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COVID-19 as analogy for antimicrobial resistance

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Introduction

Being in the middle of the COVID-19 pandemic sets the right stage for us to ponder the problem of antimicrobial resistance, or AMR. What is exactly the connection between COVID-19 and AMR? To what extent is this connection a social science issue?

Although AMR is not at the forefront of the current pandemic, the COVID-19 pandemic does illustrate the complex connection between bacterial and viral infections. Viral infections like COVID-19 cannot be treated with antibiotics. However, the damage caused by viral infections makes it easier for certain bacteria to cause *secondary* infections, such as bacterial pneumonia, that are treated with antibiotics. Studies based on Wuhan data show that the number of patients treated with antibiotics ranges from 71% – 95% and issues of highly resistant bacteria have complicated treatment (Zhou et al. 2020; Chen et al. 2020). It is clear that coinfection with antibiotic-resistant bacteria – superbugs – can lead to a higher mortality of COVID-cases (Lupia et al. 2019). This was also seen during the 2003 SARS epidemic (Chai et al. 2005; Yap et al. 2004). In the midst of the crisis, it has also been reported that compliance among hospital staff to report on usage of antibiotics and the rates of infections acquired in the facility may have fallen off during the pandemic (Reardon 2020), which complicates stewardship and increases the risk of development of bacterial resistance. Moreover, the use of antivirals for SARS-CoV-2 that were originally intended for other disease causing agents provides a risk for the development of viral resistance, since the standard dosing regimen can be insufficient because of the different target groups and because of differences in the antiviral activity (Rayner et al. 2020). Possible drug-resistance of viral phenotypes could also develop due to geographic specific viral mutations (Pachetti et al. 2020).

Overall, it is clear that inappropriate treatment of COVID-19 and secondary infections, and the use of antibiotics as a preventive measure can be an enormous driver of AMR. As a former Centers for Disease Control and Prevention (CDC) director notes: “The challenge of antibiotic resistance could become an enormous force of additional sickness and death across our health system as the toll of coronavirus pneumonia stretches critical care units beyond their capacity”(Gerberding 2020).

It is somewhat worrying in this context that there are few formal recommendations for the inclusion of antimicrobial stewardship programs (ASPs) in disaster planning or emergency response preparedness efforts (Stevens, Patel and Nori 2020). The depletion of stock of medical supplies and protective equipment due to COVID-19 can also have devastating

consequences for the management of other diseases. For example, due to the risk of COVID-19 infection, tuberculosis patients minimize unnecessary visits to health facilities. However, continuous treatment is essential since diagnostic delay and inadequate treatment influences the severity and mortality of tuberculosis (TB) as well as the risk of transmission and development of drug resistance, or the much harder to treat strains of multiple drug resistance TB (Hopman, Allegranzi and Mehtar 2020; Alagna et al. 2020).

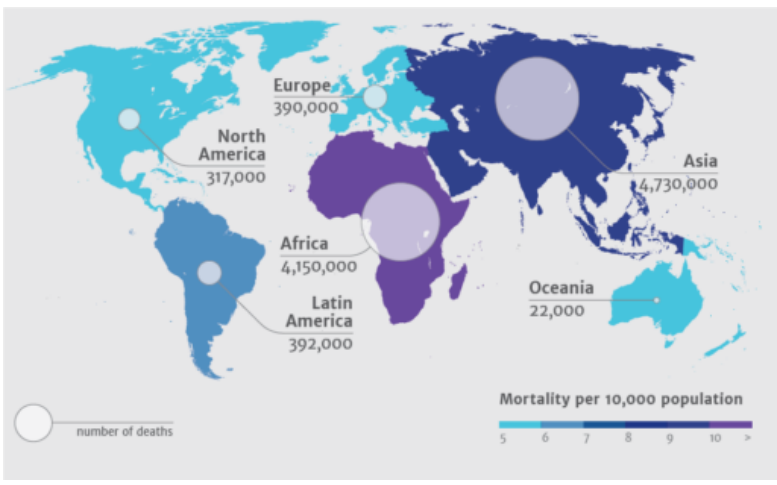
From this perspective, one hopeful message comes from the observation that people are now increasingly practicing improved hand-washing techniques and social distancing all over the world, leading to reduction of pathogens in our daily environment. Increased hygiene not only reduces COVID-19 transmission, but also helps to reduce spread of bacterial species with a low degree of pathogenicity (opportunistic pathogens), such as enterococci, that are known to contain multiple drug resistant determinants (Maillard et al. 2020), or tuberculosis.

But there is more to this linkage between AMR and COVID-19. When antimicrobials, which include antibiotics, become increasingly ineffective, infections lead to increased use of healthcare, morbidity, mortality and costs (O'Neill 2016). COVID-19 and AMR have this in common. They are both massive problems that are strongly connected to problems in our health infrastructure and may serve as analogies for each other. They are both complications which have wide societal impact and are drenched with mutual connections and symbolic, cultural lessons about interpretation.

One of the worldwide impacts of COVID-19 is increased awareness of what it may mean to have no vaccine or medicine against a disease-causing pathogen with health systems paralysed. Granted, for many people in the world, lack of access to medicines has already been a daily reality. Yet, for most of us reading this online on a fancy computer, the new normal of COVID-19 may still be a fruitful analogy to learn to understand the impact of AMR[1](#_ftn1). Since it is hard to envision the impact of AMR, the COVID-19 pandemic may serve as a fruitful analogy.

Demographic and economic analogy

A large driver of our cultural response is the notion of deaths. In the media the number of cases and deaths are highlighted on the daily news. Deaths appear popular summaries of "impact." As we have been preoccupied with deaths by COVID-19, let us compare them with what we know about AMR. Globally, estimates suggest that AMR leads to 700,000 deaths per year (O'Neill 2016). For the EU alone, the European Centre for Disease Prevention and Control (ECDC) has estimated that AMR currently causes 25,000 deaths annually and losses of at least EUR 1.5 billion per annum in extra healthcare costs and productivity (ECDC 2009). For COVID-19, the global death toll after four months (1/3 of a year) stands at around 300,000 (ECDC 2020). The impact in Europe is relatively higher than that of AMR, with 155,000 deaths to date according to ECDC (2020).



Deaths attributable to AMR per year by 2050. Source: The Review on Antimicrobial Resistance, Chaired by Jim O'Neill.

To take the analogy further, we can look at economic impact. In 2017 the World Bank estimated that drug-resistant infections could cause an annual global economic damage on par with the 2008 financial crisis, which isthe economic impact reference benchmark pre-COVID-19 (Jonas et al. 2017). We know that the complete shutdown of economies during COVID-19 is beyond the annual economic impact of the 2008 crisis. However, the costly impacts of AMR on GDP will be felt annually for a much longer period of time (the World Bank projected its impact at least through 2050), while we expect the impact of COVID-19 to be more temporary. What this means is that both in term of the number of deaths and the economic impact, AMR is not easily outshined by COVID-19 .

Sociocultural analogy

But the analogy goes beyond the number of deaths and impact on GDP. As we have seen with COVID-19, the reason why many countries chose for a lockdown was to prevent peaks in cases that would overburden the health system in absence of any medicine or vaccine. The analogy which COVID-19 provides for us here is a socialcultural one, pointing at the meanings we attach to the way societies are organized. What COVID-19 has placed at the centre is "what it is about" when we do not have medicine to rescue us. We can recognize the impact of having to turn to "traditional" methods of social distancing, and the very large gaps left when modern medicine is suddenly unable to help us out other than by keeping us alive the best it can. We see our health facilities quickly being overrun, sometimes to the point of collapse, and societies stop their business as usual. The amazing impact of COVID-19 is a new consciousness of the precariousness of our systems. For some this has given rise to new utopian thinking about other worlds that we can and should create (Neugebauer 2020). For others it has brought fear and uncertainty, perhaps even denial, and a strong desire to get things back to normal. The analogy here is strong, because a world where many of our antibiotics do not work anymore similarly means that many of the tools of modern medicine suddenly need to be rethought. So, we can imagine now the enormity of this impact — how it will affect, and already does affect, the precarity of our systems. Just like COVID-19.

The analogy also helps point out that like COVID-19, dealing with the global health challenges of AMR means huge investments in international collaboration and collective action. The good news is that we see now how rapidly humanity is able to implement drastic political measures that were unthinkable previous to the current pandemic. In a Scientific American Blog post comparing COVID-19 and AMR, the author concludes hopefully:

> "Rather than seeing the two crises as independent of each other, both are symptomatic of the challenges of living on an increasingly interconnected planet, and one will exacerbate the other. But in this crisis, we can dare to hope; let the global unity of purpose and research that is tackling COVID-19 become a roadmap for solving one of the most pernicious and long-running crises in global medicine—the issue of increasing antibiotic resistance and a stuttering pipeline of solutions." (Kirchhelle, Roberts and Singer 2020)

The symbolic role of modern medicine

But this is also where the analogy may have some limits. In a way, AMR and COVID-19 are opposites. In the case of COVID-19, the clear role laid out for biomedicine is to find a way out for all of us in this struggle. The symbolism of biomedical technologies is all about hope and a way out of uncertainty. It is about the heroism and enormous respect we have for those putting their

safety on the line to protect others. It is about the globally imposed waiting period for a vaccine or possible medicine to rescue us. But for AMR, this is the opposite. Modern medicine has largely been made possible by the invention of antibiotics. But now its success has become its own demise, a prediction that the early inventor Alexander Fleming in 1928 already cautioned against (Rosenblatt-Farrell (https://www.ncbi.nlm.nih.gov/pubmed/?term=Rosenblatt-Farrell%20N%5BAuthor%5D&cauthor=true&cauthor_uid=19590668) 2009). Because the overprescription of antibiotics in health, veterinary, and agricultural sectors has caused higher than natural evolutions of resistance. While Fleming and its successors definitely have been given heroic status in our world, this heroism is fading when it comes to AMR. Worse, hope is also not the key word to use to describe the role of biomedicine in the current AMR crisis.

Some technological optimist would point out that biotechnology may still bring us alternatives. So, there may be some hope, perhaps. Instead of heroism and hope, biomedicine has been given a new role of "stewardship." To be better and more prudent at dealing with their own invention, a concept equalling the term "sustainability" in the world of ecology and development. But when we see how the medicalisation of our society has brought antibiotic technologies deep into our livestock industry, our meat production processes in particular, and further sustained by our lack of interest in strong health systems with adequate access and prescription for all, "stewardships" gains an eerieundertone of "too little too late."

Framing of causality

The analogy can be extended further, although it gets trickier here. While we are currently in an emergency phase, eventually when we look back, reflection and blaming will proceed. It is to be expected that to some extent the acceptance of the virus may be influenced by the popular notion that there was something "natural" or unavoidable about it, because we know that historically pandemics will occur. They have been occurring all throughout human evolutionary history, are part of who we are and what we have become, and they will keep on occurring in the future. There is also a large level of randomness to it. This randomness is a fate to some extent, which means that it has elements which are outside of our human influence which help with acceptance of the cards we were dealt. From this perspective, no one is to blame. This attitude may contrast with another one, which will be more attentive to social causation. More than 6 out of 10 known infectious diseases and 3 out of 4 new or emerging infectious diseases are spread to humans from other animals, including livestock and wildlife, according to estimates published by the CDC. Obviously, our global impact on the environment is going to exacerbate these "zoonotic" contacts, and possibly increase the rate at which viruses or bacteria are going to jump from one species to the other. This time it was COVID-19. In 2014 it was West-African Ebola. Next time may come sooner than we want.

When it comes to AMR, similar processes are at play. On the one hand, it is the microbes that are mutating and evolving, outsmarting human technology. It is them, not us. Discourses here include those that are choosing to state that we—humanity—are in a perpetual war with the microbials. Framed this way, AMR seems like an external given. At the same time, we also know that AMR occurs at multiple, complex, scales that are strongly societal driven. It is about the way in which we treat and cultivate our personal microbiome (through foods) in our bodies. About how we interact with environments in terms of sanitation or pollution (e.g. hog farms) and about how we interact with animals and livestock, which in our modern bioindustry means we have pumped them full of antibiotics—often to merely fatten them up. In the case of AMR, we can recognize a similar human driven causality as in COVID-19, but it takes care to recognize it.

The need for global education on AMR

The need for global education on the importance of effective public health systems, including vaccinations and functional antimicrobials, is now more evident than ever. The global rise on consciousness should have positive impacts on global health with a strong momentum that should be maintained (Sundin 2020). In this window of opportunity which COVID-19 has given us, the problem of AMR may be understood more easily. Not only through pointing at direct linkages where co-infection with antibiotic resistant bacteria – superbugs – can lead to a higher mortality of COVID-cases. But in addition, COVID-19 can serve as a useful societal analogy for AMR that may help to educate the public on the socio, economic and cultural implications of this mostly unknown and rather complicated threat. This brief analysis of some of the analogies shows, for example, that we may want to pay attention to how the cause of both crises becomes naturalized in public discourse. Further, to see a shifting role of biomedicine and to recognize that solving these crises requires equally deep societal or infrastructural (Chandler 2019) changes in order to cope, adapt, and develop resilience.

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[1] (#_ftnref1) An analogy is a comparison between one thing and another, typically for the purpose of explanation or clarification

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