A public health approach to the COVID-19 epidemic

AUTHOR

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TITLE

A public health approach to the COVID-19 epidemics

SCOPE

This document provides to students a policy makers and all relevant stakeholders' perspective about the key aspects of a public health response to the COVID-19 epidemic. We provide a short, schematic overview of the public health strategies and measures available, and of their rational deployment.

AIM

Our aim is to provide an overview, a set of basic definitions, and a simple classification of available and actionable epidemiological and public health strategies and measures to reduce the impact of the COVID-19 epidemic.

INTRODUCTION

Evidence on covid19 is rapidly expanding, and comprehensive handbooks and regularly updated guidelines on epidemics management are available [*see WHO and CDC websites*]. International, national, and local authorities may rely on these sources and on experts for trustworthy, evidence-based information to take decisions on direction and interventions, and to communicate risk and tell people what to do to cooperate and contribute to outbreak responses. Clinicians are also highly concerned with this public health approach because they operate in special settings and provide healthcare from a highly conditioned perspective. Diagnosis and treatment are always highly impacted by the contextual circumstances of the community, and population-level that surround the health services. This is very much the case during a pandemic.

Preliminary evidence from China suggested that effective community engagement practices were crucial to attain full adherence and compliance of millions of people to highly disruptive and intrusive interventions, including a total lockdown. This engagement was grounded in a transparent and understandable communication of the risks and the nature of the disease, and on explicit explanations of the reasons of the public health countermeasures and interventions enforced by the local and national authorities to respond to the COVID-19 epidemic. The target is the whole population. Because of the scale of the COVID-19 epidemic, the challenge was grand, and unprecedented.

As the epidemic spreads, a set of coherent public health interventions (PHI) (also called non-pharmacological interventions) were implemented in an increasing number of countries worldwide. However, the timing, duration, and implementation modalities of these

interventions varied across countries. For example, in Wuhan, and the Hubei province (China), where the epidemic supposedly began, population lockdown (including schools and workplace closure, public transportation shut down, and sheltering of whole population) along with isolation of sick (symptomatic) individuals and quarantine of contacts, began in January 2020, when only few cases of COVID-19 had been confirmed. Conversely, in other countries, including Sweden only social distancing, hand hygiene, respiratory etiquette, and sanitation were implemented as of June 2020 despite the number of cases was considerably higher compared to the outbreak in China.

In Switzerland, PHI and measures enforced varied by Canton, despite a formal adherence to the Federal Office of Public Health (FOPH) recommendations. These differences may seem contradictory, and were difficult to disentangle also because authorities and experts (including scholars and researchers) did not explicitly refer to overarching and comprehensive public health approaches and strategies, within which these PHI were articulated. This is problematic because little or no availability of and poor accessibility to this information can cause confusion, and may instill a sense of distrust in the general population, which in turn may have detrimental repercussions on compliance and adherence to PHI in the public. Telling millions of people what to do without explaining why does not work.

► My aim is to relate relevant definitions of epidemiological and public health concepts to available strategies and PHI aimed at reducing the impact of the COVID-19 epidemic. My broader scope was to systematize and make information and evidence about these strategies and PHI available to medical students, clinicians and to all relevant stakeholders, and more broadly to civic society.

METHOD

This is a narrative, non-analytic review of various sources, combined with an unstructured experts consultation. The methods used to compile the COVID-19 glossary that accompanies this document are described in the Appendix.

Epidemiological and public health concepts and terms

Some basic, operational definitions of epidemiological and public health concepts are useful to understand the public health measures and strategies aimed at tackling the COVID-19 pandemic. These terms are relevant and widely used also at the local level, to tackle and communicate about the epidemic in countries, including in Switzerland.

I have personally compiled a COVID-19 glossary of common terms and concepts, with working definitions, and relevant sources, as appropriate (Appendix). Overall, the epidemiology and public health approach of the epidemic may be seen, respectively, as a quantitative description and analysis of the phenomenon at the population level, and the organized, structured, intersectoral response to it.

With descriptive epidemiology we aim to quantify the magnitude and impact of the COVID-19 epidemic. Basic epidemiological counts include:

- the total number of cases,
- hospitalizations, and
- deaths due to COVID-19,

We also consider how these relatively simple numbers may change temporally and geographically.

With analytical epidemiology we explore associations with exposures to potential infection (risks), with a variety of predisposing and pre-existing characteristics of individuals and the context, and with the clinical manifestations (including signs and symptoms).

The **public health response** consists in a structured and articulated policy and plan that make use of PHI, which are measures put in place by national and/or local authorities to reduce the impact of COVID-19, and are part of broader, overarching strategies.

Disease spreading

The exponential growth (a type of incremental rate), doubling time (of cases), and basic reproduction number (i.e. how many new cases stem out from one initial case in an all-susceptible population, on average) all refer to the dynamic of the epidemic.

'Flattening the (exponential) curve' was a widely used term during the COVID-19 epidemic, it is about the controlled spread over time of cases requiring hospitalization, but not to their absolute reduction, as we discuss below.

Because the epidemic curve is exponential, a few remarks are worth noting. An exponential growth is not linear, and it is extremely insidious because increments are slow at the beginning but become abruptly sharp. A first *public health* consideration is that the insidiousness of the exponential growth is rarely adequately accounted for to proportionally adapt preparedness, and responses through the epidemic. Second, without interventions, a plateau is reached as

susceptible people decrease, but this is typically beyond the tipping point of the health system. The dynamic of an exponential growth of a disease (or expansion of cases) must be referred to the characteristics of the disease itself, its infectiousness, severity, and lethality. The response of the health system and services depends largely on the dynamic of cases, or attack rate. Assuming that capability is fixed (i.e. we know what we know about a new disease for as long as we do not make tangible clinical improvements) **capacity** is the main focus and concern to respond to the epidemic dynamic. Capacity entails both infrastructure and workforce, and it may be increased only to a certain extent. Therefore, capacity is typically exceeded because of the rapid accumulation of cases over a short period of time (the attack rate is too much to be absorbed by the existing services). The two new hospitals built from the ground up in Hubei in a few weeks in February 2020 is an unprecedented, and previously unseen exception to the notorious limit that health services capacity places on healthcare and treatment coverage. Other organizational arrangements have been made, redesigning existing services.

Another important aspect to consider is that the number of people in the general population who are susceptible to the infection (susceptibility) is extremely important to make predictions about the spread of the disease. Because SARS-CoV-2 was a new virus, nobody had immunity for it. Technically everybody (that is all human beings) was susceptible, and could get infected if exposed to the virus, (mainly) through human-to-human contact. The epidemic dynamic depended almost entirely on the number of contacts between infected and non-infected individuals.

The basic reproductive number R0 (R "naught") is a key measure to capture the epidemic dynamic. R0 may be defined as the average number of secondary cases caused by a single infectious individual in a totally susceptible population, and it is the key parameter to express how fast the epidemic spreads, in mean duration of infectiousness (days) *no. of susceptible people / rate of contact between individuals * chance of infection/ probability of transmission on contact between an infected and a susceptible individual. We owe to Prof. Klaus Dietz the R0 metrics, who in turn stated to have been inspired by the work of the Swiss mathematician Daniel Bernoulli.

Defining COVID-19 cases

The definition of case of COVID-19 is a crucial step to collect and systematize data, organize counts, and statistics. The definition of COVID-19 case may though vary depending on the intended use of this dichotomous classification (i.e. yes/ no), and on the actual public health and clinical implications of the diagnostic grouping. Case detection is of crucial importance not only for healthcare and clinical decision, but also to inform prevention strategies including breaking chains of contagion, and ultimately to control and reduce the number of susceptible people a sick, infectious person may get in contact with.

How we define a case has obvious, and very important implications for diagnosis, and for clinical utility (e.g. for prognosis and treatment outcomes). The identification of infectious individuals may be conducted at scale in large community samples of apparently healthy individuals, using rapid, cheap, and simple procedures and tests within screening programs. In public health, we screen large groups of usually a- or pauci-symptomatic people who have not sought medical attention to prevent complications through early detection and management. During the COVID-19 pandemic screening was more aggressive, and focused on symptomatic individuals. Nonetheless, a screening test should work well in the early stages of the disease (when overt symptoms and signs might be mild or absent), be acceptable to most if not all people, and is ethical and viable only if clinical diagnosis, healthcare and services can be proportionally increased and provided to screen positives. A positive screening test is typically followed by in-depth clinical investigations, or treatment. A combination of screening and clinical diagnosis is used for epidemiological surveillance, either passive and active, to systematically collect and analyze data and information relevant to plan, implement and evaluate healthcare capacity, and public health interventions. Diagnostic tests used through the COVID-19 pandemic were not used to screen the population and detect cases timely. Diagnostic tests were instead used to diagnose infections and inform containment measures (see below). This implies that most of the tests carried out were not organized within a screening framework.

Impact of COVID-19

An epidemic increases demand, access to and use of services, but **mortality** is the ultimate measure of impact. **Case fatality rate (CFR)**, the proportion of deaths in those who are infected, is the main measure of the impact of the disease, which, to some extent reflects the efficaciousness of treatment and care. The more we know about COVID-19, on how to timely diagnose it, monitor its course, and treat it or providing adequate supporting healthcare to those who are affected, the lower the CFR. However, CFR and total deaths due to COVID-19 should be interpreted with extreme caution. Both the number of deaths attributable to COVID-19 and the total number of cases were likely underestimated and biased, so was the ratio between the two. Moreover, CFR in most diseases, including COVID-19 varies across a number of known (age, comorbidity, and health system capacity and capability), and unknown factors, and this data is not or cannot be available, or accessible. CFR should be stratified by factors that provide an appreciation of the heterogeneity of the impact of the disease, which is crucial to inform action.

Public health approach

In this section I briefly define the policy and infrastructural elements of the public health approach to the COVID-19 epidemic, stressing the importance of the inclusion of the public. I then describe the three main public health strategies within which a series of PHI are typically

articulated and deployed to reduce the impact of the epidemic. The PHI are defined in the glossary (Appendix), and their relevance and pertinence to the three main strategies is illustrated in the Table.

Policy, plans, and infrastructure

National and local authorities have the responsibility to lay down a policy to define the vision, values, principles, the overall goal and specific objectives to respond to the COVID-19 epidemic. A policy is an indispensable preamble to bind all actors and stakeholders to an agreed platform and agenda, to design a plan (and strategy), and to establish a broad model for action. It is essential that specific public health measures, and the activities required for their implementation are coherently and systematically organized across few, explicit strategies that define the lines of action. It is important that the existence of the policy is locally disseminated, along with a transparent and detailed account of the process used, and the people involved to craft it. The goal is to instill a sense of trust and belonging in the public, and to promote an informed enactment of the recommendations and measures to be enforced.

It is extremely important that national and regional governments set up a plan, define specific strategies within it, and put in place an overarching inter-sectoral organization to implement it. These are the main elements of the required infrastructure:

- a multi-agencies task force;
- a crisis unit (for health and social services);
- a public health communication team;
- social and community support unit (and groups);
- a charity, donation, and voluntary organization and fund raising mechanism;
- research and surveillance infrastructures to collect, manage and process data

Public involvement

Policy and plans should be designed and developed using a highly inclusive and participatory approach. National and local governments should proactively involve and consult with all relevant institutions, organizations, and stakeholders, including local clinicians, health managers, scientists and experts. Participatory methods are needed to attain informed acceptance and high adherence to future PHI, to decide the optimal timing and duration of specific interventions, and to plan how these should be communicated. It is also important to involve representatives of subgroups of the population who may be more intensively targeted and/or more affected by some of the PHI, and by COVID-19 itself. A SWOT analysis may precede the formulation, and inform local adaptation of strategies defined in close consultation with relevant actors and stakeholders.

An epidemic response plan should be prepared in advance, and the initial setup described above is likely more beneficial if taken in the very early stages and before the surge of the

epidemic in the region. However, a late inception is a more likely scenario, and is certainly better than inaction, not least, because the duration of the epidemic and its evolution were unpredictable, and information and communication benefit enormously from the existence of an adequately disseminated plan.

Public health strategies

Strategies set priorities of action, targets, and process and outcome indicators to monitor and measure progress. Different strategies to respond to an epidemic may have specific and distinct aims, but they tend to share a variety of public health measures. Clear explanations and explicit reference to the rational of each and all major activities within a strategy must be effectively communicated to the public. This includes defining the timing, order, and duration of PHI, and communicating who is responsible for what, the required resources, and anticipating barriers and facilitators with information from the SWOT analysis.

There are three main public health strategies to tackle epidemics, including the COVID-19 pandemic: containment, mitigation, and suppression. These strategies share the overall goal of reducing the health impact of the disease, limiting the number of cases, hospitalizations, and deaths, but their specific aims do differ. The elimination of the disease is usually not an objective of these strategies, which are best conceived as 'emergency-responses' rather than mid- to long-term responses to the pandemic. The three main strategies described below are designed, implemented and endure from the emergence of the (new) infectious disease, to the amplification, through the localized transmission phases, and may be discontinued towards the reduced transmission phase, when elimination of the risk of new outbreaks is the goal, and eradication of the disease may be considered.

Containment

The main **aim** of containment is to drastically reduce chance of infection, and breaking chains of transmission. Containment relies on aggressive testing of potentially infectious individuals identified through meticulous investigations and contact tracing of known cases. Containment is effective only if all contacts of a confirmed case are identified, and if measures to restrict the movement and contact of infected people truly stop the spread of the disease, which depends also on the disease infectiousness. This means that isolation of cases and quarantine of contacts must be strictly enforced. However, when the number of cases is high and/or community transmission prevails it becomes progressively difficult and then simply impossible to trace all contacts, and unfeasible to contain the movement of entire communities. Therefore, this strategy is typically used in the early phases of an epidemic, and was indeed done in defined geographic areas during the early phases of the COVID-19 epidemic in China, South Korea, Singapore, northern Italy, and in Switzerland too. However, though containment did certainly contribute to it was not effective in breaking chains of transmissions in most countries, and did not prevent the amplification of the epidemic. For example, there is evidence

that residents of restricted areas in western countries (including Switzerland) did violate restrictions, and contagions in proximal and distant locations have been documented and traced back to them. Containment is usually abandoned for practical and logistic reasons as the number and geographic distribution of cases expand. However, containment can and was indeed combined with other strategies at later stages of the COVID-19 pandemic in particular to target population subgroups.

Mitigation

The main **aim** of mitigation is to reduce the health impact of the epidemic (particularly on the health system), slowing the spreading of infections, and thus averting sharp and abrupt peaks of cases that need hospitalization, and intensive care. In the short term mitigation may reduce the incidence of COVID-19, but an uncertain and likely high number of severe cases and deaths likely occur. It is argued that even in the case that the overall absolute number of COVID-19 cases is the same, with mitigation the case fatality rate is expected to decline over time because quality of care and treatment can be improved whilst health services function below their maximum capacity. Spreading cases over a longer period of time also allows the accumulation of knowledge and consolidation of evidence on modifiable and non-modifiable factors associated with a severe course of the disease and death. Better knowledge about COVID-19 could contribute to precision-medicine (i.e. individual tailoring of healthcare), and to define targeted primary prevention strategies at the community level based on predisposing and prognostic factors. In addition, infected people who develop immunity at a controlled pace (including both asymptomatic cases and those who recover) progressively provide increasing protection to the susceptible population, while exerting a manageable impact on health systems and services. However, substantial knowledge, and epidemiological, clinical, and mechanistic evidence about COVID-19 is necessary to make meaningful predictions about the potential success of the mitigation strategy.

Suppression

The main **aim** of suppression is to reduce the reproductive number to below one, and thus to progressively eliminate contagions from infected to susceptible individuals. If effective, suppression leads to the postponement of the epidemic, through a steep reduction of infections, cases, and deaths. Because the number of those who are susceptible does not substantially decrease, if a vaccine or effective treatment(s) does not become available COVID-19 likely resurges as soon as the virus starts circulating again. Nevertheless, the temporary suppression allows dsimproving the preparedness of the population and of the health system in the event of a second peak. The capacity and capability of the health system can be increased and improved, and significant behavioral and environmental changes can be introduced at the community level to drastically increase primary prevention.

Public Health Interventions across strategies

Definitions of the main PHI can be found in the Glossary (Appendix).

The three main strategies, containment, mitigation and suppression share a large number of PHI, at the population level (social distancing, personal and environmental hygiene measures, isolation of cases, quarantine, epidemiological investigations and active surveillance), and the health system level (reorganization of health services, diagnostic kits, telemedicine, increased capacity, triage infrastructures, fever clinics). However, the timing, duration, mix, and modality of enforcement of these measures vary markedly between these strategies. For example, strict isolation of cases and contacts, and complete lockdown are unique to containment and suppression, respectively. The focus on the flattening of the epidemic curve rather than on the actual reduction of cases and fatalities, is unique to mitigation, which seems to be more socially acceptable than containment and suppression despite the number of cases and deaths invariably associated with this approach. In general, though the PH measures are roughly the same, they are enforced only to a certain degree in mitigation, and more strictly in containment and isolation.

While typically abandoned after the initial phase of an epidemic, containment remains worth pursuing to protect subgroups of the population who may be at higher risk of infection, or of a severe course of the disease and death. Moreover, containment can be used to delimitate and regulate access to disease-free areas, and may be combined with other strategies, using a variety of PHI. New technologies that have already been used for contact tracing in several countries including China, Singapore, South Korea, Italy and Switzerland seem to hold the promise to exploit the interconnectedness of the world's population through personal devices to apply containment measures to unprecedentedly large populations. Mobile phone APPs were developed in western countries, also supported by cost-effectiveness models that suggest good return on investment despite the costs of initial investments. Nonetheless, issues and concerns related to privacy, ethical, and legal aspects exist, and how to address them on a global scale is not simple. Importantly, if isolation and quarantine measures are sub-optimal even a hypothetically perfect efficiency of contacts tracing through mobile APPs would not lead to effective containment.

The mitigation strategy was deemed socially acceptable, and it was widely used in several countries and regions. Nonetheless, because there is no effective treatment for COVID-19 and because of the demographic structure of most Western Countries, mitigation was also invariably associated with a high number of cases, a proportion of which severe, and with many deaths, irrespective of the capacity and improved capability of healthcare services. It may be argued that only few countries openly recognized that they were using a mitigation strategy. For example, the British and the German Prime Ministers did so in late February 2020, well before the peak of COVID-19 cases in the two countries. They received media and public harsh criticisms when they acknowledged that a considerable amount of deaths were expected. Blunt accusations of being cynical, and even morally despicable followed. In practice, the success of the mitigation approach depends not only on the effectiveness of the PHI and the efficacy of

treatment and healthcare, but also on their mix and complex interplay. Indeed, there were marked differences in the intended reduction of the impact of the epidemic across countries that have implemented mitigation strategies that comprised almost identical PHI, in particular across Europe. Whether and the extent to which this heterogeneity of results is explained by variations in the design and/or implementation of apparently very similar mitigation strategies is not known.

Although a mix of the three main strategies was chosen and used, in most countries mitigation greatly prevailed, with the notable exception of China, where local authorities opted for the suppression strategy instead. However, in most cases the fact that PHI are part of a structured strategy, and that a specific strategy was in place in the first place was somewhat omitted, or not transparently communicated by national and local authorities. The focus was mainly on the PHI, their mandatory enforcement, duration, and potential impact.

The anchoring of PHI to strategies, plan, and a comprehensive public health approach is crucial to attain good adherence of individuals to practices that are largely dependent on drastic changes of lifestyles and behaviors. Understanding why and how specific PHI may reduce the risk of infection and the impact of the epidemic must be complemented by an equally good appreciation of the premises and rational of the PHI. This is best provided making explicit, and naming, the specific strategy to which each and all the enforced PHI coherently belong.

Communication

Communication of risk and of epidemic countermeasures is a core activity during an epidemic. One-way communication is important but should be limited to the dispatch of official information about the nature of the disease, and the protective and preventive measures, behaviors and practices that people can take. Both traditional media and new media may be used for mass communication. Uni-directional WhatsApp and other messaging systems provide the possibility to target subgroups in the population including health and frontline workers. However, national and particularly local authorities should aim to establish a dynamic dialogue with communities and the public.

Two-way communication is essential to design and tailor interventions accounting for cultural, contextual, and other circumstances at the local level. Authorities and experts should establish a dialogue starting with a multi-step assessment of the level of awareness and understanding of COVID-19 in the general population, and in relevant subgroups like young and older adults, and health and social care workers. It is important to use a mix of quantitative and qualitative methods to collect a variety of data and to co-design messages, and more complex interventions, including communication campaigns that account for the cultural, linguistic, and educational characteristics of the target population.

The overabundance of information, often referred to as 'infodemic', should be addressed through a careful monitoring and analysis of the phenomenon, and appropriate measures to keep it at bay. It is the responsibility of local and national authorities to block misinformation, prevent their diffusion and circulation, and explain the perils related to it. Access to and appropriate use of reliable sources of information is best achieved through community engagement rooted on dialogue and reciprocal trust between authorities and communities. Ignorance is rarely due to lack of knowledge. Ignorance is more often a distorted or bluntly false set of beliefs that individuals hold. Misinformation cannot be simply replaced by factual information. A dialogic interaction means that personal, cultural, and contextual aspects are adequately acknowledged as legitimate circumstances within which individuals form their personal opinions. The engagement of communities provides opportunities to deconstruct misinformation and wrong beliefs through dialogue instead of the imposition of transfer of factual knowledge from experts to supposedly (or supposed) incompetent parties. Information should be shared, not transferred.

CONCLUSION

There are three main public health strategies to tackle the COVID-19 epidemic. These strategies have clearly distinct aims but share a large number of PHI. Most of these PHI can and should be implemented irrespective of the specification of the strategy being enforced, but with varying timing, duration, and modalities. *De facto*, containment, mitigation and suppression are not mutually exclusive strategies, and can be combined and used as appropriate and needed.

The close monitoring at the local level, and a constant knowledge exchange on a global scale of the efficiency and effectiveness of the implementation of public health strategies can greatly contribute to attain their intended effect, that is lessening the impact of the epidemic, first and foremost in terms of lives spared. However, the local implementation and success of these measures depends on the effective engagement of communities, mutual trust and dialogue between communities and national and local authorities. This dialogue is a crucial element of the comprehensive public health approach to the COVID-19 epidemic described in this report, but one that seems to be perilously overlooked in most countries.

Despite compared to Zika, Ebola, and SARS the case fatality rate of COVID-19 is apparently significantly lower, the much higher infectiousness of COVID-19 was likely the major driver of its rapid geographic spread, and of the number of infected people worlwide. The absolute number of deaths has been high. And yet, mortality due to COVID-19 is almost certainly underestimated (particularly in the oldest old) and was destined to further increase as the disease moved into countries with lower healthcare capacity, and weaker welfare. Because the consequences of COVID-19 are rightly widely communicated, there is a serious risk to strain and erode the resilience capacity of individuals and communities, who may distrust and dismiss the PH measures and national and local authorities.

We maintain that the public health strategy endorsed by national and local authorities should not be simply communicated, but also explained and agreed with communities. This is why an effort to engage community, build mutual trust and communication is indispensable. All future decisions about PH measures should be explicitly framed within the boundaries of a strategy, or a combination of strategies. There are no alternatives to decide when, how, and for how long the current measures can be lifted, and others introduced as needed.

CAUTION

I acknowledge that this document is not comprehensive. Vaccines and vaccination campaigns that started in Switzerland in January 2021 are not discussed, neither are they contextualized within the three main strategies described above.

I make no recommendations of which strategy and/or measures should be used, and of how these may be implemented and monitored. I do not include a situational or SWOT analysis, and make no use of or reference to data about the current epidemic situation (number of cases, deaths etc.), and/or of the public health measures currently implemented in Switzerland, the timing and duration of their enforcement, their feasibility, efficiency, potential efficacy and effectiveness, and of any costs or potential societal, economic, psychological or other kind of impact or consequences on individuals and society.

At the time of latest revision of this document, the Swiss Confederation and Federal Council has approved a major relapse of all PHI, including masks wearing. The monitoring of the spreading and possible resurge of COVID-19 cases and infections in the general population is crucial. Corona Immunitas is the SSPH+ program to conduct high quality serosurveys with standard methods and procedures across Swiss Cantons. Corona Immunitas will be illustrated by Prof. Milo Puhan to ETH students. Data collection to determine the proportion of individuals in the general population with anti-SARS-CoV-2 antibodies and their duration are ongoing at the time of writing, February 2022.

TABLE

	Containment	Mitigation	Suppression
Social distancing + wash hands & hygiene			
Partial lockdown (schools closure; essential services open)			
Testing only of symptomatic			
Cases defined by symptoms			
Voluntary isolation of cases in the home			
Voluntary quarantine of contacts in the home (14 days)			
Quarantine of frail (by age & comorbidity) (alternative services in place)			

MITIGATION	SUPPRESSION
MULTI-SECTORAL APPROACH (applies to both strategies)	
Inter-governmental/ multisectoral TASK FORCE **(network across health, social, education, and police sectors)**	
Public health communication **PRINCIPLES: rational, frequent, transparent (uncertainties are acknowledged)** **OBJECTIVES: 1.Inform (debunk fake news); 2.Create bond; 3.Reduce fear/anxiety; 4.Establish dialogue** **MEANS: traditional (TV, radio, newspapers, posters) & new media (social; regional one-way WhatsApp group)** **INTERACTION: 1.hotline; 2.interactive platforms (social network); 3.two-way WhatsApp groups between Clinicians & Experts** **…?**	
Social support **Community door-knocking/ phone calls to establish contact, identify those in need, create a registry, track community cases** **Provide essential services (food; medicines; care etc.)** **Constant (daily) monitoring by phone of frail individuals (by age, health and social needs) + symptoms elicitation** **Qualitative and quantitative research to identify needs, barriers, solutions, and dynamic monitoring of the situation** **…?**	
Donation and charity fund **(for patients, health workers, poor/ in-need population, etc.)** **…?**	
PUBLIC HEALTH & POLICY measures	
Social distancing + wash hands & hygiene	Social **distancing** + all **hygiene** measures
Partial lockdown (schools closure; essential services open)	**Total lockdown** (no travels; alternative services in place)
Testing only of symptomatic	**Aggressive testing** (epi investigations)
Cases defined by symptoms	**Cases** defined by **Test+**
	Breaking of **chains of transmission** (epi investigations)
Voluntary isolation of cases in the home	**Isolation** of cases in *fever clinics*
Voluntary quarantine of contacts in the home (14 days)	**Quarantine** of contacts in the home (14 days)
Quarantine of frail (by age & comorbidity) **(alternative services in place)**	**Symptoms monitoring of frail** (by age & comorbidity) (NOTE: elders and vulnerable are in quarantine)
HEALTH SYSTEM/ SERVICES	
Health services task force (unità di crisi)	Health services **task force** (unità di crisi)
Protective measures for ALL staff in all sites	**Protective measures** for ALL staff incl. **outside H**

NEW COVID-19 dedicated clinics/ Hospitals	NEW COVID-19 dedicated clinics/ Hospitals
↑↑ **LAB** (IT-referral system; centralized testing;…)	↑↑↑↑ + ↑↑↑↑ **LAB** (IT-referral system; centralized testing;…)
NEW Test+ clinical monitoring (phone/ telemedicine)	**Test+ active tracking** (epi investigations)
NEW Telemedicine of mild cases	**NEW Fever clinics for ALL cases** (pre-hospital beds + staff)
↑↑↑↑ **hospital capacity** (more beds + staff)	↑↑ **hospital capacity** (more beds + staff)
↑↑ **ICU beds** (more beds + staff)	↑↑ **ICU** capacity (more beds + staff)
↑↑↑↑ **Recovery clinics** (post ICU)	↑↑ Recovery clinics (post ICU)
Several indicators for monitoring	Selected indicators for monitoring
Active surveillance I **voluntary symptoms reports** (*Influenzanet/ Gripnet:* **APP; phone number**)	**Active surveillance II** **compulsory symptoms report + geo-tracking of Test+** (*wearables to all Test+*)

APPENDIX

COVID-19 epidemic – a GLOSSARY

AUTHOR

Emiliano Albanese and Aliaa Ibnidris (USI) prepared the first version of this glossary.

SCOPE

We would like to favor a clear and effective communication across the SSPH+ about COVID-19, and support collaborations through a common terminology and lexicon, and a defined nomenclature of terms and concepts relevant for the work on the COVID-19 pandemic response.

WHAT

We list terms and concepts with operational definitions. Most available sources, glossaries and lists seem to be not comprehensive neither are they easily accessible. We use and cite various sources, and we do our best to standardize terminology and definitions across the glossary.

EDITS & REVISIONS

► This document is neither complete nor 100% accurate. Some terms still lack a definition. Others are simply not there yet. You can integrate, expand and edit the glossary.

TERM	DEFINITION
Acquired immunity	Resistance developed in response to an antigen (i.e., an infecting agent or vaccine), usually characterized by the presence of antibody produced by the host. CDC
Attack rate	A form of incidence that measures the proportion of persons in a population who experience an acute health event during a limited period (e.g., during an outbreak), calculated as the number of new cases of a health problem during an outbreak divided by the size of the population at the beginning of the period, usually expressed as a percentage or per 1,000 or 100,000 population. CDC
Basic reproductive number	The basic reproduction number (R0) is defined as the average number of secondary cases caused by a single infectious individual in a totally susceptible population. NCCID The R0 expresses how fast the epidemic spreads, in days*no. of susceptible people*chance of infection. The R0 (R "nought") is defined as the average number of secondary cases caused by a single infectious individual in a totally susceptible population [NCCID], and it is the key parameter to express how fast the epidemic spreads, in mean duration of infectiousness (days) *no. of susceptible people / rate of contact between individuals * chance of infection/ probability of transmission on contact between an infected and a susceptible individual.
Care rate	The proportion of those who need care who actually receive it. [no source]
Carrier	A person or animal that harbors the infectious agent for a disease and can transmit it to others but does not demonstrate signs of the disease. A carrier can be asymptomatic (never indicate signs of the disease) or can display signs of the disease only during the incubation period, convalescence, or postconvalescence. The period of being a carrier can be short (a transient carrier) or long (a chronic carrier). CDC
Case-Fatality rate	The proportion of persons with a particular condition (e.g., patients) who die from that condition. The denominator is the number of persons with the condition; the numerator is the number of cause-specific deaths among those persons. CDC
Cause-specific mortality rate	The mortality rate from a specified cause, calculated as the number of deaths attributed to a specific cause during a specified time interval among a population divided by the size of the midinterval population. CDC

Carrier	A person or animal that harbors the infectious agent for a disease and can transmit it to others but does not demonstrate signs of the disease. A carrier can be asymptomatic (never indicate signs of the disease) or can display signs of the disease only during the incubation period, convalescence, or postconvalescence. The period of being a carrier can be short (a transient carrier) or long (a chronic carrier). CDC
Case-Fatality rate	The proportion of persons with a particular condition (e.g., patients) who die from that condition. The denominator is the number of persons with the condition; the numerator is the number of cause-specific deaths among those persons. CDC
Cause-specific mortality rate	The mortality rate from a specified cause, calculated as the number of deaths attributed to a specific cause during a specified time interval among a population divided by the size of the midinterval population. CDC
Common source outbreak	An outbreak that results from persons being exposed to the same harmful influence (e.g., an infectious agent or toxin). The exposure period can be brief or can extend over days, weeks, or longer, with the exposure being either intermittent or continuous. CDC
Contact	Exposure to a source of an infection; a person who has been exposed. CDC
Coronavirus	A family of viruses that cause illness ranging from the common cold to more severe diseases, such as Middle East Respiratory Syndrome (MERS-CoV) and Severe Acute Respiratory Syndrome (SARS-CoV). The novel coronavirus recently discovered has been named SARS-CoV-2 and it causes COVID-19. WHO
COVID-19	The name of the disease caused by the novel coronavirus, SARS-CoV-2, and is short for "Coronavirus Disease 2019." WHO
Crude mortality rate	A mortality rate from all causes of death for an entire population, without adjustment. CDC
Death-To-Case Ratio	The number of deaths attributed to a particular disease, injury, or other health condition during a specified period, divided by the number of new cases of that disease, injury, or condition identified during the same period. CDC
Decontamination measures (personal and environmental)	The process of removing or neutralizing contaminants that have accumulated on personnel and equipment. Decontamination methods either (1) physically remove contaminants, (2) inactivate contaminants by chemical detoxification or disinfection/sterilization, or (3) remove contaminants by a combination of both physical and chemical means. OSHA
Detection rate	The case detection rate is calculated as the number of cases notified divided by the number of cases estimated for that year, expressed as a percentage. WHO
Diagnosis	The process of determining the nature of a disease or disorder and distinguishing it from other possible conditions. The term comes from the Greek *gnosis*, meaning knowledge. Britannica

Doubling time	The amount of time it takes for a given quantity to double in size or value at a constant growth rate. PopEd
Droplet transmission or spread	The direct transmission of an infectious agent by means of the aerosols produced in sneezing, coughing, or talking that travel only a short distance before falling to the ground. CDC
Epidemic (synonym: Outbreak)	The occurrence of more cases of disease, injury, or other health condition than expected in a given area or among a specific group of persons during a particular period. Usually, the cases are presumed to have a common cause or to be related to one another in some way. CDC
Epidemic curve	A histogram that displays the course of an outbreak or epidemic by plotting the number of cases according to time of onset. CDC
Epidemiologic investigation	A series of components including a public health response to identify cases, contacts, sources of infections, and interventions. CDC
Exponential growth	A specific way that a quantity may increase over time. It occurs when the instantaneous rate of change (that is, the derivative) of a quantity with respect to time is proportional to the quantity itself. Wikipedia
Flattening the curve	Slowing a virus' spread to reduce the peak number of cases and related demands on hospitals and infrastructure. CDC
Herd immunity	The resistance to an infectious agent of an entire group or community (and, in particular, protection of susceptible persons) as a result of a substantial proportion of the population being immune to the agent (due to infection or vaccine). Herd immunity is based on having a substantial number of immune persons, thereby reducing the likelihood that an infected person will come in contact with a susceptible one among human populations, also called **community immunity**. CDC
High-risk group	A group of persons whose risk for a particular disease, injury, or other health condition is greater than that of the rest of their community or population. CDC
Hygiene	Behaviours that can improve cleanliness and lead to good health, such as frequent hand washing, face washing, and bathing with soap and water. CDC
Immunity	Immunity refers to an individual's resistance to infection or re-infection by a causative pathogen. NCCID
Incubation/induction/latency period	The time interval from exposure to an infectious agent to the onset of symptoms of an infectious disease. CDC *Most estimates of the incubation period for COVID-19 range from 1-14 days, most commonly around five days. These estimates will be updated as more data become available.* WHO
Infectivity	The ability of an infectious agent to cause infection, measured as the proportion of persons exposed to an infectious agent who become infected. CDC

Isolation (case, contact, voluntary, and compulsory)	Separating ill persons from well persons. Rochester
Lockdown	Term in use during the COVID-19 epidemic; a measure of mass quarantine aimed at limiting movements, activities, and contact within communities. Partial or complete lockdowns may be enforced, ranging from partial to complete limitations of activities and movements. (cfr./vgl. *stay-at-home order*)
Pandemic	An epidemic occurring over a widespread area (multiple countries or continents) and usually affecting a substantial proportion of the population. CDC
Passive immunity	Immunity conferred by an antibody produced in another host and acquired naturally by an infant from its mother or artificially by administration of an antibody-containing preparation (antiserum or immune globulin). CDC
Pathogenicity	The ability of an agent to cause disease after infection, measured as the proportion of persons infected by an agent who then experience clinical disease. CDC
Positive and negative predictive value	The proportions of positive and negative results in statistics and diagnostic tests that are true positive and true negative results, respectively. Clinical Epidemiology
Quarantine (household, voluntary, compulsory, and self);	Separating well persons, who have been exposed to the infection, from other well persons during the incubation period of an illness. Rochester
Screening	The presumptive identification of unrecognized disease in an apparently healthy, asymptomatic population by means of tests, examinations or other procedures that can be applied rapidly and easily to the target population. WHO
Secondary attach rate	A measure of the frequency of new cases of a disease among the contacts of known patients. CDC
Sensitivity [*reported to be only 70% in current RT-PCR*],	The ability of a test, case definition, or surveillance system to identify true cases; the proportion of people with a health condition (or the proportion of outbreaks) that are identified by a screening test or case definition (or surveillance system). CDC
Sheltering	*See stay-at-home order, below*
Social distancing	Measures taken to reduce person-to-person contact in a given community, with a goal to stop or slow down the spread of a contagious disease. Measures can include working from home, closing offices and schools, canceling events, and avoiding public transportation. CIDRAP
Specificity	The ability or a test, case definition, or surveillance system to exclude persons without the health condition of interest; the proportion of persons without a health condition that are correctly identified as such by a screening test, case definition, or surveillance system. CDC

Spectrum bias/ effect	Variation in the performance (that is in the psychometric characteristics) of a diagnostic or screening test as a function of the prevalence of the prevalence of the disease in the population, and the characteristics of the sample being tested. This is not limited to the effect on sensitivity of severity of the disease.
Stay-at-home order	Is an order from an authority to restrict movements of population, by ordering residents to stay home. Different from lockdown, outdoor activities are allowed (with limitations), and essential businesses and activities remain open (with limitations). Wikipedia
Surveillance (active and passive)	Active: public health surveillance in which the health agency solicits reports. Passive: public health surveillance in which data are sent to the health agency without prompting. CDC
Susceptibility	The microbe's vulnerability to antimicrobial drugs by exposing a standardized concentration of organism to specific concentrations of antimicrobial drugs. MSD
Testing serum (IgG)	IgG is the most abundant immunoglobulin to be produced in response to an antigen and is maintained in the body after initial exposure for long term response. IgM is the first immunoglobulin to be produced in response to an antigen and is primarily detected during the early onset of disease. EDI
Testing swab (rt-PCR)	A real-time reverse transcription polymerase chain reaction (rRT-PCR) test for the qualitative detection of nucleic acid from SARS-CoV-2 in upper and lower respiratory specimens (such as nasopharyngeal or oropharyngeal swabs, sputum, lower respiratory tract aspirates, bronchoalveolar lavage, and nasopharyngeal wash/aspirate or nasal aspirate) collected from individuals suspected of COVID-19 by their healthcare provider. FDA
Vaccine	A product that produces immunity therefore protecting the body from the disease. Vaccines are administered through needle injections, by mouth and by aerosol. CDC
Virulence	The ability of an infectious agent to cause severe disease, measured as the proportion of persons with the disease who become severely ill or die. CDC
Voluntary sheltering	*See stay-at-home order, above*
Zoonoses	An infectious disease that is transmissible from animals to humans. CDC
Zoonoses	An infectious disease that is transmissible from animals to humans. CDC

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