How can European Schools of Public Health promote understanding, explaining and teaching about pandemic waves?

ASPHER COVID-19 Task Force Statement

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Statement of guiding principles for ASPHER members

A. Learning from past and current pandemics

Each modern historical influenza virus pandemic can be interpreted to have had two or more major waves before subsiding to become more endemic as population immunity has grown and these viruses evolved. The most disastrous 20th century influenza pandemic in 1918 and 1919 has been described as three main pandemic waves, in recognising the changing incidence of newly reported cases. Even classic influenza wave tenets can be clarified or disputed. A mortality review for New York indicated that an earlier herald excess of pandemic deaths may have occurred earlier during the 1917/1918 influenza season (*Olson DR, Simonsen L, Edelson PJ, Morse SS. 2005*). However, the longer-term health, social and economic impacts of each pandemic wave can also be studied and explained, alongside the patterns of acute incidence of new infections and shorter-term severe illness and deaths. Also, how we define each pandemic waves is important for our responses. This includes the data and criteria used in each country for alerting or reassuring populations, and for increasing or decreasing emergency responses and public health countermeasures. The recent emergence of the Omicron variant in South Africa in November 2021, with cases since appearing in European Countries, highlights the need for teaching about the principles and nature of comprehensive and integrated systems offering multiple interventions. While current vaccine strategies and other scientific technical advances offer much hope for better pandemic outcomes, there is still a need for Schools of Public Health to reinforce principles of vigilance and the necessary capabilities to vary intensity and length of integrated public health systems.

- ***European Schools of Public Health should share their understanding of country-level criteria used in defining each local COVID-19 pandemic wave.***
- ***Schools of Public Health can seek greater consistency in developing our pan-European understanding and teaching about each pandemic wave across the whole region and the sub-regions for the 53 countries associated with ASPHER and WHO (Europe).***

B. Teaching on repeated COVID-19 Infections (Reinfections)

Some countries (e.g. UK and Israel) are identifying repeated infections that illustrate impacts of new variants and their impact via incomplete or waning population immunity in some groups. This should be recognised as the ability of SARS-CoV-2 to continue to mutate and for natural or vaccine induced immunity for some people to be incomplete or temporary. This can include principles that population-based countermeasures may be relaxed too early or need reintroduction. Vigilance is needed to identify immune escape that can be expected with new variants whereby natural post-infection immunity or vaccine derived immunity to other variants is not sufficient. Recently the Delta variant has surged and spread widely largely due to incomplete vaccine coverage of populations. However, 'booster' doses are also being found to be needed, usually several months after the primary course to top up immunity levels. The recent emergence of the genetically much different Omicron variant raises the additional fear of significant immune escape, albeit that phenomenon has yet to be fully established.

- ***Teaching should include the growing evidence on repeated infection levels within each pandemic wave and the associated links to new variants, or waning population immunity, or to the changes in the intensity of countermeasures being applied.***

C. Teaching on Global Pandemic Response Mechanisms

Pandemics are by definition global, expected and with periodic occurrences, albeit unpredictable in timings as world-wide health phenomena. WHO has the leading role in pandemic oversight and global declarations of pandemics and Public Health Emergencies of International Concern (PHEICs). Students from Schools of Public Health will need to be knowledgeable of such global governance mechanisms. SARS-Co-V2 is unlikely to be globally *eradicated* and efforts to *eliminate* it at country or territory level are usually transient features. The most pragmatic models and strategies are to seek to better *control* transmission levels to avert disastrous large waves and to mitigate impacts on populations.

- ***Teaching should include the global governance role of the World Health Organisation (WHO) in pandemics, including their key role in declaring a pandemic has begun and also in declaring that global pandemic waves have subsided or have ended.***
- ***Teaching in Schools of Public Health should recognise the International Health Regulations framework, along with the full technical and global expert support to the Director General: through WHO expert groups such as the SAGE mechanism (Strategic Advisory Group of Experts), GOARN (Global Outbreak Alert and Response Network) and other expert advisory and response systems. A good example is the recent WHO SAGE Roadmap for prioritizing uses of COVID-19 vaccines in the context of limited supplies.*** *(WHO 2021).*
- ***Teaching should include the need for further WHO developments and teaching resources to support consistent global alert and surveillance systems, along with further necessary public health emergency response systems, based on lessons from the COVID-19 pandemic.***

- ***Teaching should include EU and WHO-E preparedness, monitoring and response systems, and ECDC roles. Public Health skills are needed in enhancing community engagement and in ways to understand and address scientific mistrust and address misinformation.***
- ***Public Health Interventions and roles at Ports and Borders should be included.***

D. Teaching on Health Emergency Systems

The phenomena of all epidemic responses, and inherently pandemic responses, are also related to broader systems of emergency preparedness and management. Pandemics are global disasters. There are overlaps in how we seek to prevent and prepare for other disasters due to climate change, or other global phenomena. Each wave of the pandemic contributes to the overall disastrous consequences. Teaching about Health Emergency Response frameworks and Disaster Risk Reduction models should include systematic recognition of population vulnerability and need for improving community resilience before disasters strike. Teaching should also recognise that the recovery phases of pandemics, to address longer-term impacts, may take continued efforts over many years and should not be limited to the intra-pandemic acute illness waves.

- ***Global principles of Disaster Preparedness and Response, including Disaster Risk Reduction (DRR), should be incorporated into Public Health Schools' teaching and research on pandemic waves.***
- ***Teaching about emergency management models and systems should more fully embrace pandemic responses.***

E. Sharing Teaching resources

ASPHER academic experts are involved in developing newer concepts and understandings that could form the basis for new teaching materials. Creating an illustrative teaching slide-set and Basic Term e-booklet is underway in ASPHER.

- ***ASPHER supports and will facilitate that member Schools of Public Health can collaboratively develop and share useful resources for teaching and wider communication.***

F. Learning from wider sciences

Other planetary sciences, such as in seismology and meteorology, can show/help us to develop better scales and models for prior population risk and vulnerabilities to pandemics, and intra-pandemic scales of wave severity or magnitude, and in assessing their early and later health impacts.

- **ASPHER supports learning from other sciences and building a better epidemiological and public health basis for our models covering pandemic waves and their precursors, population vulnerabilities, intra-pandemic dynamics, and long-term impacts and health outcomes.**

G. Teaching on epidemiology and surveillance

Teaching should include principles of epidemiological surveillance. Systems are needed in each country that cover relevant information on the changing nature of pandemics such as greater transmissibility or in ascertainment, whether due to changing weak detection systems, altering case-definitions, or linked to milder illness or asymptomatic transmission. ASPHER reports weekly in its Pan-Europe situation bulletin across six sub-regions, covering the 53 countries.

- **Teaching should include features of high-quality epidemiological surveillance and reporting, and principles of independent public health interpretation and guidance.**
- **Teaching should include epidemiological principles of under ascertainment, reporting bias, reporting delays, and uses and pitfalls of cross-country comparisons of incidence estimates**
- **Teaching should recognise the importance of fuller coverage and access to genomic surveillance across all 53 European countries to highlight emergence of new variants of concern or of scientific interest. The recent emergence of the Omicron variant in November 2021, with its early seeding into several European countries also highlights the need for teaching about modern genomic surveillance systems.**

H. Sharing ASPHER reports and updates

Various other technical reviews have been conducted since March 2020. There is also scope to learn from sub-regions about the different pandemic waves features and the drivers and mitigators and impacts of each wave. This could inform our teaching and research during the 2021/22 academic year.

- **ASPHER is organising a rapid review to compare and contrast pandemic wave features in each of nine European sub-regions undertaken, starting in November 2021, to inform and support teaching in our Schools of Public Health and our partner institutions.**

Guiding Principles References

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Aims of this ASPHER statement

Context

In view of the lack of consistent explanations and usage of the term 'pandemic wave', ASPHER has identified the desirability of further descriptions and other useful materials that can promote improved shared understanding and learning with the current pandemic and as a potential basis for future pandemic preparedness.

Aims

1. The COVID-19 pandemic wave patterns brought into question in the classic Public Health School definitions prior to the pandemic. There is profound academic work to be done on how Public Health Schools should define broad content of the teaching on pandemic waves reflecting recent experience.
2. To update or formulate ASPHER commentaries and resources, or other technical reports, to cover the nature of pandemic waves and their implications for populations to assist the professional advisory roles of public health academic, field and clinical practitioner colleagues.
3. To identify or produce useful materials than can aid ASPHER members in conducting their teaching, epidemiological investigations and research, advice-giving to public health systems and other bodies, and assist the development of broader epidemiological sciences.

Goals

1. To draft a short ASPHER statement for the COVID-19 Task Force and our wider membership in October 2021.
2. To collate pandemic wave reports/materials from across the European sub-regions to inform our learning and practice.
3. To suggest any update on any relevant content in any current ASPHER COVID-19 resources such as basic terms booklets in epidemiology or in health inequalities or in testing.
4. To identify/generate any useful teaching materials for Schools of Public Health.
5. To help develop underpinning theoretical and conceptual reports, for later publication and wider dissemination.

Background to ASPHER's concerns about pandemic waves

The ASPHER COVID-19 Task Force has promoted early for greater understanding and harmonisation since the pandemic began, while also recognising the long-term challenges.[1] *"The COVID-19 crisis appears likely to present a protracted challenge, which will require preparedness, necessitating a harmonisation of measures and coordinated response between countries across the European region and globally".*

The previously taught characteristics proved to be different from the COVID-19 pandemic, as new characteristics appeared and, mainly, the existing definitions could not be applied in a predictive way. From a taxonomic point of view, there was a lack of scholarly definitions for many of the manifestations that have occurred during COVID-19. For example, the strict definition of wave start and end, wave amplitude, wave cyclicity, among other aspects.

The absence of an initial universally agreed definition of a pandemic wave was recognised by ASPHER in their Second Wave statement, and a pragmatic definition was suggested.[2] "*a resurgence of the incidence rate during a pandemic, which cumulatively presents an exponential increase in the number of cases of the disease in a given time period and specific territorial zone. This exponential increase follows from the disappearance or near disappearance of cases of the disease and may be influenced by a new behavioural characteristic of the infectious agent or a modified characteristic from another already known* (Middleton et al. 2020) In the meantime it appears that some countries (e.g. Scotland) have developed national operational definitions with epidemiological criteria. There is concern in ASPHER that there may be public or professional confusion where more global guidance is not clear, and that mass media or non-public health or political bodies might fill any gaps in professional public health concordance.

The wider aspects of pandemic waves impacts are being recognised. ASPHER's statement on third wave issues includes an emphasis on long-term complications and improved surveillance for these.[3] " *Enhanced surveillance is needed for COVID-19 sequelae and COVID-associated medical conditions. There should be an international agreement on categories of long COVID manifestations and a surveillance system implemented*" A much wider concept of surveillance is needed to generate and encompass surveillance data from social and other sciences to capture population behaviours and disease determinants and to highlight inequalities.

ASPHER Statements

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2. Middleton, J., Lopes, H., Michelson, K. et al. *Planning for a second wave pandemic of COVID-19 and planning for winter*. *Int J Public Health* 65**,** 1525–1527 (2020). https://doi.org/10.1007/s00038-020-01455-7
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Glossary of Basic Terms

This will be developed further as an ASPHER Basic Terms e-booklet.

ASPHER to continue to consider what other terms we want to include for pandemic understanding, explaining and teaching. The list below is an initial list with some explanations. A full e-booklet of pandemic wave basic terms is currently being developed.

ASPHER will consider use of historical definitions, or acknowledge those from WHO, ECDC, CDC etc, or may adapt or devise ASPHER ones for this context.

There is a long list of online WHO and other wider public health glossaries to draw upon if needed.

There will be an ASPHER e-booklet of Pandemic Wave Basic Terms that will be produced to support Schools of Public Health for their teaching and any wider educational purposes.

Basic term	Definitions suggested	Alternative definitions or additional ASPHER comments
Control of disease	The range of deliberate policies, strategies and specific countermeasures or interventions that are applied in a defined geography to reduce the incidence of new cases and to reduce their morbidity, mortality and the wider population health impacts of a pandemic.	This is the current main model for COVID-19 to reduce transmission and to mitigate the impacts on population health and on services.
Elimination of disease in a specified geography	The absence of a disease caused by a specific agent in a defined geography area as a result of deliberate control efforts that must be continued in perpetuity to prevent re-emergence of disease (Cochi and Dowdle 2011).	e.g. definitions used in measles, infectious Hepatitis, plague, cholera in Europe also good examples as they highlight the importance of place, infrastructure and standards. So far elimination of transmission of COVID-19 has been a temporary feature in some territories for instance in some Islands populations.
Global Eradication	The worldwide absence of a specific disease agent in nature as a result of deliberate control efforts that may be discontinued where the agent is judged no longer to present a significant risk from extrinsic sources (Cochi and Dowdle 2011).	This was possible eventually with smallpox but is otherwise difficult and elusive for many infections. Viruses like SARS-Co-V2 or influenza that transmit easily and adapt/mutate quickly/readily are more suitable for control strategies. Eradication is unlikely to be achieved with COVID-19 as it may eventually become a more endemic seasonal disease due to virus evolution and adaptation within human populations. How likely is it to be seasonal like flu (requiring annual immunisation of a significant minority of the population) or an ever present threat controlled by immunisation like measles, mumps and whooping cough? Most endemic respiratory viruses have a seasonal cycle, worse in winter when indoor mixing is most frequent.
Decline (fall)	The movement of the curve towards a trough. This decline in movement may be interrupted if population countermeasures are relaxed too soon; thereby leading to another surge.	Number of data points required to determine? – minimum two full incubation periods. Deceleration can include measures such as the Estimated Dissemination Ratio, (EDR). See Pérez-Reche et al, 2021

Inter-wave period	The period between pandemic waves when cases and transmission level is low or absent in a defined geographical zone	EDR stable at 0.4-0.6, WHO at testing levels of x per 100,000 and positivity is at 2% or less. NB also requires widespread whole genome sequencing so that any new strains are rapidly identified on emergence
Outbreak of disease	Often used synonymously with "epidemic", usually to indicate localised as opposed to generalised epidemics. (WHO Glossary of Health Emergency and Disaster Risk Management Terminology 2020)	Two or more cases with links in time, place or person - cases of an important infectious disease within two incubation periods require investigation to exclude an outbreak. Very important to differentiate between an outbreak (a cluster is what we call an outbreak until we have confirmed the link between cases) and an epidemic which has larger numbers from poorly controlled spread and involves multiple outbreaks. Any definitions used in epidemiology can be subject to scrutiny and further development (see Doshi 2011 and Fre´rot 2018).
Peaks (or crests)	Each pandemic wave may have several peaks or crests before the that wave reaches the trough period.	Some graphs use rolling averages to smooth out fluctuations.
Surge period	Surge refers to the period of exponential growth in the first wave and in further waves after each trough period.	You don't need a trough to get a surge – but it's more difficult to see exponential growth when baseline rates are very high.
Trough period	This is a more specific time than the inter-wave period and refers to the lowest point that each wave reaches but also while the disease is not eliminated in that geography	A trough is the lowest point in the wave cycle or the resting level The wave being washed out partially by a stable period but at very high levels are not the same and we can differentiate – in hydrology think about the apparent calm before a waterfall or recirculation
Wave of pandemic = pandemic wave	"a resurgence of the incidence rate during a pandemic, which cumulatively presents an exponential increase in the number of cases of the disease in a given time period and specific territorial zone. This exponential increase follows from the disappearance or near disappearance of cases of the disease and may be influenced by a new behavioural characteristic of the infectious agent or a modified characteristic from another already known" (Middleton et al. 2020).	Rapid acceleration from base level or previously determined acceptable or threshold level. Considerations of thresholds and other epidemiological and transmission parameters can be found in global guidance (WHO 2020) and in each country's assessments, such as in Finland (Finnish Institute for Health and Welfare 2021).

Glossary References

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Technical Notes

Mathematical models: These are extensively used in countries to forecast wave features, but they have limitations, and it can be argued for them to be refined further, and there is a need to recognise their limitations and also scope for future development. Their uncertainties need to be fully acknowledged [1-6].

Under ascertainment in surveillance systems: There are serious concerns about the need to enhance and change surveillance systems to minimise under-ascertainment and underestimation of pandemic wave magnitude.[7]

New variants of SARS-CoV-2: These can be expected to spear and drive pandemic waves.[8] There is a vital need to recognise new variants early in each of the 53 Pan-European countries. Genomic surveillance systems inequalities across Europe should be addressed.

Pandemic terminology: The terminology used around pandemic waves and their features is sometimes inconsistent and needs greater clarity. For instance, Fisayo and Tsukagoshi 2021 write about three waves of the COVID-19 pandemic.[9] However their important considerations are of “first-, second- and third-order impacts of the virus manifest over different time frames” that relate to waves of direct and indirect impacts rather than classic pandemic incidence rate waves.

Global public health governance: Calls to end or defeat the pandemic, or to declare it ended, may be premature. There are many uncertainties across our sciences, public health models and in public policy formulation.[10-12] There are also major global resources to be

found to enable countries to recover well from the pandemic and that its enduring problems and legacies are not ignored or neglected. There are important lessons from case studies in the first winter waves 2020/21 from five European countries (France, Germany, UK, Sweden, Switzerland). This includes building trust in epidemiological sciences and communicating clearly about any value judgements being made.

Non Pharmaceutical Interventions (NPIs): Our use of NPIs was influenced by the fairly recent influenza preparedness guidance (WHO 2019)[13] and these were largely adapted as countermeasure packages for COVID-19 . However the size and nature of pandemic waves are still being, and will continue to be affected, by how far such control measures are used in Europe.[14-15]

Emergency Preparedness and Response models: Theses includes including Disaster Risk Reduction (DRR)[16-17] Previous emergency preparedness systems in Europe were not fully anticipating the severity of this current pandemic. The most recent 3 pandemics of influenza did not show the disastrous scales as experienced in the current pandemic of morbidity, morality, social and economic disruption. It is important for all Schools of Public Health to embrace the broadest impacts and most extensive emergency response models in their teaching along with usual tools for pandemic epidemiological and policy measures.

Country level and sub-regional analyses: Examples should be sought of sub-regional or country reports with summative analyses of what has initiated or driven or mitigated each pandemic wave should be sought. For example, a comparison of Nordic countries highlighted the difference with Sweden in particular.[18] Sweden has had other interesting pandemic features reported on vulnerability and countermeasures.[19,20] Genetic changes and variant emergence from imported cases was also important as shown in Scotland.[21] Genomic surveillance showed the influence of three SARS-CoV-2 variants on the three pandemic waves in England.[22] Clusters and outbreaks may be insightful as in the France Ski resort cluster.[23] A newsworthy review of the first twelve months in Ireland illustrates varying vulnerabilities and community outbreaks, and other drivers of their first three pandemic waves.[24,25] Case study reports may be found from Public Health Agencies in each country highlighting dynamics of transmission as in examples from Scotland.[26,]

Vaccine strategies and their influences: It is important as current vaccines rollout out and new ones are devised, that complimentary countermeasures are part of the packages.[27]. Understanding such sensible country-level multi-level approaches is worthy of consideration.

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