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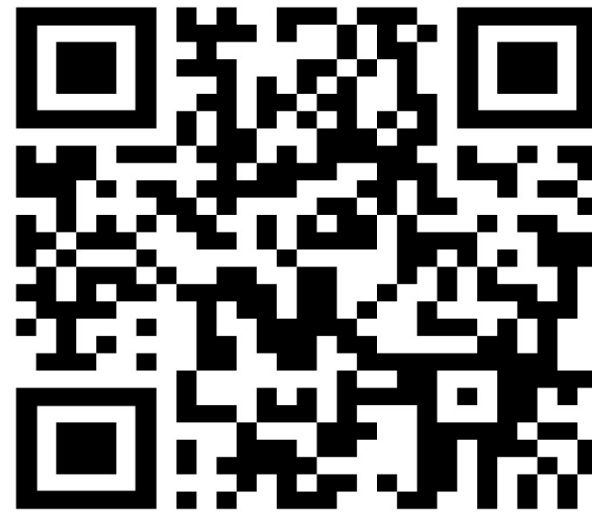
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ETH zürich

A public health approach to the COVID-19 pandemic – it's everywhere, but nobody knows what it is – you will.

Prof. Emiliano Albanese

Full professor, Faculty of Biomedical Sciences, Università della Svizzera italiana

SSPH+/ETHZ Lecture Series "This Is Public Health"

**A public health approach to the COVID-19
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knows what it is – you will**

Prof. Emiliano Albanese MD, PhD, MPH

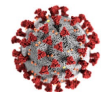
Institute of Public Health – Università della Svizzera Italiana (USI)

23.02.2022

1. Lecture CONTENT

A public health approach to COVID-19

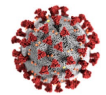
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A public health approach to the COVID-19 pandemic



2. Learning OBJECTIVES – COVID-19

By the end of this lecture you should be able to:

- Define the public health response to an epidemic
- Demonstrate knowledge of the three main pandemic strategies
- Contextualize the public health interventions (AKA non-pharmacological)
- Value the importance of health communication

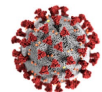


A public health response to COVID-19

Aim To describe the actionable epidemiological and public health strategies and measures aimed at reducing the impact of the COVID-19 epidemic on individuals, communities, and society at large.

Motivation

- Clinicians must know the rationale of the public health interventions (PHI) available to respond to the COVID-19 epidemic.
- The timing, duration, and implementation modalities of the PHI vary across countries



GLOSSARY

GLOSSARY

A public health approach to the COVID-19 epidemic

AUTHOR

Emiliano Albanese (USI professor of public health) [additional authors will be listed to newer versions of this document, as appropriate – see below]

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You need a common vocabulary and lexicon to understand each other, and to describe what's going on

GLOSSARY

You need a vocabulary to understand what's going on.

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
<u>Basic reproductive number</u>	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
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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. NCICD
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 attack 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 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. FDI
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
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KEY CONCEPTS

Key concepts

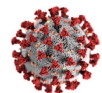
Disease spreading (dynamic of the epidemic)

1. Exponential growth

2. Basic reproductive number (R_0)
3. Flattening the (exponential) curve
4. Number of susceptible individuals



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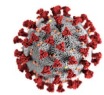
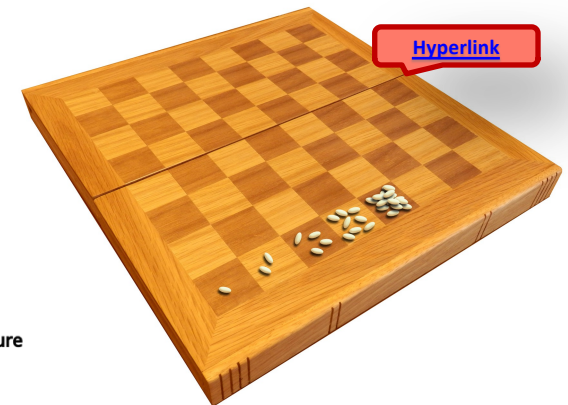
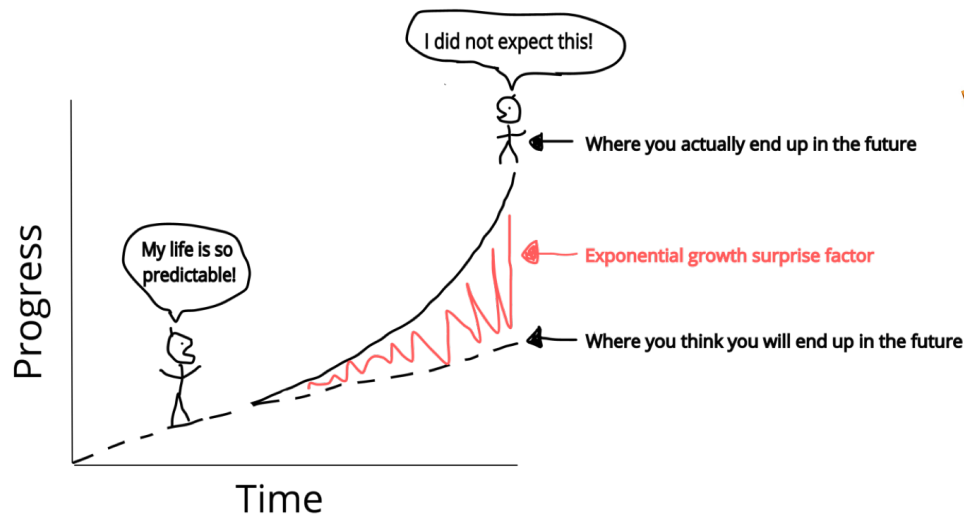


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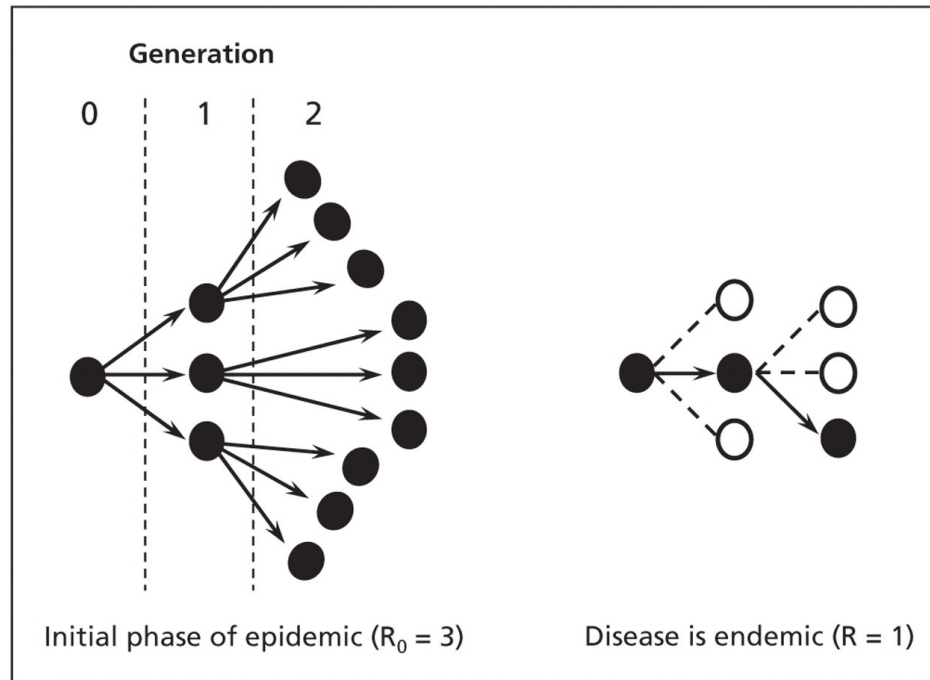


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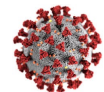
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Key concepts

Disease spreading (dynamic of the epidemic)

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- The average number of secondary cases caused by a single infectious individual in a totally susceptible population

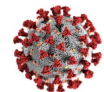
$$R_0 = D \times c \times \beta$$

Where:

- D = mean duration of infectiousness.
- c = the rate of contact between infected and susceptible individuals.
- β = the probability of transmission on contact between an infected and susceptible individual.

epidemic

- $R_0 > 1$ there will be an epidemic.
- $R_0 < 1$ the number of cases will decline.
- $R_0 = 1$ the disease will be endemic.



R_0 (Basic reproductive number) number of secondary cases caused by a single infectious individual in a totally susceptible population

D = mean duration of infectiousness

c = rate of contact between infected and susceptible folks

β = probability of transmission on contact

$$R_0 = D \times C \times \beta$$

Vaccines (may) reduce the number of susceptible individuals
Quarantine, lockdowns, social distancing reduce contact between infected and susceptible individuals

Masks reduce the likelihood of transmission

Preventive measures

Vaccines may reduce the infectiousness

Vaccines (may) reduce the number of susceptible individuals

Quarantine, lockdowns, social distancing reduce contact between infected and susceptible individuals

Masks reduce the likelihood of transmission

Neutralizing antibodies induced by vaccines may confer better immunity

Less opportunities for the virus to replicate

Before vaccine these were the only measures

Masks reduce the spread of and contact with virus-containing droplets

- $R_0 > 1$ there will be an epidemic.
- $R_0 < 1$ the number of cases will decline.
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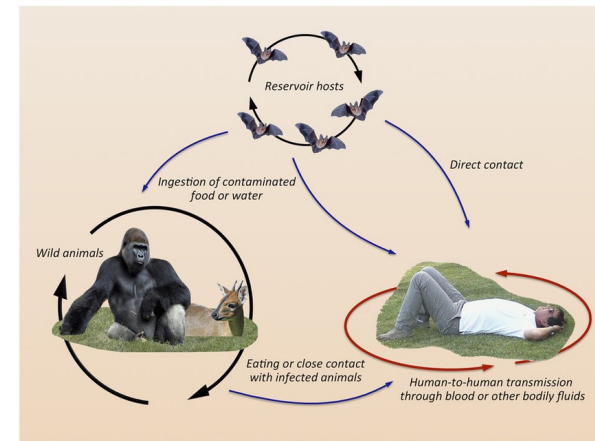
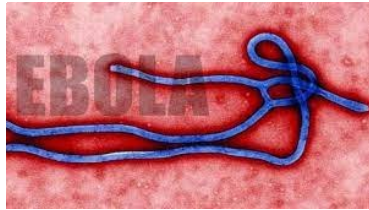
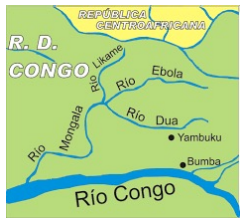
Zika



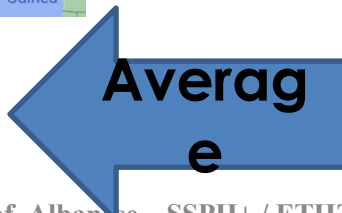
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Ebola



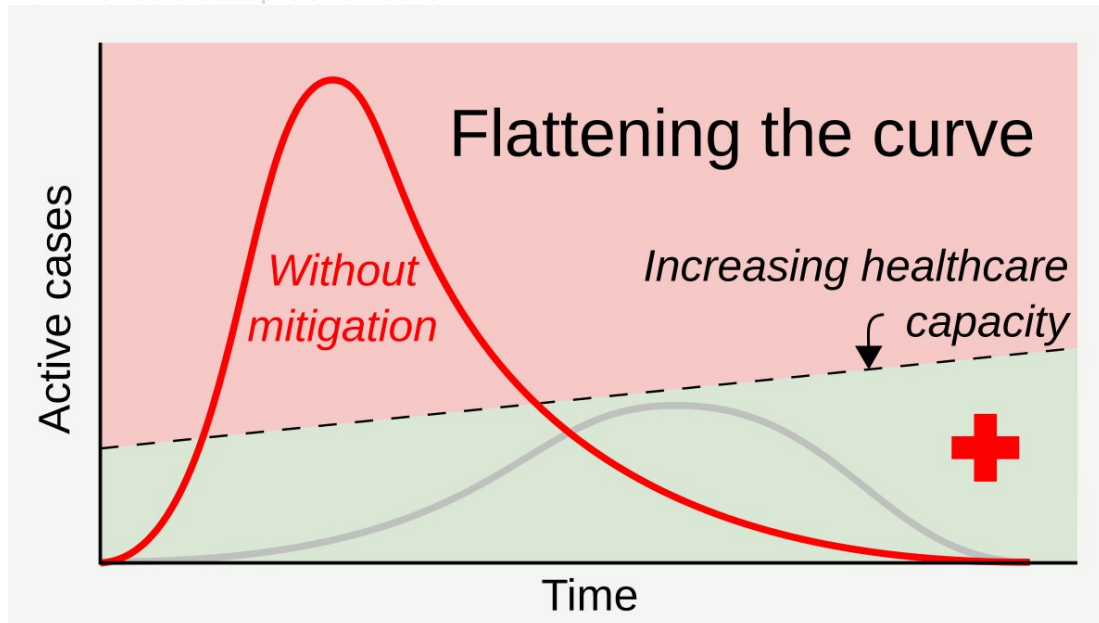
$R_0 = 2$



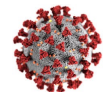
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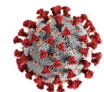
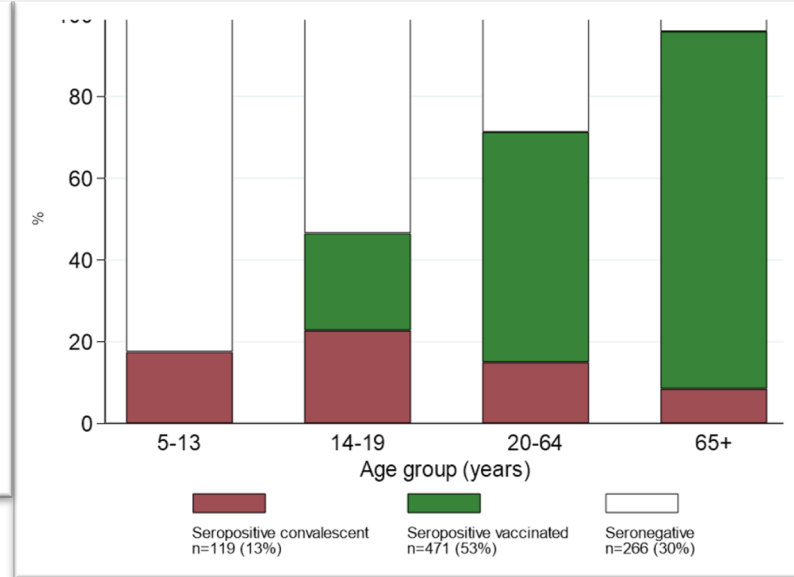
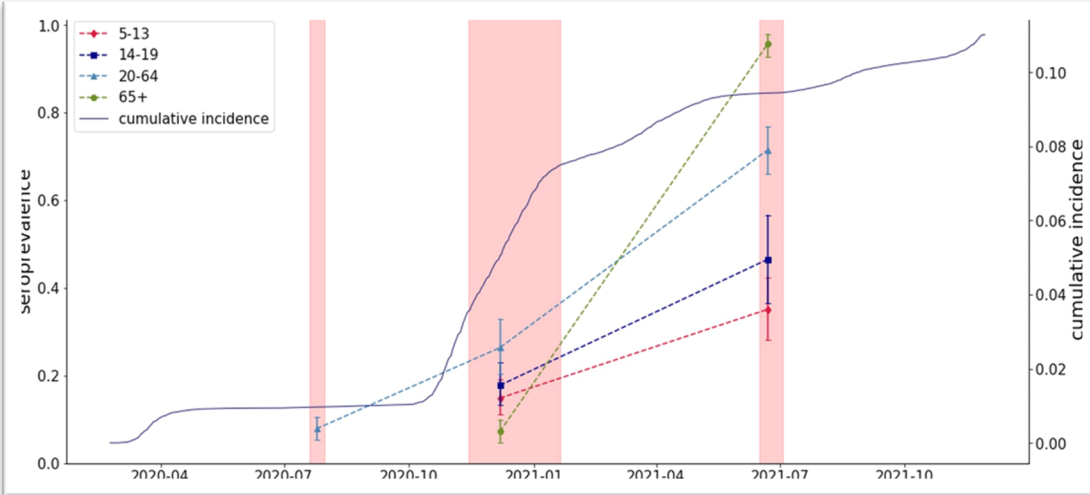


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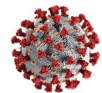
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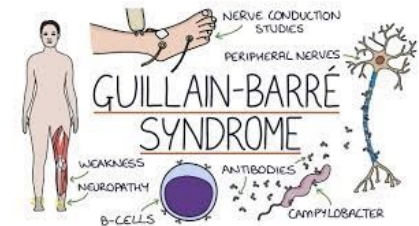
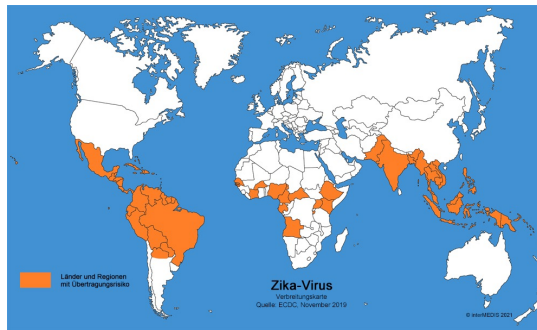
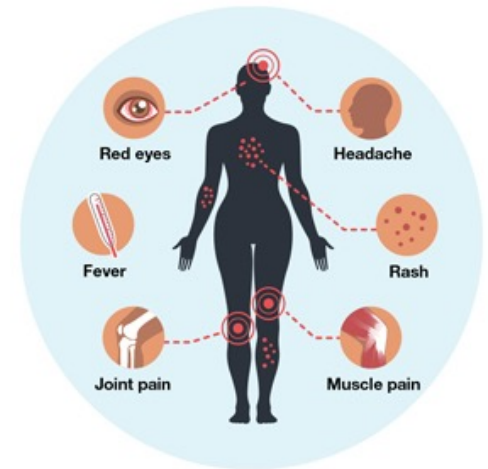
Impact

1. **Health system and service capacity**
2. **Mortality (total, and Case fatality rate, CFR)**
3. **Morbidity**
4. **Caseness and limitations of data**





Zika



Public Health APPROACH

Public health APPROACH

1. Describe – EPIDEMIOLOGICAL STUDIES
2. Understand – EPI & CLINICAL STUDIES
3. Raise awareness – PARTICIPATORY ACTIONS
4. Policies – INDISPENSABLE PREAMBLE

Agreed platform and agenda

Plan and model for action

Define **strategies** within which PHI are coherently articulated

Disseminate, instill trust, promote an informed enactment of PHI

ORGANIZATION & INFRASTRUCTURE:

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- Multi-agencies taskforce;
- Crisis unit (for health and social services);
- Communication team;
- Community support unit (and groups);
- Charity, donation, and voluntary organization and fund;
- Research and surveillance infrastructure



Public Involvement

- HOW - Policy and plans a participatory approach.
- WHO - Involve: relevant institutions, organizations, and stakeholders, clinicians, scientists and experts.
- WHY - Participatory methods are needed
 - To know and meet needs and expectations
 - To tailor action to the context and local culture
 - 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.
- **WHEN - An epidemic response plan should be prepared in advance. However, a late inception is a more likely scenario, and is certainly better than inaction.**

COMMUNICATION

ONE-WAY COMMUNICATION

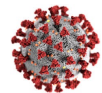
- Communication of risk and of epidemic PHI is key during an epidemic.
- Should be limited to the dispatch of official information (about the nature of the disease, the protective and preventive measures etc.)
- Use both traditional and new mass media.

TWO-WAY COMMUNICATION

- **Build a dialogue and reciprocal trust between authorities and communities**
- **Essential to co-design and tailor interventions.**
- **First, assess awareness and understanding of the disease**
- **Engage communities**
- **Use a mixed methods to co-design communication campaigns**

INFODEMIC

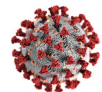
- **WHAT** - Overabundance of (mis)information, which is part of an epidemic
- **ACTIONS**
 - Infodemic must be monitored and kept at bay.
 - Engage communities to deconstruct misinformation through dialogue
 - Information should be shared, not transferred **(the imposition of knowledge from experts to supposedly (or supposed) incompetent parties does not work)**



STRATEGIES

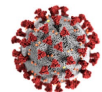
STRATEGIES

- **WHAT** - Strategies set priorities of action, targets, and process and outcome indicators to monitor and measure progress.
- **WHICH** - Different strategies have specific and distinct aims, but they may share some public health measures.
- **WHY** - Explicit reference to the rationale of each activity within a strategy must be effectively communicated to the public.
- **HOW** - Defining the timing, order, and duration of PHI



STRATEGIES

- 1. CONTAINMENT**
- 2. MITIGATION**
- 3. SUPPRESSION**

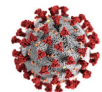


STRATEGIES

	CONTAINMENT	MITIGATION	SUPPRESSION
GOAL	reducing the impact of the epidemic	reducing the impact of the epidemic	reducing the impact of the epidemic
AIM	To reduce chance of infection and breaking chains of transmission	To reduce the impact of the epidemic (particularly on the health system), slowing the spreading of infections	to progressively eliminate contagions from infected to susceptible individuals
KEY	DIFFICULT - Effective only if all contacts of a confirmed case are identified, and isolation of cases and quarantine of contacts must be strictly enforced	VERY DEMANDING - Deaths occur, but the case fatality rate declines because services function below their max capacity, and prevention and treatment improve over time	IMPOSSIBLE? - Can lead to the postponement of the epidemic until treatment and vaccines are available, and allows to improve preparedness (of the population and health system)
TIMING	Early phases of an epidemic Abandoned as the number and geographic distribution of cases expand	Start as soon as containment is no longer feasible , endures until $R_0 < 1$, or it is socially and economically sustainable	Immediately , as soon as the epidemic is declared.

Main Public Health Interventions (PHI)

	CONTAINMENT	MITIGATION	SUPPRESSION
Physical distancing	Suggested	Partial to full	Full
Cough etiquette, hand washing & hygiene	Recommended	Compulsory	Compulsory
Masks	Minimal	Medium/ Compulsory	Compulsory
Lockdown	Minimal	Partial	Total
Testing	Targeted/ Mass	Only symptomatic	Clustered/ Mass
Isolation	Imposed	At home	In fever clinics
Quarantine	Imposed	Partial	Enforced
Supplementary community services - Survey and registries - Provision of services (food, medicines,	Little	Some	Capillary
Communication	One-way	One-way	Two-way
Vaccines	Subgroups	Subgroups	Mass



VACCINATION

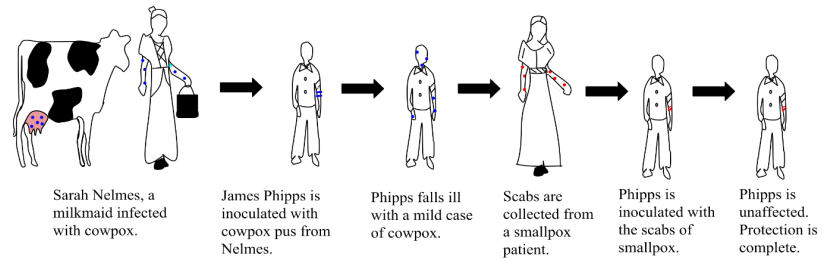
Vaccines

Edward Jenner > smallpox 'experiment' of *variolae vaccinae*: 'vaccine'



Observations that cowpox rendered people immune to smallpox (by others)

Experiment by Jenner (and others...)



1796 *Variolae vaccinae* experiment

Vaccination

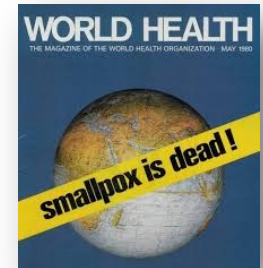
- The introduction of a substance into the body to induce the production of antibodies (without causing the infection)
- Of the greatest advances in medical science (millions of lives saved)
- Population immunity is the protection conferred to those not vaccinated
- AIMS
 1. Protection to those vaccinated
 2. Indirect protection through herd immunity
- Key features: safety, ethics, public confidence
- Critical Proportion: $p = 1 - (1 / R_0)$

Smallpox

- **Epidemics:** the spread of a disease in excess of the norm (**pandemics:** on a global scale)
- **Eradication:** the global reduction of the prevalence of a disease to zero (different from **elimination**, which is not complete).



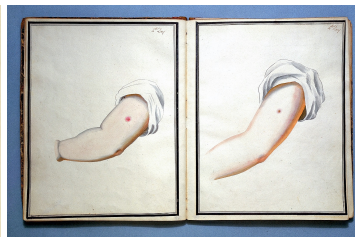
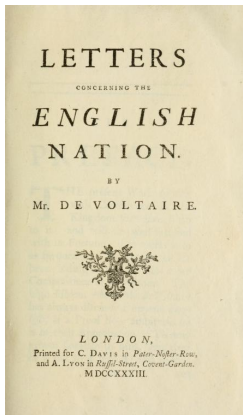
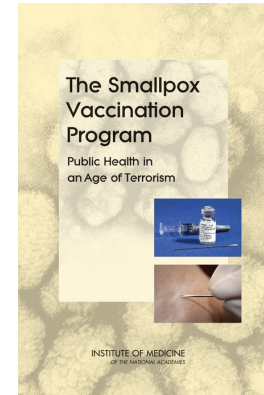
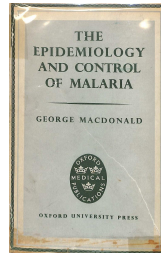
Spanish flu 1918-1919



1980



Smallpox



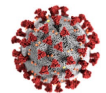
Controlled contagion requires cultural contagion

Vaccination hesitancy is a luxury due to our success

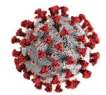
Prof. Albanese – SSPH+ / ETHZ Lecture Series 2022 - This Is Public Health – 23.02.2022
A public health approach to the COVID-19 pandemic

RECAP

- There are 3 main public health strategies to tackle the COVID-19 epidemic.
- The 3 strategies have the same goal, but different AIMS
- The main PHI are the same but timing, duration, and modalities vary.
- Containment, mitigation and suppression are not mutually exclusive, may overlap.
- Effective engagement of communities and dialogue with authorities are key.



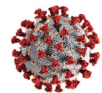
Grazie

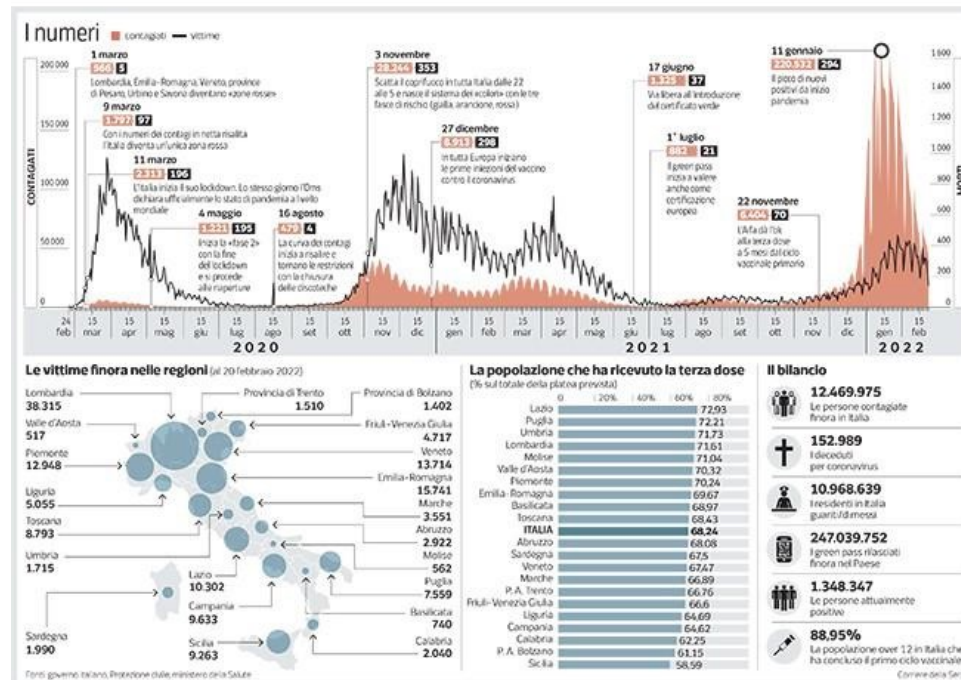




Zero-COVID PROJECT

- WHO – USI BioMed students
- GOAL – Zero COVID-19 cases among students until Dec 31st 2020
- AIMS
 - Protect health
 - Design and implement an epidemic strategy
 - Engage with local communities and services
- WHAT – extra-curricular work
- HOW - contact the Institute of Public Health (USI)... if interested





Nome Cognome o evento, data



ETH zürich

Coming up next week:

Public Health Research on COVID- 19 in Switzerland

Prof. Milo Puhan

Director of EBPI, University of Zürich; President of SSPH+



SSPH+

SWISS SCHOOL OF
PUBLIC HEALTH

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