428
	-	246	945 326	945 572
		4 920	995 080	1 000 000

PPV = (4 674/54 428) x 100 = 8.59 per cent, or nearly 1 out of 10 will be a true positive.
NPV = (945 326/945 572) x 100 = 99.97 per cent, or 1 in approximately 5 000 testing negative might be positive.

Example 11

County X: Prevalence of 5.994 per cent, worst case test with a sensitivity of 95 per cent and a specificity of 95 per cent.

Disease status

		Present	Absent	
Screening test result	+	56 943	48 003	103 946
	-	2 997	893 057	896 054
		59 940	940 060	1 000 000

PPV = (56 943/103 946) x 100 = 54.78 per cent, or slightly over 1 out of 2 will be a true positive.
NPV = (893 057/896 054) x 100 = 99.67 per cent, or 1 in approximately 300 with a negative test might be positive.

Notes:

1.— The prevalence does not affect the performance of the test with respect to the sensitivity and specificity. It affects the number of infected and uninfected persons in a cohort of people.

2.— As prevalence goes up when performing a screening test, so does the positive predictive value.

3.— In a low prevalence situation, the negative predictive value is very little affected by even relatively poor performing tests.

4.— Poor performing tests will significantly increase the number of false positives who would be denied boarding, at least initially until confirmatory test can be completed.

Justifications for setting the minimum sensitivity and specificity levels at 95 per cent for molecular tests

1. It will allow a wider range of test devices to be used that are currently fielded as opposed to forcing States to procure newer models that are frequently hard to obtain.

2. The wider range also allows for the use of rapid antigen tests as a screening device which are more accessible and practical for application in the aviation environment; which are much faster and less expensive to use. In addition, it would reserve the more expensive real-time RT-PCR tests for confirmation of positives in conjunction with clinical correlation.

3. Setting the specificity at 95 per cent maintains a high NPV and reduces the false positives.

4. Setting the sensitivity at 95 per cent will reduce the risk of false negatives and improve the PPV.

5. In low prevalence settings (equating to 10-25 cases per 100 000 on a rolling average), the NPV equates to mislabelling an infected person as negative between 1 in 5 000 and 10 000 negative tests. In higher prevalence settings (equating to over 50 cases per 100 000 on a rolling average), the mislabelling rises close to 1 in 300.

6. In the same low prevalence and higher prevalence range, the PPV improves from correctly labelling a positive from approximately 1 in 10 to 20, to slightly better than 1 out of 2 of positive tests.

7. Few States set their sensitivity and specificity higher leading to further improvements in test performance.

STEP TWO: Pre-departure testing interval

Assumptions

— Incubation time: 2-12 days (95 per cent) with a medial of 5-6 days.

— Shedding can occur 48 hours prior.

— The most sensitive tests turn positive 1-3 days prior to symptoms.

— Leaving a 2- to 4-day period where a person could be infected but not infectious with a negative test.

— The goal is to limit infectivity in flight.

Considerations

1. If the testing is placed at 72 hours before their departure, at least 60 per cent of those infected with a negative test will manifest their illness and hopefully remove themselves from travel even if they were infected walking into the testing facility.

2. If the person with a negative test is a true negative and becomes infected walking out of the testing facility, they should not begin shedding the virus in most cases until after arrival at the destination.

3. Moving testing to 48 hours prior to departure would potentially let a few more of the negative but infected slip through who could begin shedding the virus in flight before developing symptoms, but would increase the likelihood that a person subsequently infected would not become infectious in flight.

STEP THREE: Can quarantine be reduced with serial testing?

Considerations

Consideration was given to two studies from the United Kingdom examining the relative effectiveness of various health measures on arrival to reduce the potential for onward transmission. It is summarized below:

- Quarantine of 14 days (Gold Standard): 78-99 per cent effective

- Single RT-PCR upon arrival: 39.6 per cent effective (2 in 5 cases detected)
- Single RT-PCR at 4 days after arrival: 64.3 per cent effective
- Single RT-PCR at 5 days after arrival: 88 per cent effective
- Upon arrival and 4 days after arrival (two tests): 68.9 per cent effective
- Single RT-PCR at 7 days after arrival: 94 per cent effective

Discussion

a) Assuming the effective percentages are the ability to find the people who could transmit the disease after release from quarantine, it seems reasonable to say that a 5 or 7-day window prevents most of the subsequent transmigration of disease.

2. The question is whether testing 72 hours prior to arrival, with a second test on day 4 or 5, would approach the 94 per cent effectiveness described for a single RT-PCR test 7 days after arrival.

3. Logically, it would appear a 7-day window of proven negativity would provide the same level of effectiveness.

Notes for consideration

1.— In the screening environment, the exact test is not as important as the technique in conjunction with the sensitivity and specificity. The sensitivity and specificity should be of at least 95 per cent and performed by people adequately trained using the techniques specified by the manufacturer. Laboratory certification is preferred.

2.— Evaluation of the positive cases must be considered.

3.— With the level of prevalence in various States, the PPV with the best tests available are going to be in the 10 to 25 per cent range, meaning 1 in 4 to 10 will be true positives.

4.— The other 75 to 90 per cent will be false positives and denied boarding.

5.— If less sensitive and specific tests are used for screening, the numbers go up significantly to as many 24 out of 25 positive tests being false positives.

6.— Furthermore, some of the true positives may be shedding viral remnants and no longer be infectious and could therefore travel.

7.— Clinical correlation and more definitive testing will be required in case of positive screening test results.

8.— States should consider what form would be acceptable to declare someone with a positive test as not infectious and ready to travel.

Attachment B

ESTIMATED EFFECTIVENESS OF INDIVIDUAL RISK MITIGATION MEASURES

Mitigation strategy	***Estimated effectiveness****	***Implementation cost*** **
Universal travel bans	Very high (100%)	Low
Selected travel bans	Varies depending on the State selection and the timing of the measure	Varies
Travel restrictions, do not board lists, for persons ill with COVID-19 or high-risk contacts who defy public health recommendations	High	Varies
Pre-departure strategies:		
Isolation of potential COVID-19 infected cases and quarantine of contacts	High	Varies
Single pre-departure testing	Low for preventing translocation*	Medium to low
Health declaration forms (symptom and contact checks)	Very Low	Low
Temperature screening	Very Low	Low
High ventilation	Medium	Low to medium
In-travel strategies:		
Traveller health education	Medium	Low
Using appropriate public health countermeasures	Medium	Low
Managing and positioning of sick passengers	Medium	Low
Reduce plane capacity	Low	Medium to high
Airflow and HEPA filters	Medium	Low

By comparison, pre-departure tests have a higher effectiveness mitigating transmission during the journey. With regards to preventing translocation, effectiveness increases the closer to the time of departure the test of carried out.

Post-arrival strategies		
Quarantine for 14 days upon arrival	High to very high (78-99% for State supervised quarantine)	Varies (State supervised quarantine can be high)
Data collection/sharing for proper contact tracing	Medium	Low
Single PCR testing	Medium (40%)	Medium
Health declaration forms (symptom and contact checks)	Low	Low
Temperature screening	Low	Low

Combined testing/quarantine strategies		
7-day quarantine followed by testing	Very high (94%)	High
5-day quarantine followed by testing	High (88%)	Medium
Post-arrival testing and 4-day quarantine followed by the second testing	Medium (69%)	Medium
4-day quarantine followed by testing	Medium (64%)	Medium
Pre-departure testing with post-arrival quarantine and testing	Currently being explored. Early models show similar rates to quarantine	Medium

* *The effectiveness estimates are based on:*

a) strategies to reduce the risk of SARS-CoV-2 re-introduction from international travellers", Samuel Clifford et al., Centre for Mathematical Modelling of Infectious Diseases, Department of Infectious Disease Epidemiology, London School of Hygiene and Tropical Medicine, UK;

b) she risk of introducing SARS-CoV-2 to the UK via international travel in August 2020", Rachel A. Taylor et al., Department of Epidemiological Sciences, Animal and Plant Health Agency (APHA), UK; and

c) public health authorities and expert consensus.

** *Cost reflects the relative administrative expense of implementing a measure and is not meant to reflect societal or industry cost. States should consider the value of implementing a strategy with respect to potential gains of increased traffic. Note that these costs do not consider the impact of the measures on States' economies.*

ATTACHMENT C
DECISION AID

Example of a basic decision process

Disclaimer: The below represents a basic decision process for a tabletop exercise. It is neither complete, operational, or universally applicable but can support the development of operationally viable inter-agency risk management processes

- Draft scenarios to be assessed, considering if the risk is related to passengers, crew members, staff at airports and any other person inside the Public Health Corridor (PHC)

Example: An infectious person, whose condition is unknown or revealed, is boarding an international flight.

- Assess the likelihood of the risk scenario, considering existing management strategies
- Assess the impacts of the risk scenario and its context (health care system, operational, social, political, organizational), considering existing management strategies
- Collect data and information to support qualitative and quantitative assessments
- Define the inherent risk as the combination of the likelihood and impacts of the risk scenario before any actions by the State

Example: The likelihood of an infectious passenger, whose condition is unknown or revealed, to board an international flight, is high. The application of the mitigation measures may result in a reduction of this likelihood.

A probabilistic estimation for the inflight transmission can be defined (x).

States should consider one or more risk management strategies to modify the inherent risk: **Avoidance, Transfer, Mitigation, and Acceptance**.

More information about risk management can be found in Chapter 2 of this manual.

A State may determine that the inherent risk is acceptable depending on its public health capabilities. As needed, the State may select additional mitigation, considering the individual effectiveness and result of combined strategies for risk management.

The mitigation measures for public health risks are described in Chapter 3 of this manual.

In order to select other mitigation measures, useful questions may be posed by the State to help the evaluation of the risk management strategy:

- What is the individual efficacy and effectiveness of each risk mitigation?
- If a risk management strategy is applied, would it reduce the likelihood of an infectious person to contaminate others or reduce the impacts from this contamination in the public health system?
- What are the measures commonly practiced internationally?
- What are the methods available to apply each risk mitigation?
- What would be the recommended procedures to assure or enhance the effectiveness of each risk mitigation?
- To which extent procedures applied in aviation would be applicable to domestic phases of the travel and connection with other modes of transportation?
- Are the risk management strategies coordinated with other national, regional and international stakeholders and the aviation community?

More information about the selection of a combined strategy for risk mitigation is presented in Chapter 4 of this manual.

Example: The States coordinate procedures to be conducted before people engage in air travel, during the flight, in the airport environment and after arrival.

A probabilistic estimation for the transmission at the arrival can be defined (y).

- After the application of the risk management strategy, assess if States are expected to effectively modify the inherent risk
- The residual risk should be evaluated in order to be commensurate with the State's public health capabilities and resilience

Example: After the assessment of combined strategies, the State considers that the residual risk is acceptable.

A probabilistic estimation for the local transmission at the State can be defined (z).

- The State should coordinate actions with other States in order to facilitate air travel
- After the strategies are implemented, their actual effectiveness, efficacy and the stabilization of the residual risk should be continuously monitored
- As States are subjected to changing conditions, it is important to recognize the need to review the risk scenarios and applied mitigation strategies to ensure continuity of traffic connections between States

Example: States should establish indicators and monitor the changing environment of their public health systems and measures implemented by other States in order to identify the need to reassess their initial risk scenario.

— END —