It is all about Pandemic(s) ?

- New insights in Mortality and Longevity -

Achim Regenauer, Partner Re

About the speaker

Dr. Achim Regenauer - Chief Medical Officer, PartnerRe

1990-2016 Munich Re: Chief Medical Officer

Since 2017 PartnerRe: Chief Medical Officer

Specialities Medicine: Genomics, Oncology, Epidemiology, Infections

Specialities Insurance: Underwriting, Products, Claims, Manuals, Hot & Emerging Topics

PartnerRe

Why this presentation?

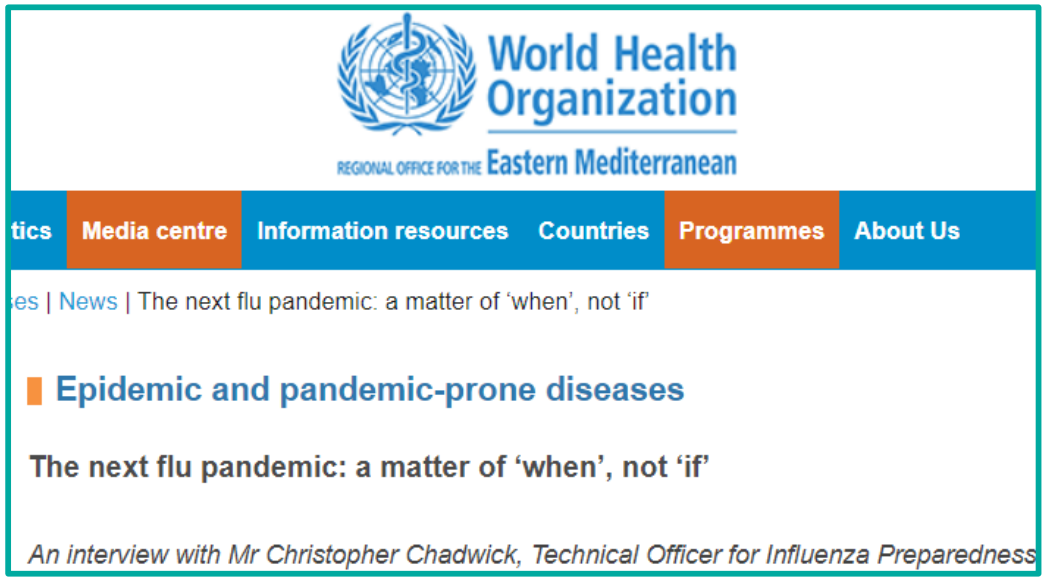
We do not want to accept unpleasant news

1. WHO: there will be new **pandemics**: not if, but when!

   Since 16th century, influenza pandemics at intervals btw. 10-50 years

2. **Antimicrobial resistance (AMR)** is an increasingly serious threat to global public health

What does one have to do with the other?



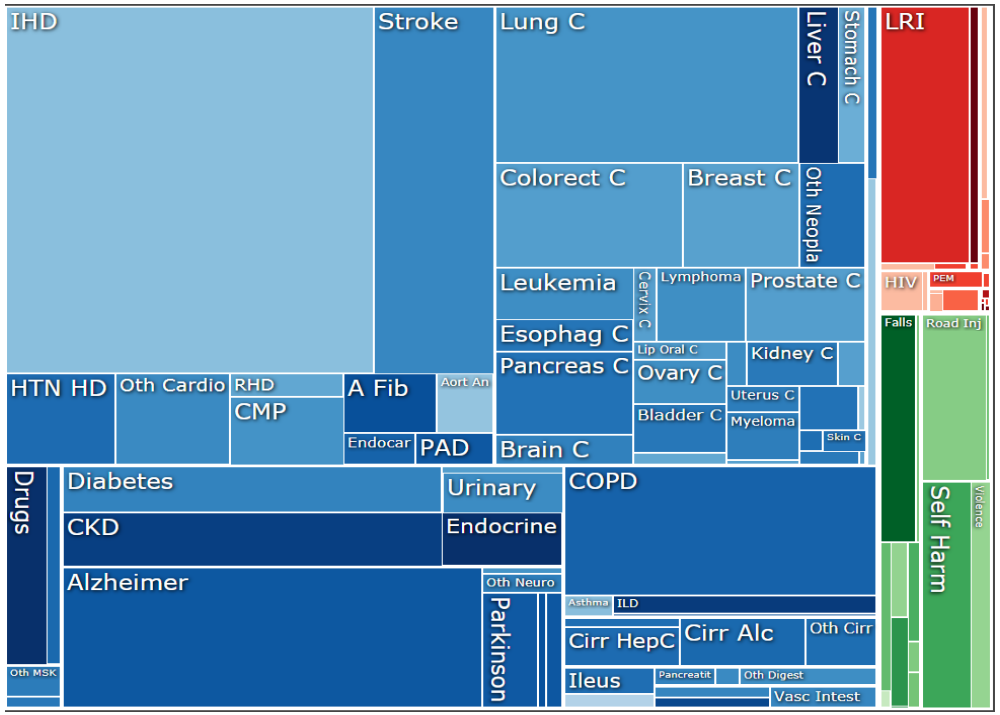
Source: http://www.emro.who.int/pandemic-epidemic-diseases/news

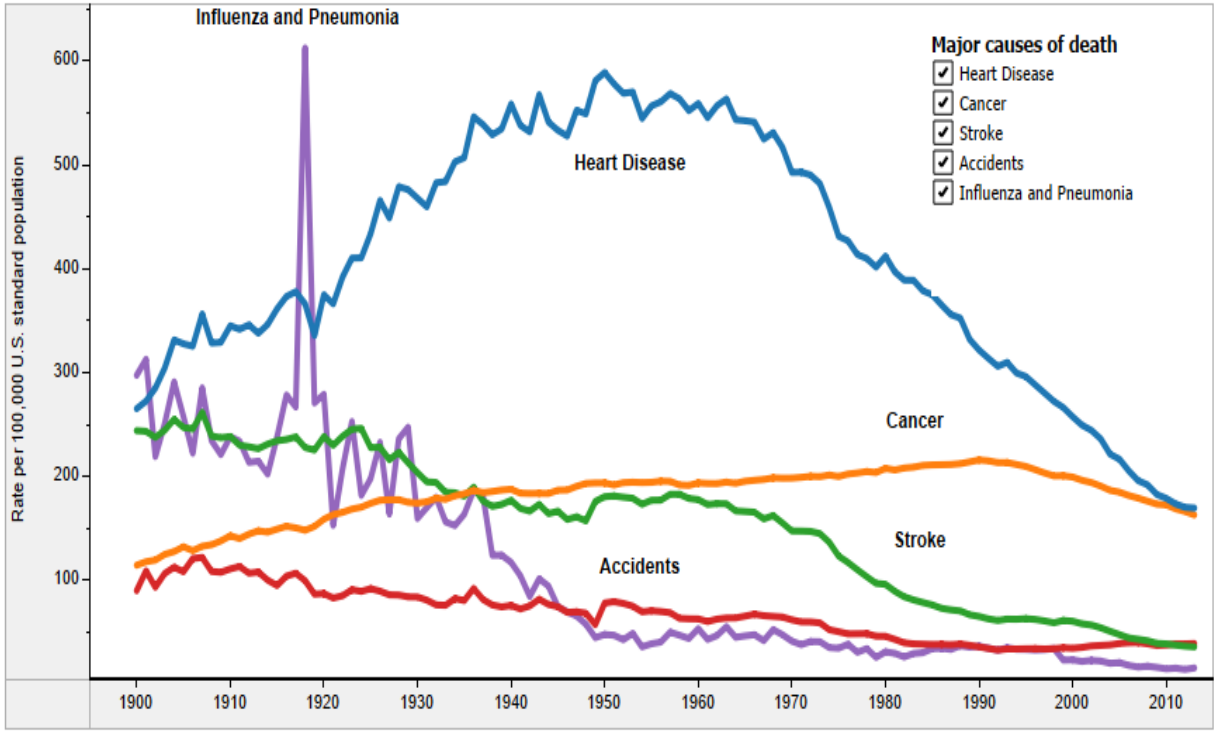
Source: https://www.who.int/news-room/detail/29-04-2019

aoc 2020

Causes of death – here USA

Infections are negligible?





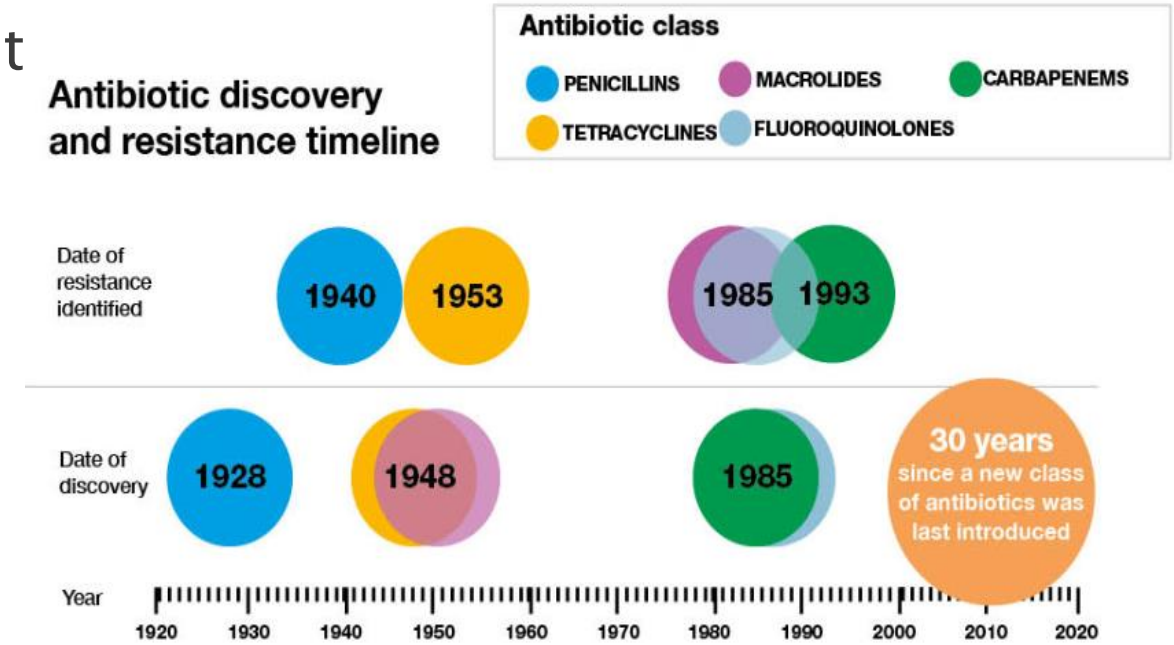
Source: https://vizhub.healthdata.org/gbd-compare/

Infectious disease are loosing importance re Mortality improvements

Developing of Antibiotic Resistance

2.

- Natural phenomenon (≈ Darwin's 'natural selection').
- Bacterial infections grow more resistant to antibiotics
- AMR nearly all antibiotics



Source https://www1.compareyourcountry.org/antimicrobial-resistance/en/1/all/default

Every 100 years a big pandemic?

What is different now?

1.

1919

Source:Wikipedia

Pandemic

- Used in context of influenza

2019

Source:https://en.wikipedia.org/wiki/COVID-19_pandemic

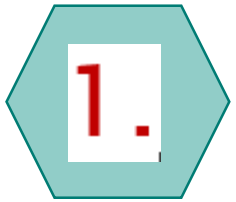
Pandemics during the last 100 years

21st century: a second player joins the recurrent pandemics

Source: https://www.who.int/emergencies/diseases/managing-epidemics-interactive.pdf

Do current pandemic models take this into account ?

Characteristics of SARS & Influenza pandemic



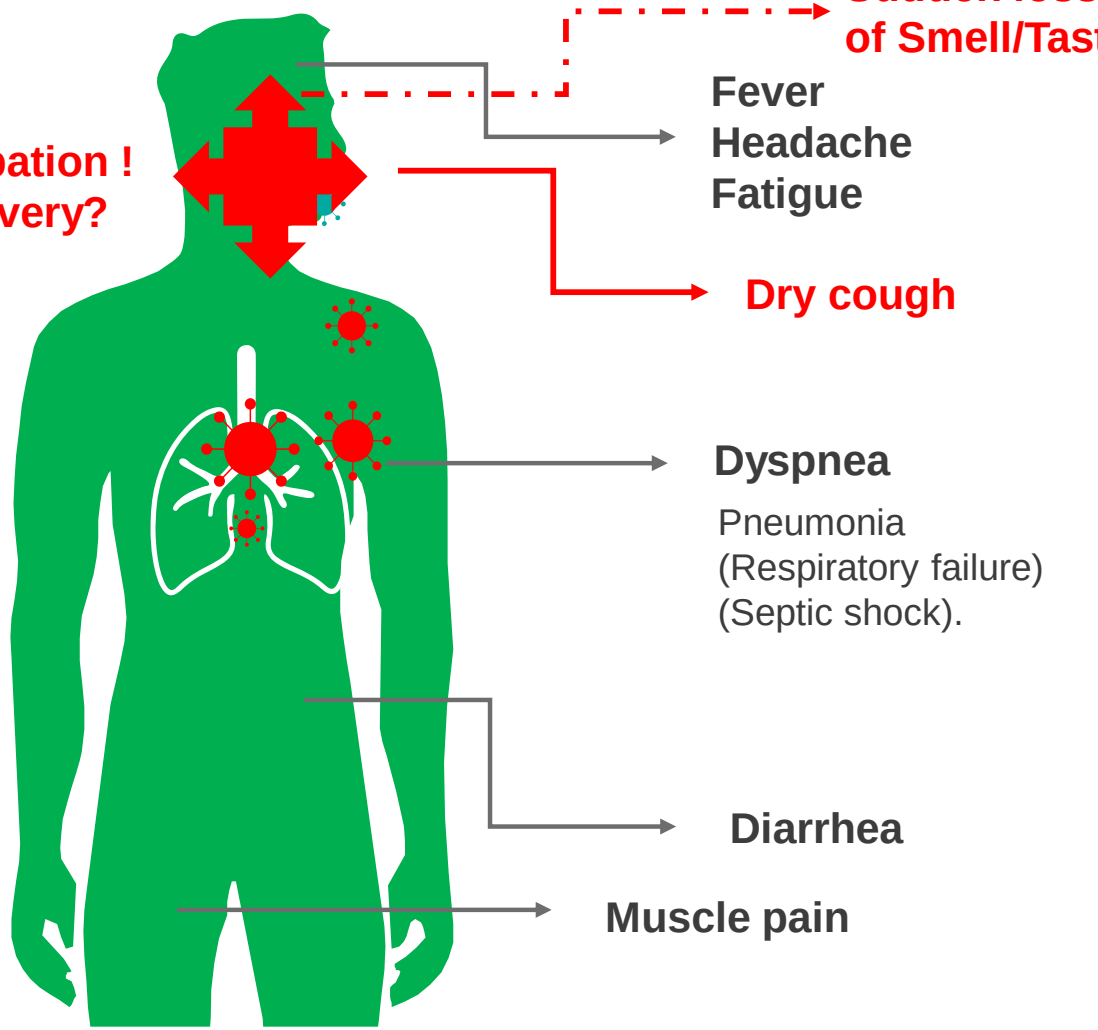
What is different now?

	SARS-CoV2	SARS-CoV1	Spanish Flu	Swine flu	How efficacious is SARS-CoV2
Year	2019 & 2020 & ??	2003	1918 &1919	2009 (1957,1968)	
Transmission pattern (Ro)	Clustering 2.5	? 2.4	Homogeneous 2	Homogeneous 1.7	Highest
Incubation (d)	4-12	2-7	?	2	Longer hidden
Onset to max. infectivity (d)	0	5-7	2	2	Immediate – harder to contain
Proportion Asymptomatic/ mild	> 80%	Low	High	High	Facilitates unde-tected transm.
Immunity	None	None	None	Partial	
Mortality	0.5-58/100,000 pop. Total: 0,7 Million	CFR 9% Total >8,000 cases	2.5% population Total: 50 -100 Million	0.04% population Total: 151,700 - 575,400 cases	SARS-CoV-2 ranking 2nd – in progress!
Proportion death of young (<65)	0.6-2.8%	?	95%	80%	

Mid-term: Not only Influenza but also Corona pandemics to be expected

COVID-19: Medical Features

Unfortunately unspecific!



Mild course > 80%,

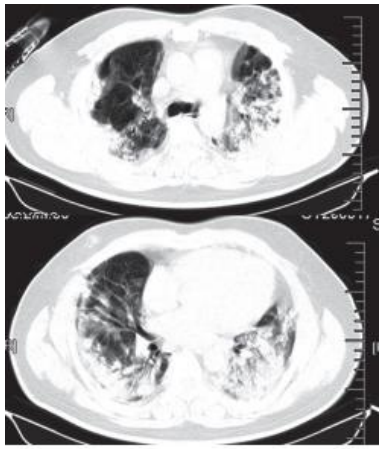
Moderate course ≈ 15%,

Severe course ≈ 5%

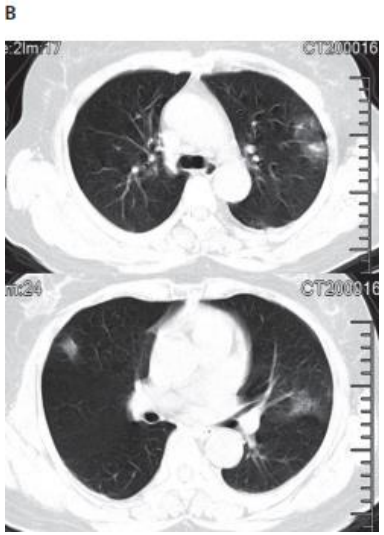
Treatment of COVID-19

By now supportive care for Sepsis and Acute Respiratory Distress Syndrome only

- Oxygen
- Sedation
- Artificial respiration (Bottleneck!)
- Dexamethason
- Remdesivir
- Antibiotics: presumptive/confirmed bacterial co-infection



Antiviral drugs??



Antibiotics ??

Source: Lancet 2020; 395: 497–506

Treatment of COVID-19

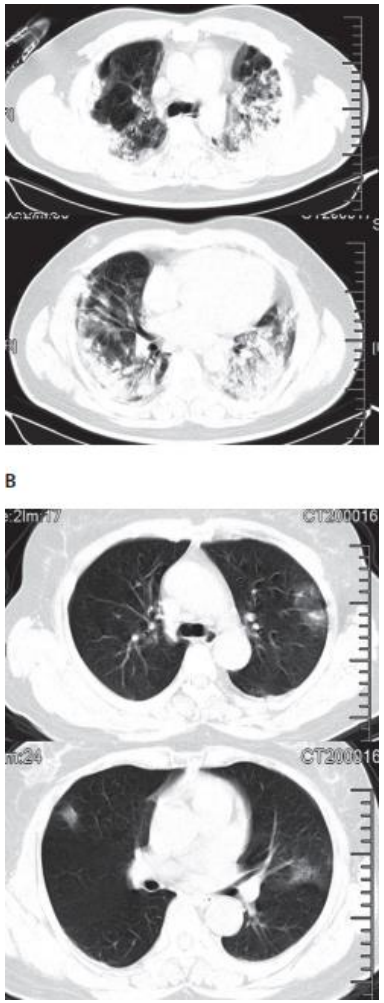
Paucity of data

9 studies:

- 8% cases of bacterial/fungal co-infection
- 72-99% of COVID-19 cases antibacterial therapy
- Broad spectrum antibiotics, quinolone, cephalosporins, carbapenems

Source: Clin. Infect. Dis Rawson, T. M. et al. 2020

1. AMR spurred through overuse
2. ICUs are epicentres for AMR development



Antiviral drugs??

Antibiotics ??

Source: Lancet 2020; 395: 497–506

COVID-19 death and Antibiotic Resistance

2.

SARS-CoV-1: rate of methicillin-resistant *Staphylococcus aureus* (MRSA)
3.53% (–pre SARS period) → 25.3% (SARS period) ⇑

	Number of known cases	Known cases per 100 000 population	Deaths	Deaths per 100 000 population
USA	1382362	421	83819	26
South Korea	11037	21	262	0·5
Spain	230183	490	27459	58
Italy (Lombardy)	84119	841	5374	54
Germany	173772	209	7881	9
UK	236715	353	33998	51
South Africa	13524	23	247	0·4

Data taken from the WHO situation report on May 17, 2020.[4] Population data from Eurostat.

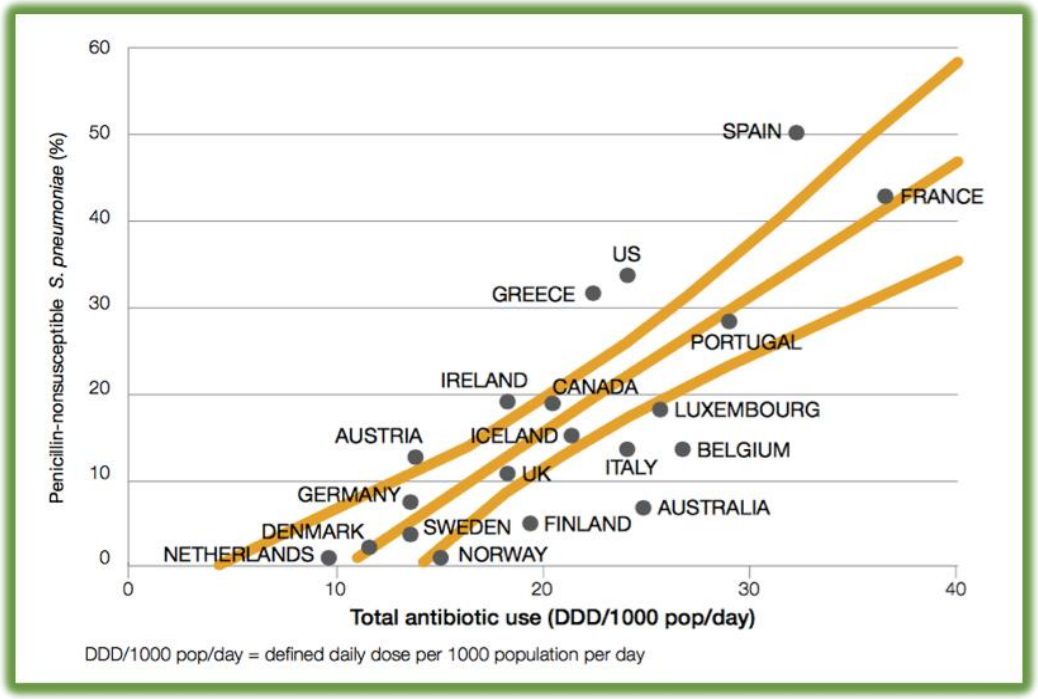
***Table 4*: Cumulated prevalence, mortality, and diagnostic tests per country**

Source:Lancet Infect Dis 2020 July 3

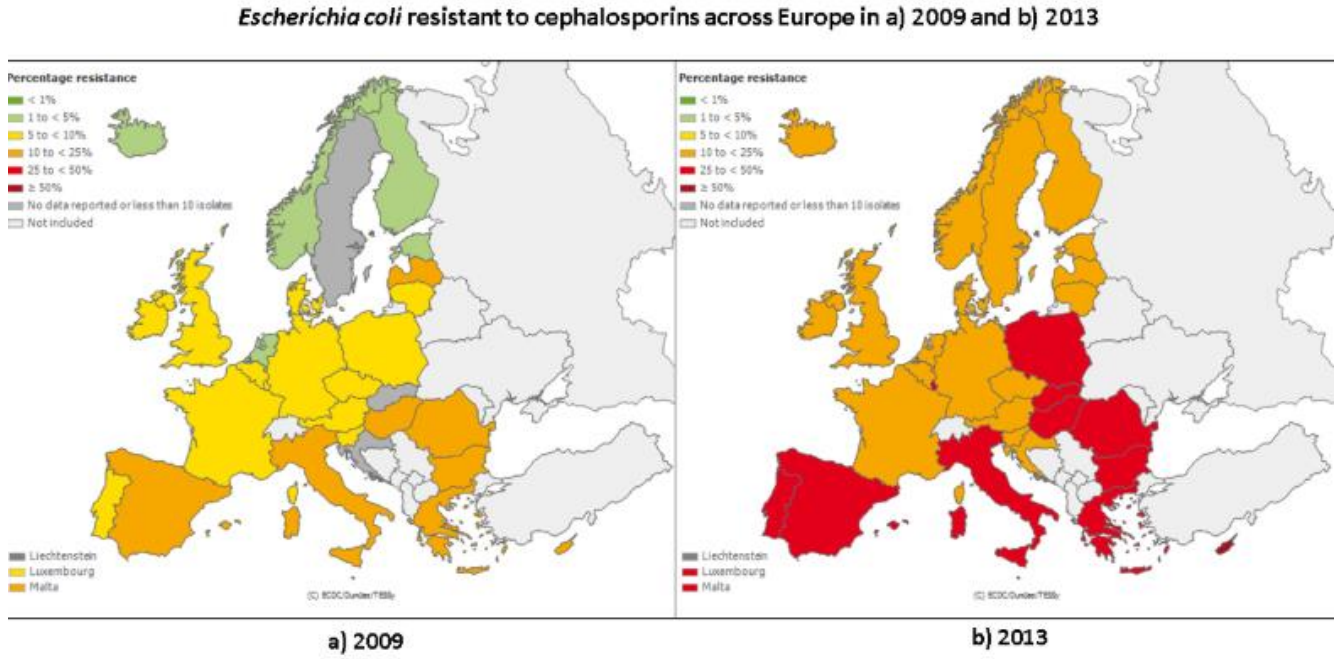
Antibiotic use and AMR

Here: Consumption of penicillin and E.coli/cephalosporins

2.



Overuse drives evolution of AMR



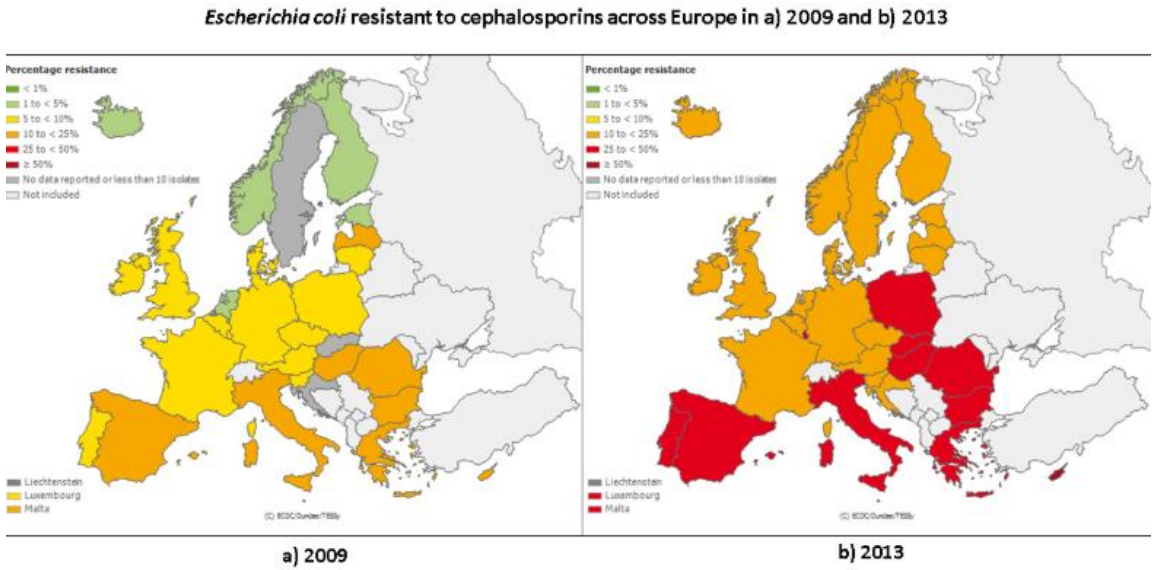
Source: https://publichealthmatters.blog.gov.uk/2015/10/23

Source: https://wwwnc.cdc.gov/eid/article/10/3/pdfs/03-0252.pdf

AMR and COVID-19

Here: E.coli/cephalosporins and CFR COVID-19

2.



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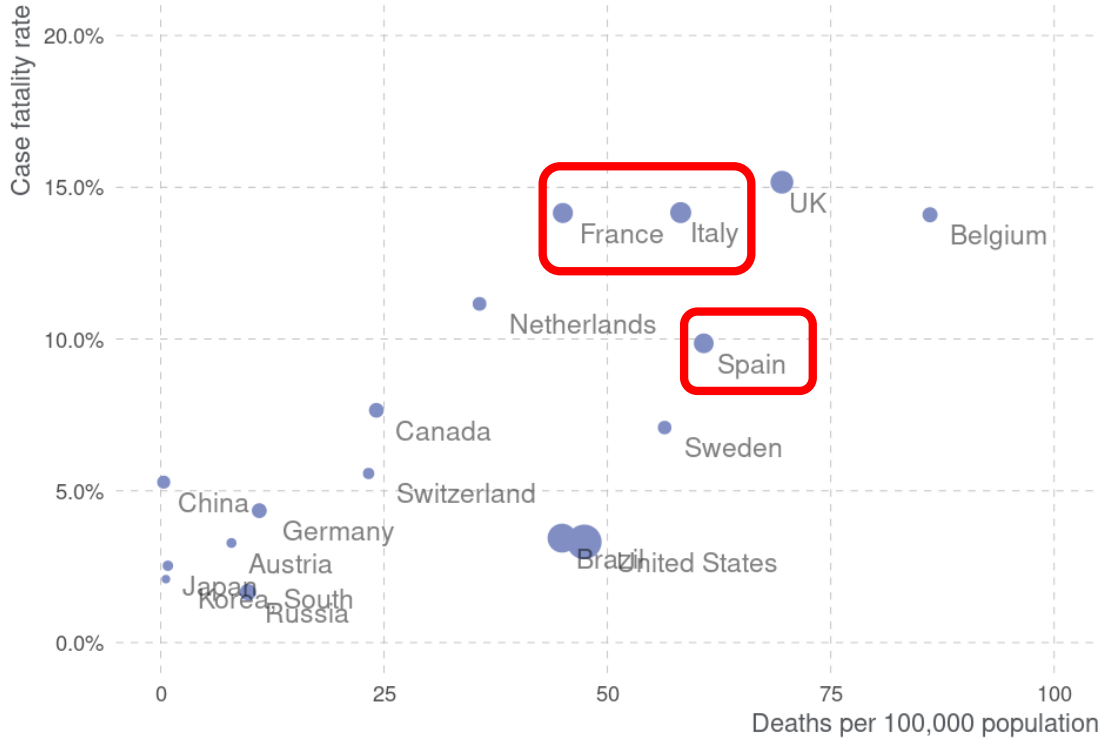
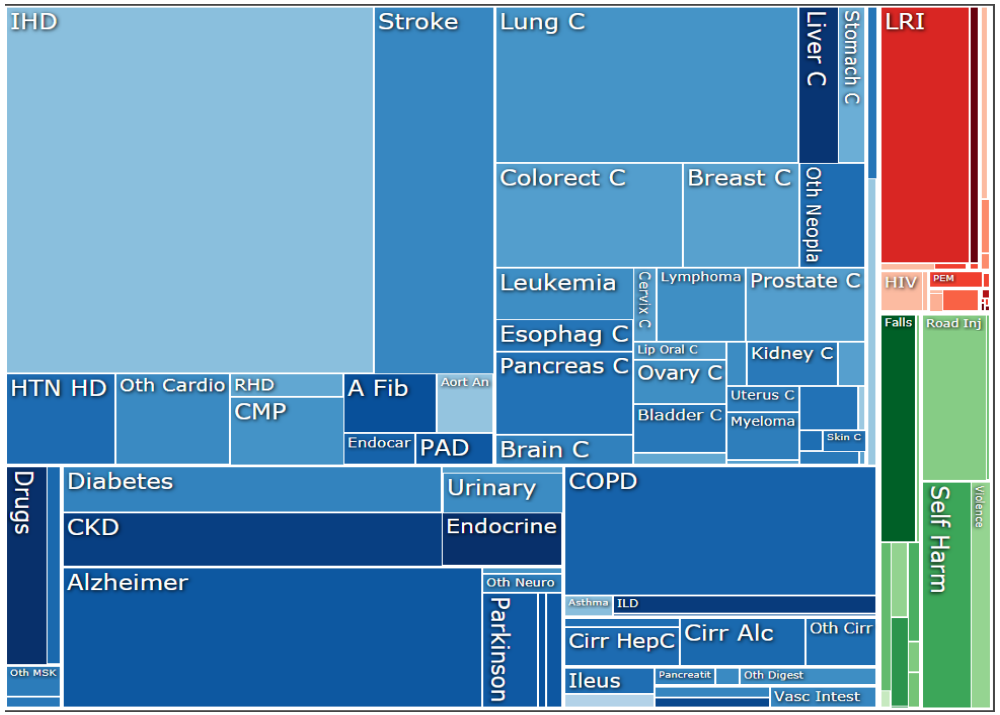


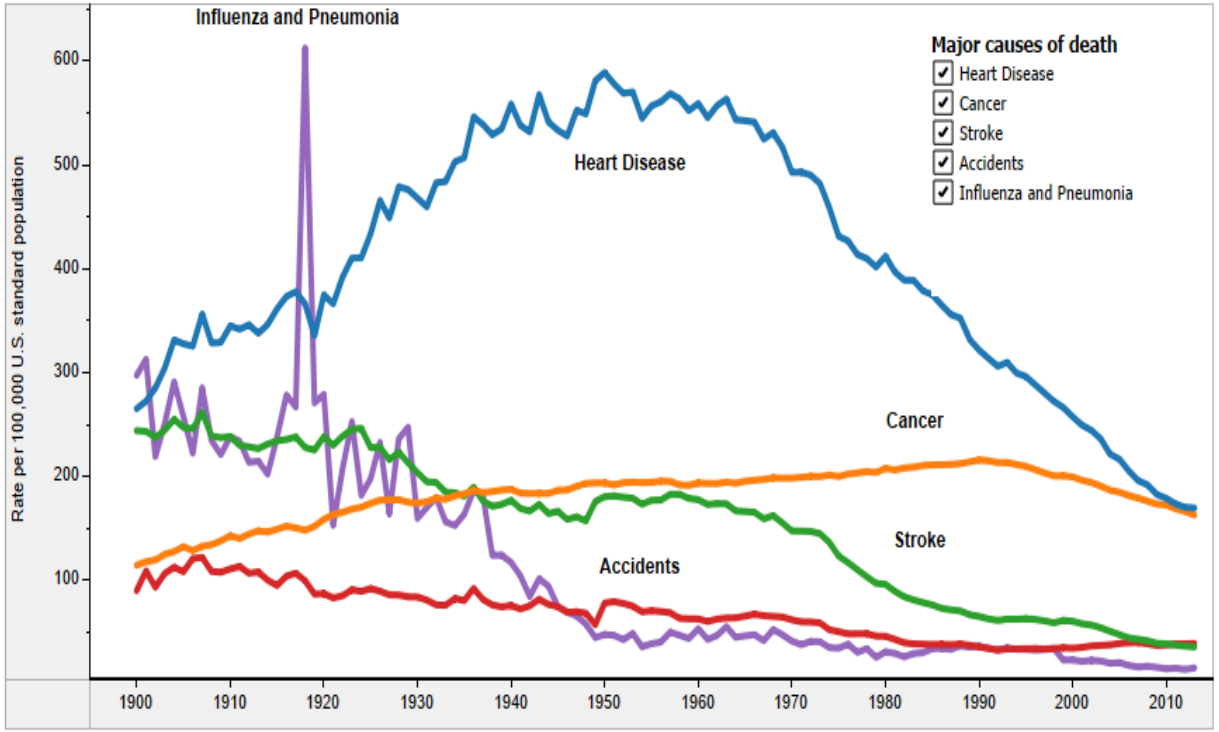
Source: PartnerRe Research

1. **SARS-CoV-2 Mortality partially due to AMR**
2. **SARS-CoV2 pandemic adds more fuel to the fire of AMR**

Resurgence of infections? Much more…..

With implications for mortality and longevity





Source: https://vizhub.healthdata.org/gbd-compare/

Infectious disease are gaining importance re Mortality shocks + Mortality improvements

Developing of Antibiotic Resistance

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- Natural phenomenon (≈ Darwin's 'natural selection').
- Bacterial infections grow more resistant to antibiotics
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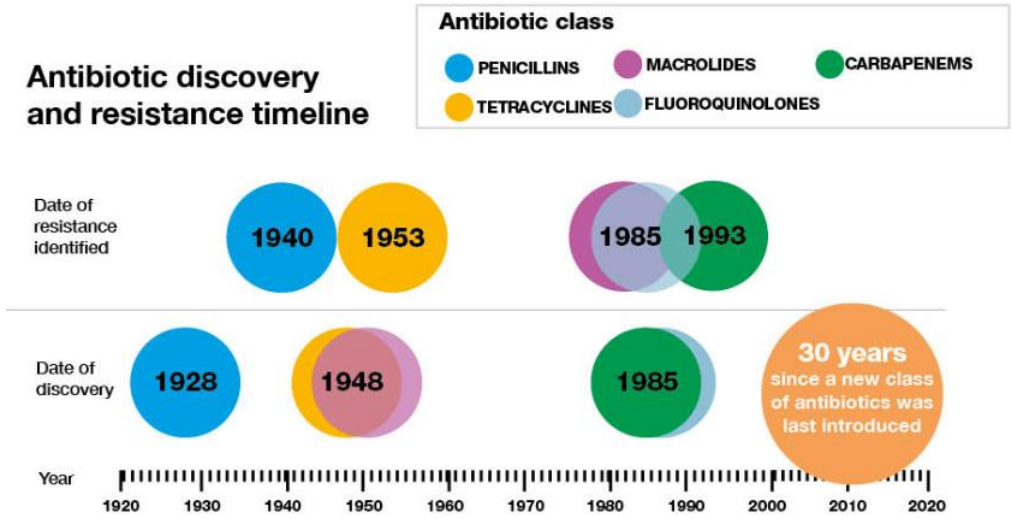
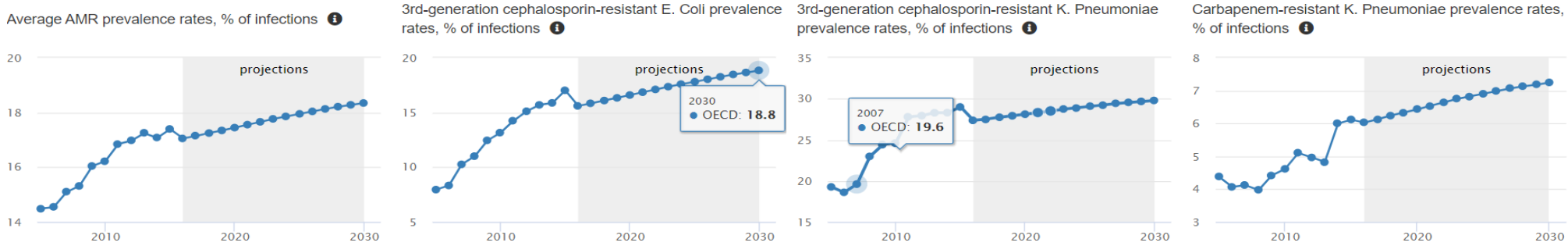
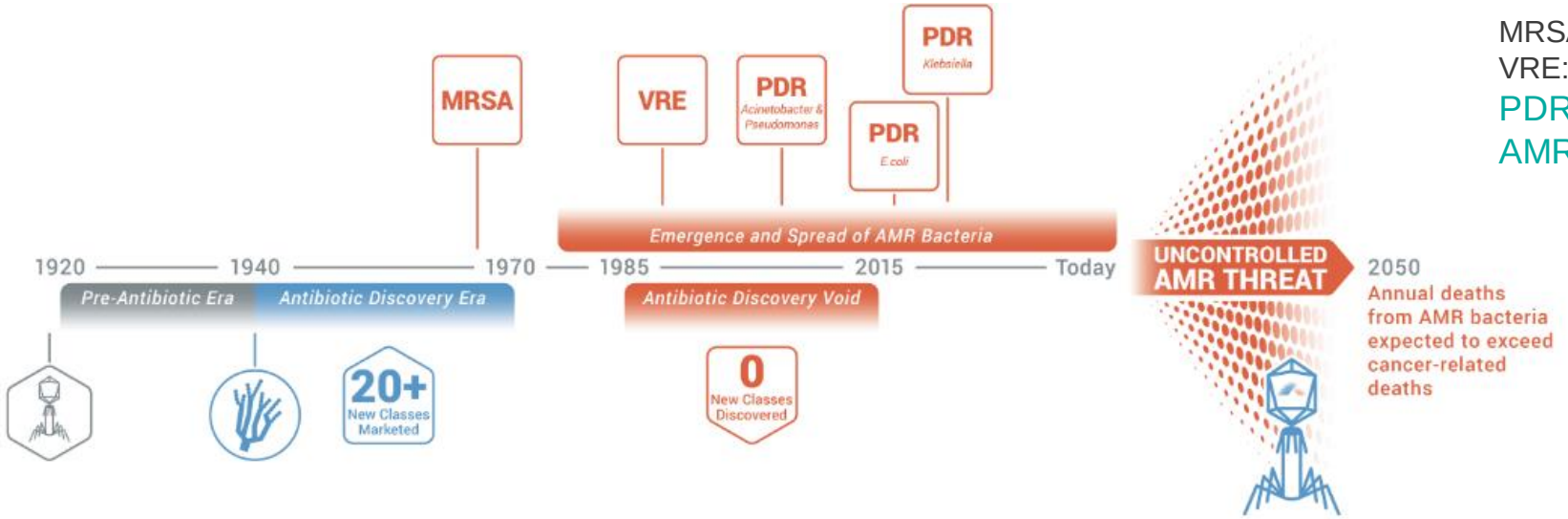




Source https://www.gov.uk/government/publications/health-matters-antimicrobial-resistance/health-matters-antimicrobial-resistance

Source https://www1.compareyourcountry.org/antimicrobial-resistance/en/1/all/default

Developing of Antibiotic Resistance



MRSA: methicillin-resistant *Staphylococcus aureus*;
VRE: vancomycin-resistant enterococci;
PDR: pandrug-resistant;
AMR: antimicrobial resistance.

- Pharma companies are pulling out of antibiotics research
- Fewer new antibiotics approved
- Only 25% truly new
- None against Gram-negative bacteria (superbug infections)

Infections harder to control

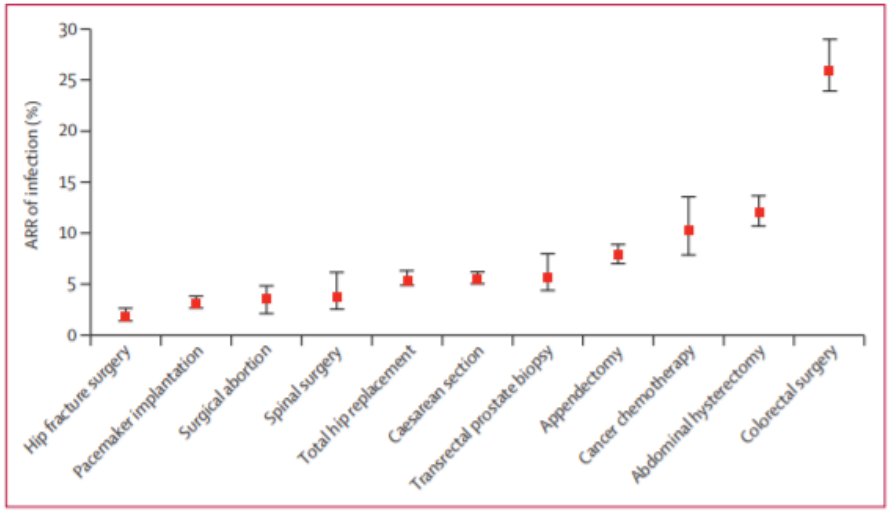
Source: https://www.armatapharma.com/technology/overview/

Hampered antibiotic prophylaxis

With implications for surgeries and cancer

2.

- Surgeries
- Cancer chemotherapies
- Transplantations
- Diabetes
- Births (Cesearean section)



- All **invasive procedures**
  - Surgeries e.g. Appendectomy, Bypass
  - Diagnostics: Biopsies, Heart catheter
- All **diseases** treated
  - prophylactically
  - with immunosuppressive drugs
- **Age** dependent
  - weakened immune system

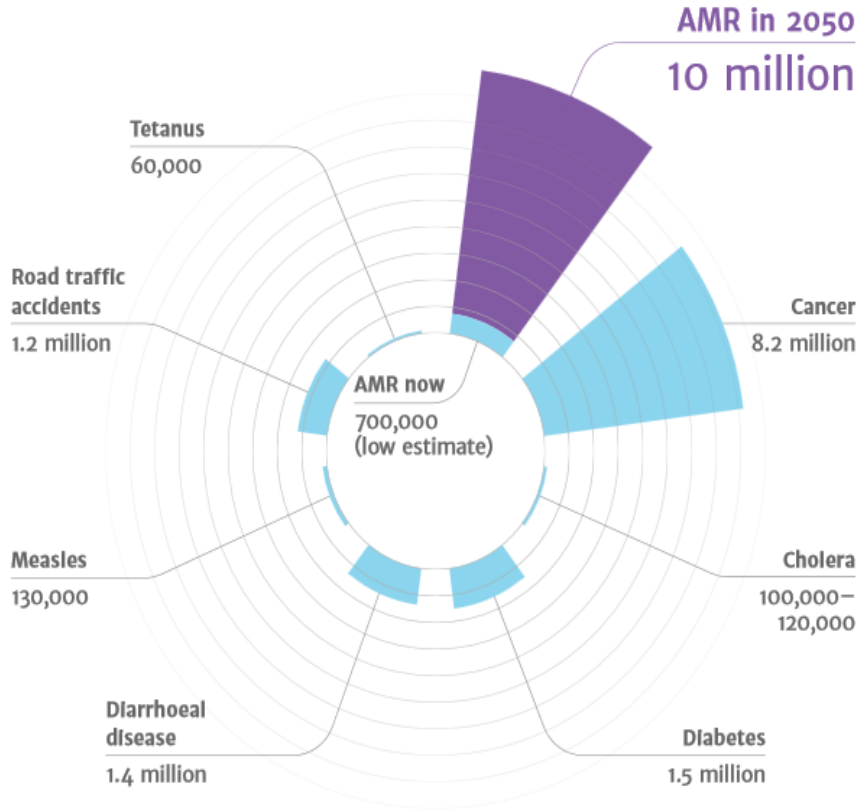
AMR will have significant implications on Mortality improvements and Mortality shocks

Source: www.thelancet.com/infection Vol 15 December 2015
Abs. risk reduction = Nº annual infections/ Nº procedures x efficacy of AB prophylaxis

Emerging double pandemic?

2.

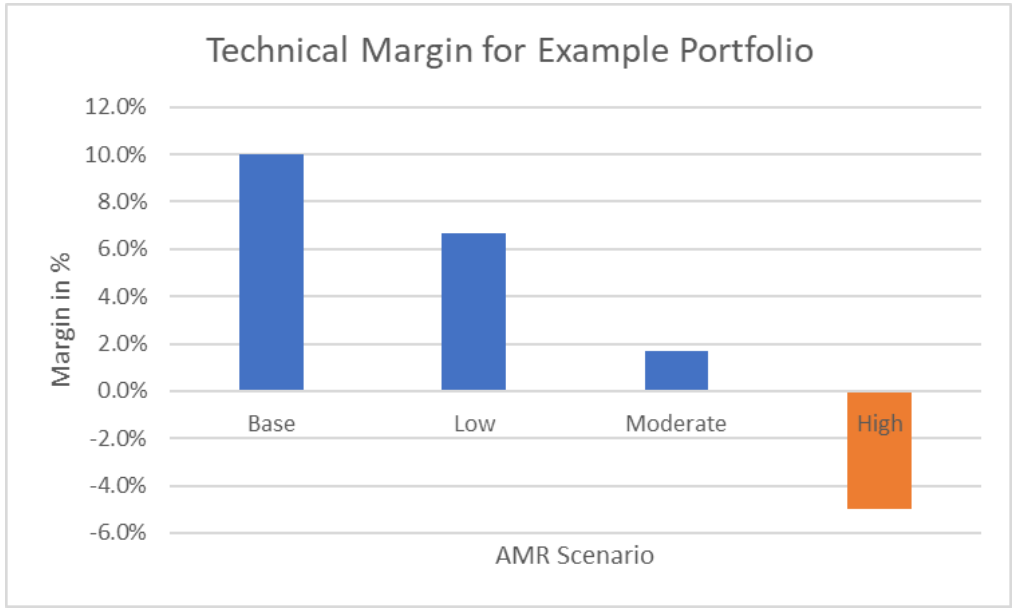
- Treatment of resistant infections: harder, more expensive, impossible ?!
- Standard medical procedures more risky
- Next influenza/corona pandemic?
- ≈ 10 Million AMR deaths/year by 2050
  Source: O'Neill Report (2016)



Source: www.amr-review.org

Economy and healthcare system ?
Life & Health (re)insurance ?

Potential Impact of AMR on Life (Re-)Insurance



- Stress scenarios of an example portfolio of existing Life insurance (Death benefit)
- Estimated impact solely based on infections after chemotherapy
- Scenario assumptions (Base/Low/Moderate/High):
  - Infection rate: 20%/30%/40%/50%,
  - Mortality due to infection: 10%/20%/30%/40%

Source: PartnerRe L&H

Assumptions: 100 male policies with age distribution around age 40, Term 30 years, YRT premiums with 10% margin (base), 1% risk-free-rate; Mortality and cancer death rates by age from Japan, cancer fatality (w/o infections) at 25%, 75% probability to receive chemotherapy

With an infection rate of 40% and an infection mortality of 30%, the profits are mostly gone

But there is hope !

Alternatives to Antibiotics

- New forms of vaccines: monoclonal Ab
- Bacteriophages: GMO viruses infecting + destroying bacteria
- Probiotics
- Fecal transplants
- Nanotechnology-based coating sprays: antibiofilm surfaces
- …

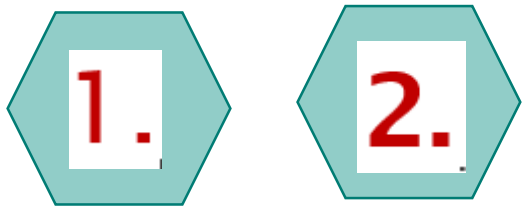
Table 2 Overview of assessments of technologies

Assessment process:	Literature review			Industry expert MCDA		Clinicians roundtable discussion	Summary score
Assessment parameter:	Potential to deliver products			Potential to reduce demand		Potential to impact on clinical use	Overall potential
Assessment criteria, or score:	In clinical use	Products in pipeline	Targets priority pathogen (CDC list)	Score (max 27, min 6)	Assessment*	May reduce antibiotics demand	
Rapid point-of-care diagnostics	Yes	Yes	Yes	20.0	High	Yes	High
Vaccines	Yes	Yes	Yes	14.8	High	Yes	High
Probiotics	No	Yes	Yes	15.4	High	Yes	Medium
Fecal microbiota transplantation	No	Yes	Yes	15.0	High	Yes	Medium
Therapeutic antibodies	Yes	Yes	Yes	15.1	High	No	Low
Antimicrobial peptides	Yes	Yes	Yes	11.4	Low	No	Low
Antibiotic biomaterials	Yes	No	n.a.	12.4	Low	Yes	Low
Antimicrobial nanoparticles	Yes	Yes	No	8.0	Low	No	Low
Anti-virulence materials	No	No	n.a.	12.0	Low	No consensus	Low
Bacteriophages (and lysins)	No	Yes	Yes	8.8	Low	No	Low

Legend: "Yes" means a response in the affirmative for the criterion in any given the column heading, whereas "No" means that the criterion was not fulfilled
*High potential technologies are those with a total score greater than the median of the total scores of the entire data set (13.4), where total score = (Time + Demand + Cost) x Confidence

Source: Nwokoro et al. Journal of Pharmaceutical Policy and Practice (2016) 9:34

Take aways for Insurance



1. SARS-CoV-2 pandemic will be a big(ger?) one!
2. **Pandemic models** have to consider Influenza + Corona
3. AMR underreported and largely **neglected**
4. SARS-CoV-2 pandemic adds fuel to the fire of AMR (**superimposed pandemic**)
5. Implications for mitigated Mortality improvements **beyond infections** only (**Longevity**)
6. **Life insurance products** may be challenged
7. Increased awareness due to SARS-CoV-2

Thank you very much for your attention!

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