Epidemics, Pandemics and Global Health

Stefano Vella MD
Adjunct Professor, Global Health, Catholic University, Rome
Affiliated to Research, Clinical Pharmacology, Karolinska Institutet, Stockholm
Italian Delegation, Horizon Europe (Health Cluster), European Commission
Pandemics and Global Health

1. The pandemics in human history
2. The concept of Global Health
3. Covid 19: Was it predictable? What went wrong?
4. An example: the response to HIV pandemic
5. What to do: be prepared for the «next one»
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Le grandi epidemie della storia

Because a virus doesn’t care about state lines or national borders, it can wipe out millions and span multiple continents rapidly. Here is a look at the infectious diseases the world has battled throughout history.

What is a Pandemic?
Derived from the Greek word \textit{pandemos} meaning “pertaining to all people,” a pandemic is a widespread disease that affects humans over a wide geographic area.

**PLAGUE of JUSTINIAN**
541 - 750
25+ million

**HIV / AIDS**
1981 - TODAY
25 million

**MEASLES**
7th Century BC - 1963
200 million

**SMALLPOX**
10,000 BC - 1979
300+ million

**BLACK DEATH**
1340 - 1371
75 million

**SPANISH FLU**
1918 - 1919
50-100 million

**TYPHUS**
430 BC - TODAY
4 million

**CHOLERA**
1817 - TODAY
3 million

**HONG KONG FLU**
1968 - 1969
1 million

厌恶瘟疫的万民，这句古希腊语“pertaining to all people”就是对传染病的广泛定义，它影响着地球上广泛的人口。

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**OUTBREAK**
Deadliest Pandemics in History

**HONORABLE MENTIONS**
Although the following viruses do not have a figure for total amount of lives claimed, they continue to terrorize various areas around the world.

**MALARIA**
1600 - TODAY

Common Symptoms
Chills, Headache, Fever, Jaundice, Muscle Pain, Nausea, Vomiting, Seizures

Death Toll
According to the World Health Organization’s 2020 “World Malaria Report,” an estimated 768,000 people are killed by the virus every year.

**TUBERCULOSIS**
700 BC - TODAY

Common Symptoms
Cough, Chest Pain, Fatigue, Fever, Headache, Sweats

Death Toll
There are almost 2 million tuberculosis-related deaths worldwide every year.

**YELLOW FEVER**
16th Century - TODAY

Common Symptoms
Bleeding, Fever, Nausea, Vomiting, Delirium, Seizures, Jaundice

Death Toll
Worldwide, 30,000 deaths are caused by the infection each year.

*Ring Around the Rosie, a Pocket Full of Plague*
Legend says the Black Death plague inspired the children’s rhyme “Ring Around The Rosie,” which alluded to the rash-like rings and ashes of the deceased victims.
Throughout the 17th and 18th centuries, a series of "Great Plagues" routinely ravaged cities across Europe.

Antonine Plague 165–180
Plague of Justinian 541–542
Japanese Smallpox Epidemic 735–737

Black Death (Bubonic Plague) 200M
1347–1351

Small Pox 56M
1520

17th Century Great Plagues 3M
1600

18th Century Great Plagues 600K
1700

Cholera 6 outbreak 1M
1817–1923

The Third Plague 12M
1855

Yellow Fever 100-150K
LATE 1800s

Spanish Flu 40–50M
1918–1919

Russian Flu 1M
1889–1890

HIV/AIDS 25-35M
1981–PRESENT

Asian Flu 1.1M
1957–1958

Hong Kong Flu 1M
1968–1970

SARS 770
2002–2003

Swine Flu 200K
2009–2010

MERS 850
2015–PRESENT

Ebola 1K
2014–2016

Novel Coronavirus (COVID-19) 4.7K*
2019–PRESENT

Despite their names, both of these outbreaks are believed to have originated in China.

THROUGHOUT HISTORY, as humans spread across the world, infectious diseases have been a constant companion. Even in this modern era, outbreaks are nearly constant.

Here are some of history's most deadly pandemics, from the Antonine Plague to Novel Coronavirus (COVID-19).
Death toll vs population of the great epidemics

Peste di Giustiniano 541-542
DC
100 milioni di morti

Peste nera
1346-1350
50 milioni di morti

Influenza Spagnola
1918-1920
20-30 milioni di morti

VELLA_SIF_JULY
1. The plague
"A plague so great as this, and so dreadful a calamity, in human memory could not be paralleled." This passage comes courtesy of the Greek historian Thucydides in one of the well-known passages from his *History of the Peloponnesian War*. Granted, this was around 430 B.C. and the world had yet to witness, well, basically all of recorded history. But the Plague of Athens was catastrophic nonetheless, especially to Greek forces who were in the midst of a war with Sparta. Modern researchers have conjectured about the nature of the plague, with some saying it was typhoid, typhus fever, smallpox or even anthrax. But its true nature may never be known. Virtually all of the information we have comes from Thucydides, who traced its roots to Ethiopia and said a third of the city’s people perished as a result. He's as good a source as any, considering Thucydides himself also contracted it.
Antonin plague (165 – 180 DC)
PLAGUE OF JUSTINIAN (541-542)
Death Toll: 25 million
Cause: Bubonic Plague

Thought to have killed perhaps half the population of Europe, the Plague of Justinian was an outbreak of the bubonic plague that afflicted the Byzantine Empire and Mediterranean port cities, killing up to 25 million people in its year long reign of terror. Generally regarded as the first recorded incident of the Bubonic Plague, the Plague of Justinian left its mark on the world, killing up to a quarter of the population of the Eastern Mediterranean and devastating the city of Constantinople, where at its height it was killing an estimated 5,000 people per day and eventually resulting in the deaths of 40% of the city’s population.

THE BLACK DEATH (1346-1353)
Death Toll: 75 – 200 million
Cause: Bubonic Plague

From 1346 to 1353 an outbreak of the Plague ravaged Europe, Africa, and Asia, with an estimated death toll between 75 and 200 million people. Thought to have originated in Asia, the Plague most likely jumped continents via the fleas living on the rats that so frequently lived aboard merchant ships. Ports being major urban centers at the time, were the perfect breeding ground for the rats and fleas, and thus the insidious bacterium flourished, devastating three continents in its wake.
Quando la peste varcò gli oceani
BLACK DEATH: COUNTRIES THAT STILL HAVE THE PLAGUE

- Madagascar
- Peru
- China
- Congo
- Algeria
- Malawi
- India
- Western USA
- Bolivia
- Brazil
- Lybia
- Saudi Arabia
- Kenya
- Russia
- Kazakhstan
- Uzbekistan
- Turkmenistan
- Mongolia
- Burma
2. Smallpox
smallpox is dead!
WE, THE MEMBERS OF THE GLOBAL COMMISSION FOR THE CERTIFICATION OF SMALLPOX ERADICATION, CERTIFY THAT SMALLPOX HAS BEEN ERADICATED FROM THE WORLD.

NOUS, MEMBRES DE LA COMMISSION MONDIALE POUR LA CERTIFICATION D’L’ÉRADICATION DE LA VARIOLE, CERTIFIONS QUE L’ÉRADICATION DE LA VARIOLE A ÉTÉ RÉALISÉE DANS LE MONDE ENTIER.

МЫ, ЧЛЕНЫ ГЛОБАЛЬНОЙ КОМИССИИ ПО СЕРТИФИКАЦИИ ЛИКВИТАЦИИ ОСПЫ, НАСТОЯЩИМ ПОДВЕРЖДАЕМ, ЧТО ОСПЫ В МИРЕ БОЛЬШЕ НЕТ.

NOSOTROS, MIEMBROS DE LA COMISIÓN MUNDIAL PARA LA CERTIFICACIÓN DE LA ERRADICACIÓN DE LA VIRUELA, CERTIFICAMOS QUE LA VIRUELA HA SIDO ERRADICADA EN TODO EL MUNDO.

Geneva, 5 December 1977
Polio
The history of polio
TB
Fig. 1. Out-of-and-back-to-Africa. The evolutionary history of the out and back of TB to East Africa. MTBC originated in East Africa and some lineages accompanied the out and back Africa migrations of modern humans. The evolutionary modern MTBC lineages spread, and expanded with increases in human populations throughout the global regions (each dark gray dot corresponds to 1 million people) via exploration, trade, and conquest. In (A) the 3 colors represent the three evolutionary lineages. (From Hershberg R, Lipatov M, Small PM, et al. High functional diversity in Mycobacterium tuberculosis driven by genetic drift and human demography. PLoS Biol 2008;6(12):e311; with permission.)
Estimated TB Incidence rates, 2014

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.


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MALARIA
Cholera
Fig. 3.4
Countries reporting cholera deaths and imported cases, 2016

- **Imported cholera cases**
- **Deaths**
  - 1–9
  - 10–99
  - ≥100
  - Not applicable

Legend:

- **Map scale:** 0 - 3500 Kilometers
Flu

the prototype of modern pandemics
Flu Pandemic of 1918

Flu in 1918
- August
- September
- October
- November

Major Sea Routes
Railroads in 1914
4 MARZO 1918
PANDEMIA - GIORNO ZERO

PRIMA PERSONA CONTAGIATA.
KANSAS, STATI UNITI

APRILE 1918
40° GIORNO DI PANDEMIA

CONTAGIATI: 20 MILIONI
MORTI: 20.000

LUGLIO 1919
500° GIORNO DI PANDEMIA

BILANCIO GLOBALE DELLE VITTIME:
FINO A 100 MILIONI
The Spanish Flu came in Three Waves
IL VIAGGIO DELL’INFLUENZA
Flu Pandemics in the 20th Century

- 1918 Spanish Flu (H1N1)
- 1947 (a “pseudopandemic”, primarily on military bases)
- 1957 Asian Flu (H2N2)
- 1968 Hong Kong Flu (H3N2)
- 1976 Swine Flu (H1N1) (Restricted to Fort Dix but led to panic vaccination of 43,000,000; later associated with Guillain-Barré syndrome)
- 1977 Russian (“Red”) Flu (H1N1). Predominantly affected <25 year-olds. Unexplained reappearance of H1N1, absent in humans since 1957. Inadvertent release of biological weapon?
- 1997 Bird Flu (H5N1): particularly dangerous as there was some direct bird-to-human transmission and high mortality.
HIV/AIDS
LA DIFFUSIONE DEL VIRUS HIV

1950-1980
Ebola
Ebola is back — and the top White House official in charge of pandemics is gone

There's a new outbreak in the Democratic Republic of the Congo.

By Julia Belluz | juliaoftoronto | julia.belluz@voxmedia.com | May 11, 2018, 11:40am EDT
SarsCov2 / COVID
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What is Global Health

What Global Health is not

Millions die **prematurely** every year in developing countries for lack of adequate access to basic health care. **They die for causes that are very often preventable or treatable.**

Despite the convergence on the concept of health as a human right, there still exist intolerable global inequalities in accessing health and health services and in terms of life expectancy and morbidity and mortality from **communicable and non-communicable diseases.**

The persistence of inequalities in terms of health - **not only between rich and poor countries, but also between different regions in the same country** - is also a contradiction to science, given the growing geographic interdependence of the **biomedical causes and of the social determinants of health and diseases.**
ma queste sono.....medie !!!
The Haves and the Have-Nots

A Brief and Idiosyncratic History of Global Inequality

Branko Milanovic
Share of the population living in extreme poverty, 2014

Extreme poverty is defined as living with per capita household consumption below 1.90 international dollars per day (in 2011 PPP prices). International dollars are adjusted for inflation and for price differences across countries.

Source: World Bank

OurWorldInData.org/extreme-poverty • CC BY-SA
The unequal rise of «healthy» life expectancy

Healthy life expectancy (HALE) at birth, both sexes, 2016

HALE (years)
- <50.0
- 50.0–59.9
- 60.0–64.9
- 65.0–69.9
- Not applicable
- 70.0–75.0
- Data not available

Source: World Health Statistics 2016, WHO
Note: WHO Member States with a population of less than 90,000 in 2015 were not included in the analysis.
What Global Health is….not
What Global Health is... not
Poor vaccine coverage

60 percent through 2030. Dramatic improvements are needed to increase coverage and avoid leaving children behind in these settings.

The heatmap shows that even within countries that may be doing well, certain areas can be neglected. More than half of children haven’t received the necessary three doses of DTP in 26 percent of districts in sub-Saharan Africa. The priority now is replicating successful strategies in the most challenging places so that all people everywhere receive lifesaving vaccines.
Figure 1. Mean predicted deaths due to the 10 Vaccine Impact Modelling Consortium (VIMC) pathogens per 100,000 population per country for years 2000-2019 under the no vaccination and with vaccination (routine immunizations; R only) scenarios. Countries are arranged by World Health Organisation (WHO) African (AFRO), Eastern Mediterranean (EMRO), European (EURO), Pan American (PAHO), South East Asian (SEARO), and Western Pacific (WPRO) regions. The difference i.e. deaths averted between these two scenarios are shown in Table 2 and Figure 2.
Figure 2. Deaths averted per year of vaccination for hepatitis B (HepB), Haemophilus influenzae type b (Hib), human papilloma virus (HPV), Japanese encephalitis (JE), measles, Neisseria meningitides serogroup A (MenA), Streptococcus pneumoniae (PCV), rotavirus (RotA), rubella, and yellow fever (YF). The bars show the number of deaths averted (in millions) in each vaccination year. Error bars indicate 95% CI. The line shows the number of fully vaccinated persons (FVPs; in millions) achieved in each year’s vaccination activities.
What Global Health is….not
Fig. 3.4
Countries reporting cholera deaths and imported cases, 2016
What Global Health is… not

Probability of dying prematurely from non-communicable diseases

Probability of dying from the four main NCDs* between the ages of 30 and 70
2012, %

Source: WHO

*Non-communicable diseases: cardiovascular diseases, cancer, chronic respiratory diseases and diabetes
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il disastro di cui ci si preoccupava di più era la guerra nucleare.
non è più questo.
Oggi il più grande rischio di catastrofe globale
È più simile a questo, invece.
Qualcosa accadrà e saranno guai

Dalla peste a HIV: le infezioni colpiscono per colpa di globalizzazione, povertà e carestie. Ma oggi passiamo intercettarle prima che accada il peggio.

N

La peste e il HIV sono due esempi di come la globalizzazione possa avere conseguenze negative. La peste è stata una delle più grandi epidemie del passato, con milioni di morti, mentre il HIV è stato diagnosticato per la prima volta nel 1981 e ha causato un impatto globale con milioni di morti.

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WHAT WENT WRONG
Key findings – Early failings

- **The world had been warned** of an inevitable pandemic threat, but many countries were not prepared and had not learnt from the past.

- **Valuable time was lost** as the formal notification and emergency declaration procedures under the International Health Regulations were much too slow to generate the rapid and precautionary response required.

- **Too many countries took a ‘wait and see’ approach rather than enacting an aggressive containment strategy** following the declaration of the Public Health Emergency of International Concern (PHEIC).

- **Countries with delayed responses** were also characterized by a lack of coordination, inconsistent or non-existent strategies, and the devaluing of science in guiding decision-making.
PIPISTRELLI....

Lyssavirus - rabies
Marburg
Ebola
Nipah
Hendra
SARS
MERS

....... and more
SARS: Cumulative Number of Reported Probable* Cases

Total number of cases: 3169 as of 14 Apr 2003, 16:00 GMT+2

*Due to differences in the case definitions being used at a national level, probable cases are reported by all countries except the United States of America, which is reporting suspect cases under investigation.

Cumulative number of Reported Cases (From 1 November 02 to 14 April 03)

- 1
- 2 - 10
- 11 - 100
- > 1000

Type of transmission
- no local transmission
- local transmission

Data Source: World Health Organization
Map Production: Public Health Mapping Team
Communicable Diseases (CDS)
© World Health Organization, April 2003
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Key findings – Global impact

The lack of planning and gaps in social protection have resulted in the pandemic widening inequalities with a disproportionate socio-economic impact on:

- Women and vulnerable and marginalized populations, including migrants and workers in the informal sector.
- Health impacts have been compounded for people with underlying health conditions.
- Education for millions of the most disadvantaged children has been terminated early by the pandemic.
Key findings – Some successes

- Health workers have been stalwart in their efforts
- Open data and open science collaboration were central
- Vaccines were developed at unprecedented speed
- Successful national responses
- Country wealth was not a predictor of success
Recommendations

An outbreak must never become a pandemic again
Recommendations - *for immediate actions*

**High income countries** with a vaccine pipeline for adequate coverage should, alongside their scale up, **commit to provide** to the 92 low- and middle-income countries of the Gavi COVAX Advance Market Commitment,

- **at least one billion vaccine doses no later than 1 September 2021** and
- **more than two billion doses by mid-2022**, to be made available through COVAX and other coordinated mechanisms.
Recommendations - *for immediate actions*

The World Trade Organization (WTO) and WHO should convene major vaccine-producing countries and manufacturers to agree to voluntary licensing and technology transfer for COVID-19 vaccines.

G7 countries should immediately commit to provide 60% of the US$ 19 billion required for ACT-A in 2021 for vaccines, diagnostics, therapeutics, and strengthening of health systems.

Every country should apply non-pharmaceutical public health measures systematically and rigorously at the scale the epidemiological situation requires, with an explicit evidence-based strategy agreed at the highest level of government to curb COVID-19 transmission.
The current pandemic trajectory, particularly when combined with increases in seasonality in the northern hemisphere, suggests that COVID-19 is not over, and we expect substantial mortality in the months ahead.

Southeast Asia is experiencing major surges in several locations including Indonesia, Malaysia, Thailand, Cambodia and Vietnam.

In sub-Saharan Africa, the Delta variant is driving surges in many countries including Malawi, Mozambique, Zimbabwe, Nigeria and Senegal. However in some countries including Uganda, Zambia and Rwanda, the surge has already peaked.

In Europe, some of the countries with major surges are the United Kingdom, Spain, Greece, Cyprus and the Netherlands, while other countries have smaller increases or continued declines in cases.

In South Asia, Bangladesh continues to experience a huge surge while in Pakistan cases are beginning to increase and in India reported cases are staying steady.

In Mexico and the United States, cases are increasing in most states due to the Delta variant as well as the nearly complete removal of social distancing mandates and plummeting mask use.

In South America, although the death toll is still high, transmission is declining overall.

In Central America and the Caribbean, transmission is increasing in some countries, most notably Cuba, while it is decreasing in others.
Pandemics and Global Health

1. The pandemics in human history
2. The concept of Global Health
3. Covid 19: Was it predictable? What went wrong?
4. An example: the response to HIV pandemic
5. What to do: be prepared for the «next one»
The spread of HIV
AIDS: a devastating impact in just a few years

50 million deaths

50 million living with HIV
### Trends in Annual Rates of Death from Leading Causes of Death Among Persons 25-44 Years Old, USA

<table>
<thead>
<tr>
<th>Year</th>
<th>Deaths per 100,000 Population</th>
</tr>
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<tbody>
<tr>
<td>1982</td>
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<tr>
<td>1984</td>
<td></td>
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<td>1986</td>
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<td>1992</td>
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<td>1994</td>
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</tbody>
</table>

- **Unintentional injury**
- **Cancer**
- **Heart disease**
- **Suicide**
- **HIV infection**
- **Homicide**
- **Chronic liver disease**
- **Stroke**
- **Diabetes**
The arrival of protease inhibitors (1992-1995)
Antiretroviral Therapy for HIV Infection
in 1996

Recommendations of an International Panel

Charles C. J. Carpenter, MD; Margaret A. Fischl, MD; Scott M. Hammer, MD; Martin S. Hirsch, MD;
Donna M. Jacobsen; David A. Katzenein, MD; Julio S. G. Montaner, MD; Douglas D. Richman, MD;
Michael S. Saag, MD; Robert T. Schooley, MD; Melanie A. Thompson, MD; Stefano Vella, MD;
Patrick G. Yeni, MD; Paul C. Volberding, MD, for the International AIDS Society-USA

Objective.—To provide clinical recommendations for antiretroviral therapy for human immunodeficiency virus (HIV) disease with currently (mid-1996) available drugs. When to start therapy, what to start with, when to change, and what to change to were addressed.

Participants.—A 13-member panel representing international expertise in antiretroviral research and HIV patient care was selected by the International AIDS Society-USA.

Evidence.—Available clinical and basic science data, including phase 3 controlled trials, clinical endpoint data, virologic and immunologic endpoint data, interim analyses, studies of HIV pathophysiology, and expert opinions of panel members were considered. Recommendations were limited to drugs available in mid-1996.

Process.—For each question posed, 1 or more member(s) reviewed and presented available data. Recommendations were determined by group consensus (January 1996); revisions as warranted by new data were incorporated by group consensus (February-May 1996).

Conclusions.—Recent data on HIV pathogenesis, methods to determine plasma HIV RNA, clinical trial data, and availability of new drugs point to the need for new approaches to treatment. Therapy is recommended based on CD4+ cell count, plasma HIV RNA level, or clinical status. Preferred initial drug regimens include nucleoside combinations; at present protease inhibitors are probably best reserved for patients at higher progression risk. For treatment failure or drug intolerance, subsequent regimens considered include nonnucleoside reverse transcriptase inhibitors, available drug options, disease stage, underlying conditions, and concomitant medication(s). Therapy for primary (acute) infection, high-risk exposures to HIV, and maternal-to-fetal transmission are also addressed. Therapeutic approaches need to be updated as new data continue to emerge.

JAMA. 1996;276:146-154

IMPORTANT ADVANCES in understanding the biology and treatment of human immunodeficiency virus (HIV) infection have occurred during the past 18 months. As a result, new scientifically sound approaches to therapy have been developed that offer new options for persons with HIV infection. The relevant recent advances fall into 4 major categories: (1) a better understanding of the replication kinetics of HIV throughout all stages of disease; (2) the development of assays to determine the viral load in individual patients; (3) the availability of several new effective drugs; and (4) the demonstration that combination therapy is more effective than monotherapy.

In light of these advances, the recommendations of earlier state-of-the-art guidelines are no longer applicable to clinical decision making in 1996. Therefore, an international panel of clinical investigators experienced in HIV patient care was selected and convened by the International AIDS Society-USA to develop current recommendations for the clinical management of HIV-infected individuals.

The panel addressed 4 central questions about antiretroviral therapy: when to initiate therapy, which types of drugs to use, when to change therapy, and which types of drugs to use when a change in therapy is indicated. In addition, the treatment of primary HIV infection, prevention of vertical transmission, and postexposure prophylaxis were addressed. The recommendations are not based solely on the results of controlled clinical trials with well-defined clinical endpoints. Developing clinical guidelines in the HIV field at this time requires an approach firmly anchored in data from controlled, double-blind clinical trials when available, but must also include information from trials in progress and available virologic and immunologic endpoint data, as well as extrapolations from studies of the pathophysiology of HIV infection. Clinical decisions must be made for best use of up to 8 available antiretroviral drugs, at a time when long-term studies with clinical endpoints have been completed for only a few possible combinations.

The recommendations herein reflect the panel's agreement on the importance of plasma HIV RNA measurements for predicting risk of clinical progression as well as the recent demonstration from clinical trials of combination therapies that reductions in plasma HIV RNA
The battle for access to treatment and care for HIV in resource limited setting
Per Stefano Vella la prospettiva di cura in un cocktail di farmaci dai costi elevatissimi

Ma la terapia sarà solo per pochi?

GIANCARLO ANSELMI

È nata bella, finita brutta, ma è ancora bella. Tale è la duplice valutazione di Stefano Vella, un ricercatore che svolge attività di ricerca e assistenza in medicina interna e infettologia all’Università degli Studi di Bari. «La prospettiva di cura in un cocktail di farmaci da effettuare tutti i giorni per tutta la vita è stata presentata in maniera difamante.»

Dopo due anni di studio e ricerca, Vella ha riscritto la storia della terapia antiretrovirale, che è diventata un vero e proprio cocktail di farmaci, ciascuno dei quali ha un ruolo specifico nella lotta contro l’HIV.

«La terapia antiretrovirale è divenuta un vero e proprio cocktail di farmaci, ciascuno dei quali ha un ruolo specifico nella lotta contro l’HIV.»

Vella ha analizzato l’andamento della malattia e ha evidenziato come la terapia antiretrovirale abbia permesso di arrestare l’avanzamento della malattia, di ridurre la trasmissione virale e di migliorare la qualità della vita dei pazienti.

«La terapia antiretrovirale è divenuta un vero e proprio cocktail di farmaci, ciascuno dei quali ha un ruolo specifico nella lotta contro l’HIV.»

Vella ha anche evidenziato che la terapia antiretrovirale non è solo un giornale di cura, ma anche una strategia per la prevenzione della trasmissione virale.

«La terapia antiretrovirale non è solo un giornale di cura, ma anche una strategia per la prevenzione della trasmissione virale.»

Vella ha concluso dicendo che la terapia antiretrovirale è un importante strumento per combattere l’HIV e per prevenire la sua diffusione in futuro.

«La terapia antiretrovirale è un importante strumento per combattere l’HIV e per prevenire la sua diffusione in futuro.»
Millions were dying for a treatable disease
We had two choices:

accept it

or........
fight!
2001 – Global Commitment
Deaths from HIV/AIDS by age group, World
Total number of annual deaths from HIV/AIDS, categorised by broad age groups.

- 1.5 million deaths
- 1 million deaths
- 500,000 deaths
- 0 deaths

Year:
- 1990
- 1995
- 2000
- 2005
- 2010
- 2015
- 2017

Source: IHME, Global Burden of Disease (GBD)

Change country Relative

Source: World Bank life expectancy data
“Each member has the right to grant compulsory licences and the freedom to determine the grounds upon which such licences are granted” and “to determine what constitutes a national emergency or other circumstances of extreme urgency”.

Public health crises include “those relating to HIV/AIDS, tuberculosis, malaria and other epidemics” and “other circumstances of extreme urgency”.
HIV DRUG PRICING INNOVATION

Box 4: Access to medicines and the Doha Declaration on TRIPS and Public Health

Measuring access to medicines is a complex task, but price is one key factor among others. The Doha Declaration on TRIPS and Public Health recognized concerns about effects on prices while noting the need for innovation. Since the Declaration was adopted in 2001, prices for many treatments have fallen significantly, in part due to generic competition and tiered pricing schemes (see graph below). Surveys also show a marked increase in the use of TRIPS flexibilities to promote access to medicines.

Falling prices of first-line combinations of some first-line anti-retroviral therapies for HIV/AIDS since 2000

Access to medicines: lessons from the HIV response

Just two decades ago, HIV/AIDS treatments were prohibitively expensive and accessible in only a few affluent countries. But remarkable reductions in costs have enabled treatment expansion that has reduced mortality and transmission. Today, first-line HIV drugs cost less than US$100 per person per year, a 99% reduction from more than $10,000 in 2000. The number of people receiving HIV treatment doubled in just 5 years, from 9 million in 2011 to more than 18 million today.¹

In a world facing growing inequalities, the HIV response has lessons for low and middle-income countries (LMIC)—but also for high-income countries—on access to care and treatment for communicable diseases and for non-communicable chronic diseases, a global pandemic that dwarfs the HIV epidemic in scale.² The transformative power of the HIV response was underpinned by moral rather than technical arguments. A unique coalition of activists, scientists, celebrities, and religious and community leaders from all over the world argued that no one should be denied life-saving treatment because of area of residence or income. The moral imperative was operationalised by activism for more urgent drug discovery, regulatory approval, and voluntary and compulsory licensing, followed by shifts towards large-scale generic production. Economies of scale underpinned a drive towards more efficient, cheaper production, and drove prices down. Major donors such as the Global Fund to Fight AIDS, Tuberculosis, and Malaria and the US President’s Emergency Plan for AIDS Relief bought generic drugs. The Clinton Health Access Initiative negotiated price-volume discounts.

1. HIV drew together - with the common objective of fighting HIV health inequality - a multisectoral group of dedicated people

2. It recognized the **supranational** character of problems of disease and their amelioration, and the fact that no individual country can adequately address diseases in the face of the movement of people, trade, microbes, and risks.

3. It mobilized **innovative drug production, pricing and procurement**, both from generic and proprietary manufacturers
4. it focused on deeper knowledge of the burden of disease to identify key health disparities and develop strategies for their reduction.

5. it recognized that people affected by disease have a crucial role in the discovery and advocacy of new modes of treatment and prevention and their equitable access

6. It based the action on ethical and moral values that recognize that equity and rights are central to the larger goals of preventing and treating diseases worldwide.

7. It introduced the concept of health as a common good
The concept of “public good”

non exclusive: anyone can use them
non competitive: their use will not limit others to use them
The concept of “public good”

Progress of medicine and essential medicines (including vaccines) shall be considered as global public goods and be accessible to all human beings living on our planet.
Tracking Coronavirus Vaccinations Around the World

By Josh Holder  Updated July 15, 2021

Total doses administered
3.54 billion
3
2.5
2
1.5
1
0.5
Dec. 2
July 14

More than 3.54 billion vaccine doses have been administered worldwide, equal to 46 doses for every 100 people. There is already a stark gap between vaccination programs in different countries as this map shows.
COVID-19 vaccine doses administered per 100 people

Total number of vaccination doses administered per 100 people in the total population. This is counted as a single dose, and may not equal the total number of people vaccinated, depending on the specific dose regime (e.g. people receive multiple doses).
Pandemics and Global Health

1. The pandemics in human history
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4. An example of pandemic response: the HIV pandemic
5. What to do: be prepared for the «next one»
What can we do?
Be Prepared !!
Emerging Infectious Diseases: a complex One Health system
1. CONSIDER THE GROWTH OF THE HUMAN POPULATION

By 2100, Lagos and Kinshasa will rise from their current rankings to become the top two most-populated cities.

Mexico City has seen immense demographic migration into its urban center, and further urbanization will propel its megacity status in 2035.

Jakarta is projected to be the most populated city in 2035, but if Banjar becomes Indonesia's capital as planned, this may stunt Jakarta's growth.
2. and, where we live.....
3. We are not alone.
The Global Virome Project

Expanding viral discovery can improve mitigation

By Dennis Carroll, Peter Daszak, Nathan D. Wolfe, George F. Gao, Carlos M. Moredí, Subhash Merzaria, Arid Palleri Melkonian, Oyewole Tomori, Joanna A. K. Maier

Outbreaks of novel and deadly viruses highlight global vulnerability to emerging diseases, with many having massive health and economic impacts. Our adaptive toolkit—based largely on vaccines and therapeutics—is often ineffective because our current countermeasures development and implementation are not fast enough to respond to the speed of novel viral emergence and spread. Following each outbreak, the public health community repeatedly calls for more rapid reporting and ongoing research to better protect against the next epidemic. Our ability to avert future disease emergence is undermined by our poor understanding of the diversity and ecology of viral threats, and of the drivers of their emergence. We describe a Global Virome Project (GVP) aimed to accelerate discovery of all known virome families and the viruses that contain them. The GVP’s emphasis on large-scale sampling and viral discovery, however, has yet to be realized. Analysis of data from existing surveillance programs suggests that we estimate the number of samples required to find the number of samples required to find the number of samples required to find the number of samples required to find the number of samples required to find the number of samples required to find the number of samples required to find

Other previous studies had begun to conduct targeted viral discovery in wildlife (9), and develop mitigation strategies for the emergence of avian flu, for example. However, the USAID Emerging Pandemic Threats (EPT) PREDICT project is the first global-scale coordinated program designed to conduct viral discovery in wildlife reservoir hosts and characterize ecological and socioeconomic factors that drive their risk of spillover, to mitigate their emergence in people (10). Working with local partners and governments, wildlife and domestic animals and at-risk human populations in geographic hotspots of disease emergence (2) are sampled, and viral discovery conducted. A strategy to identify which novel viruses are most at risk of spillover has been developed (11), and further work is conducted on these to characterize them prior to, or in the early stages of, spillover. Metadata on the ecology of wildlife-livestock-human transmission interfaces, and on human behavioral patterns in communities, are concurrently analyzed so that strategies to reduce spillover can be developed (supplementary text). To date, EPT PREDICT has discovered more than 1000 viruses from viral families that contain zoonoses, including viruses involved in recent outbreaks (2), and others of ongoing and emerging public health concern (12). The focus of EPT PREDICT on capacity building, infrastructure support, training, and epidemiological analysis differs substantially from the GVP’s emphasis on large-scale sampling and viral discovery. However, to discover the bulk of the projected remaining 167 million unknown viruses in animal reservoirs and characterize the majority of 632,000 to 872,000 of these unknown viruses have zoonotic potential (supplementary text). We have no readily available technological countermeasures to these as-yet-undiscovered viruses. Furthermore, the rate of zoonotic viral spillover into people is accelerating, mirroring the expansion of our global footprint and travel networks (2), leading to a nonlinear rise in pandemic risk and an exponential growth in their economic impacts (8).

PROMISING PILOT, CHALLENGING SCALE

Since 2009, the U.S. Agency for International Development (USAID) has conducted a large-scale pilot project, spanning more than 35 countries over 8 years at a cost of around $20 million, to evaluate the feasibility of preemptively mitigating pandemic threats.
111 viral families have been discovered globally to date.

Of these 111 viral families, the GVP will target 25 containing viruses known to infect (or to have substantial risk of infecting) people.

In these 25 families, an estimated 1.67 million unknown viruses exist in mammals and birds—hosts that represent 99% of the risk for viral emergence.

Of these 1.67 million viruses, an estimated 631,000 to 827,000 likely have the capacity to infect people.
4. The one health approach

Each year around the world, it is estimated that zoonoses (diseases shared between people and animals) cause 2.5 billion cases of sickness and 2.7 million deaths.
Sustainable Development must account for pandemic risk

Di Marco, Baker, Daszak, De Barro, Eskew, Godde et al. (2020) PNAS, 117:3888-3892
Risk of emerging infectious disease (zoonotic)

Predicted risk of emerging infectious disease events

One Health Preparedness: **Prevent** → **Detect** → **Respond** → **Recover**

Invest in multidisciplinary environmental science to predict and forecast risk → use predictions to inform socio-economic planning

Prevent environmental/biodiversity loss in areas of high EID risk; regulate both wildlife AND livestock trade and farming

Establish an international One Health Fund with a strong biodiversity component and a science-policy mandate
The Challenge

The COVID-19 pandemic, catastrophic as it is, is not a one-off event.

We must **plan for an endemic COVID-19 as well as the future risk** of more frequent and severe pandemics.

Vaccinating a majority of the population in all countries is the most urgent priority of the international community today.

Preventing future pandemics is also a race against time, and has to be a central obligation of national and global governance.

We must ensure that the world is better equipped to detect, prevent and counter another major outbreak. It could be worse than COVID-19.
Plugging Four Major Global Gaps

1. Global surveillance and R&D: to prevent and detect emerging infectious diseases

2. Resilient national systems: to strengthen a critical foundation for global pandemic prevention, preparedness and response (PPR)

3. Supply capacity for medical countermeasures: to radically shorten the response time in a pandemic

4. Global governance: to ensure that the system is tightly coordinated, properly funded and with clear accountability for outcomes
Financing Pandemic PPR: the Basic Approach

Pandemic PPR is fundamentally not about aid, but investment in global public goods for which all nations benefit.

• Pandemic PPR should be anchored in enhanced multilateral funding.
  • Prevention and Preparedness require predictable and sustainable funding
  • IFIs’ financing of response must be scaled up and enable timely access
  • Discretionary bilateral funding as an important complement and a catalyst for action
  • All funding flows must show clear accountability for outcomes
Recommendations – *for bold and vital reforms*

1. Elevate leadership to prepare for and respond to global health threats to the highest levels to ensure just, accountable and multisectoral action
   
   - Establish a high-level *Global Health Threats Council* led by Heads of State and Government.
Recommendations – *for bold and vital reforms*

2. **Strengthen the independence, authority and financing of WHO**

   - *Focus WHO’s mandate on normative, policy, and technical guidance*; empower WHO to take a leading, convening, and coordinating role in operational aspects of an emergency response.

   - Establish the *financial independence of WHO* based on fully unearmarked resources, and on an increase in Member States’ fees to two-thirds of the WHO base Programme Budget.

   - Strengthen the authority and independence of the Director-General, including by having a *single term of office of seven years with no option for re-election*.

   - *Resource and equip WHO Country Offices* sufficiently to respond to technical requests from national governments to support pandemic preparedness and response, including support to build resilient equitable and accessible health systems and universal health coverage.
3. Invest in preparedness now to prevent the next crisis

- *All national governments to update their national preparedness plans* against targets and benchmarks to be set by WHO within six months, ensuring that there are appropriate and relevant skills, logistics and funding available to cope with future health crises.

- *WHO to formalize universal periodic peer reviews* as a means of accountability and learning between countries.

- The *IMF should routinely include a pandemic preparedness assessment*, including an evaluation of economic policy response plans, as part of the *Article IV consultation* with member countries.
4. A new agile and rapid surveillance information and alert system

- WHO to establish a new global system for surveillance, based on full transparency by all parties, using state-of-the-art digital tools.

- The World Health Assembly to give WHO both the explicit authority to publish information about outbreaks with pandemic potential immediately without requiring the prior approval of national governments, and the power to investigate pathogens with pandemic potential with short-notice access to relevant sites, provision of samples, and standing multi-entry visas for international epidemic experts to outbreak locations.

- Future declarations of a public health emergency of international concern should be based on the precautionary principle where warranted, as in the case of respiratory pathogens, and on clear, objective, and published criteria.
Recommendations – *for bold and vital reforms*

5. Establish a pre-negotiated platform for tools and supplies
   - *Transform the current ACT-A into a truly global end-to-end platform* to deliver the global public goods of vaccines, therapeutics, diagnostics, and essential supplies.
   - *Secure technology transfer and commitment to voluntary licensing* in all agreements where public funding has been invested in research and development.
   - *Establish stronger regional capacities for manufacturing, regulation, and procurement* of needed tools for equitable and effective access to vaccines, therapeutics, diagnostics, and essential supplies, as well as for clinical trials.
6. Raise new international financing for pandemic preparedness and response

- **Create an International Pandemic Financing Facility** to raise additional reliable funding for pandemic preparedness, and for rapid surge financing for response, with the capacity to mobilize long term (10-15 year) contributions of approximately US$5-10 billion per annum to finance preparedness and the ability to disburse up to US$50-100 billion at short notice in the event of a crisis.

- There should be an ability-to-pay formula adopted whereby larger and wealthier economies will pay the most, preferably from non-ODA budget lines and additional to established ODA budget levels.

- The **Global Health Threats Council will have the task of allocating and monitoring funding** from this instrument.
Thank you for lessoning...

stefano.vella@unicatt.it
stefano.vella08@gmail.com