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Editorial

Lessons from the COVID-19 Pandemic—Unique Opportunities for Unifying, Revamping and Reshaping Epidemic Preparedness of Europe's Public Health Systems



Introduction

Following the devastation of World War II, the vision of a unified Europe earned the continent over seventy years of economic growth and prosperity, the longest period in its modern European history. The initial six countries who signed the European Coal and Steel Community (ECSC) treaty in April, 1951 in Paris, and the European Economic Community (EEC) treaty in Rome in 1957, expanded in number over time. Following the fall of the Iron Curtain and the dissolution of the Soviet Union, several countries from Eastern Europe joined the European Union at the beginning of 21st century. However, the quest for building of a united Europe with democracy, respect for human rights and universal health and prosperity is far from complete ([European Council on Foreign Relations, 2020](#); [European Commission Crisis management and Solidarity, 2020](#)). The rapid spread of the unprecedented COVID-19 pandemic has revealed the weakness of European public health and related political institutions. Furthermore, it has highlighted the failure to implement the European Treaty provision to safeguard the well being of Europe's citizens and guarantee the highest level of protection from health scourges ([European Commission Crisis management and Solidarity, 2020](#)). The fight against pandemics like COVID 19 cannot rely on a patchwork of fragmented, individual and uncoordinated measures as we see currently with the COVID-19 outbreak in different EU/EEA/UK countries.

The European response to the pandemic at national level has been generally inconsistent over time and focused mostly on an internal perspective, with key actions sometimes resulting in open contrast (border closures, trade policies, etc.). Some states have shown an overall weakness in adapting and managing health services to address the pandemic, with inadequate public health actions and overall healthcare services were unprepared to face epidemic emergencies. Moreover, governments have had difficulties in coordinating interventions within their territories: the organization of health services was different in the individual regions of the individual states. Above all, the absence of adequate preparedness and the lack of updated pandemic plans at national and EU levels became blatantly evident. In addition, the present recrudescence of the pandemic equally covers all countries, whatever their initial response, but most of all it found governments unprepared once again.

Here we discuss recent public health systems inefficiencies, and we highlight unique opportunities to revamp and reshape Europe's health and welfare systems, both at national and EU levels. Our aim is to contribute to the development of robust common reference systems, able to coordinate national preparedness plans, and at the same time to allow political institutions to take rapid evidence-based critical decisions during public health emergencies.

Europe and COVID-19-Desperation and Hope

In light of the weak political and legal instruments and leadership at national and EU level, effective coordination of COVID-19 public health interventions such as early selective closures of national borders, procurement of personal protective equipment (PPE) and medical appliances, and conduct of priority clinical, translational and basic science research were not forthcoming in the first few months of the pandemic.

The world's largest economies were frozen by national decisions to lock down society, populations saw their movements restricted and most public health bodies struggled to curtail the spread, often ignoring wilfully progress made in East and South East Asia. Some of the world's most advanced health care systems were overburdened and unable to cope. Some of these inefficiencies are summarised in [Table 1](#). As of 19th October 2020, of over 39.8 million COVID-19 cases (with 1,110,938 deaths) worldwide reported to the WHO, the EU/EEA and the UK account for 7,889,000 cases, approximately 15% of the global COVID-19 burden ([WHO, 2020](#)). Several lessons arise from the COVID-19 Pandemic and unique opportunities for unifying, revamping and reshaping Epidemic Preparedness of Europe's Public Health Systems come from The European Commission and the European Council's European Coronavirus Recovery Package of 750 billion Euro, and the new Health programme provides hope for modernization of the public health and welfare systems of EU countries ([European Council, 2020](#)).

Europe Epidemic Preparedness

The number of new infectious diseases with epidemic potential has increased nearly fourfold over the past six decades ([Zumla and Hui, 2019](#)). Since 1980, the number of new outbreaks per year has more than tripled and the current COVID-19 pandemic should not

Table 1

Specific governance issues at national level to contrast COVID-19 pandemic: Critical areas highlighted in the framework of the response of health systems at national and local level and by supporting agencies.

Public health system organization	<u>National level:</u> non-existent or inadequate coordination and follow up actions <u>Local level:</u> Disparities in healthcare organizations <u>Supporting Agencies:</u> non-existent or inadequate to support preparedness tasks
Funding health care and public health	<u>National level:</u> Fragmented financing system <u>Local level:</u> spending decisions entrusted to the local government
National strategies	<u>Main priorities:</u> priorities non clearly identified in the national plans <u>Specific technical areas:</u> pandemic plans inadequate, not regularly or correctly updated Public health decisions not based on the priorities definitions Strategies to achieve goals: often not clearly defined.
Criteria used for priority-setting and decision-making	Not provided Often inadequate Often outdated and purely epidemiologically oriented systems.
Key actions to preventing Health inequalities developing under the pandemic	
Intersectoral collaboration	
Monitoring and evaluating public health policies.	

have come as a surprise. In 2004, following the appearance of the SARS-CoV-1 pandemic, the WHO European Observatory on Health Systems and Policies investigated public health decision-making in eight countries which included six EU countries: Denmark, Finland, France, Germany, the Netherlands and Sweden, mapping priority-settings in public health (Allin, 2020). This was based on several lessons learnt, underlying a mix of stylized facts, gaps in the literature, and evidence of mistakes.

First it highlighted that public health capacity for response to emergencies was clearly insufficient in many countries, a quite alarming observation considering that it refers to high income and high resources countries. Second, there was a lack of well-documented research on the complex mechanisms of decision-making in real life, indicating the need of a better understanding of the policy processes, because, even if they cannot be applied directly in other contexts, the experiential knowledge can be systematized. Third, it paved the way for more detailed analyses in the field, enabling to better understand how governments can address emerging threats to health and provide their citizens with the greatest opportunity to make healthy choices. Fourth, there was a need for much more detailed international comparisons of public health policy-making and implementation, including the role of informal networks and mechanisms. Fifth, there were varying degrees of decentralization and extensive pluralities in health policy-making in different countries. Sixth, in all six countries, important weaknesses were identified in the public health infrastructure, including in information and surveillance systems, human resources and evaluation resources. Although this is an area of increasing attention in these countries, little has been done to ensure improvement and unfortunately, many of the weaknesses identified are still present today (Kock et al., 2020).

Policymakers and public health authorities around the world have struggled to combat a rapidly escalating Covid-19 pandemic. In trying to do so, however, they have often repeated many of the errors made earlier and the state of unpreparedness has continued (Allin, 2020). The COVID-19 pandemic has highlighted that political decisions should be consistently based on scientific evidences, and on the other side public health officials should not put themselves in a position where they support decisions already taken at political level without an accurate scientific evidence. A continuing feature of the disorganisation of the public health community is the persistence of debates set up with poorly qualified late-comers to the field and the replacement of data-based evidence by personal opinions uttered by self -or media-appointed experts. These permanent pugilistic confrontations

nearly automatically lower the credibility of public health relevant science and thereafter the measures science inspires, and it is in good part responsible for the erratic and contradictory measures taken by governments. Media checks of the credentials of these so called 'immediate experts' have not been scrupulous, and result in ill-informed dogmatic views over sound arguments. All this leads to continuous perpetration of the state of unpreparedness by hesitation and competitive inhibition.

Identifying weaknesses and failures in governance

The COVID-19 pandemic has highlighted limitations of public health and political systems and has brought forth deeper issues in countries with advanced economies. The shortcomings are seen in countries where the political decision-makers and public health professionals have not been able to work together and did not respect their respective roles. These two systems need to collaborate based on mutual respect and understanding.

We have observed the lack of recently adopted plans and the inability to quickly adapt those existing, once the threat emerged. "Pandemic preparedness plans" boasted by high income countries turned out to be all hopelessly out of date and had at best been limited to episodic desk and media exercises. Central to these limitations have been a catalogue of failures to provide adequate medical care to patients at many different levels (hospital, territory, community), diagnostic capacity, availability and supply chains of medical devices and PPE, as well as the inability of public health systems to rapidly implement infection prevention and control activities in critical areas such as nursing homes.

Worryingly, even the World Health Organization (WHO), has struggled with the basic concepts of preparedness and systematic coordination and implementation and the vetting of the quality of different countermeasures. A common feature worldwide has been poor preparedness plans coupled with lack of resources, infrastructures, training and educational activities. Countries did not consider their strategic obligation to provide large scale training and refresher courses, to promote problem-directed research and innovation and thus to ensure constant and adequate level of preparedness, delegating much of these tasks to regional and other devolved authorities left with no means to follow up.

COVID-19 has exposed the existing need to develop trusting and more effective meaningful collaborations between countries and Human, Animal and Environmental Health knowledge systems, in line with the OneHealth concept, to rapidly initiate public health actions (Kock et al., 2020). The focus of pandemic preparedness

should include upstream prevention through better collaboration of different sciences, to enhance capacity to identify potential pathogens before they become serious human threats, and to prevent their emergence where possible (McCloskey et al., 2014). This ONE HEALTH approach should be carried out within the framework of the International Health Regulations that need urgent reform and effective collaboration among countries. Equitable collaborative research partnerships and biological material and data sharing, will be a common advantage for all countries as well as a common sanctions framework (Zumla et al., 2017). An ongoing example is the spread of COVID-19 to minks and the transmission between humans to minks and back again (Oreshkova et al., 2020).

The recurrent Ebola epidemics and the current COVID-19 pandemic present important lessons (Ezenwa et al., 2015; Jacobsen et al., 2016; Al-Tawfiq et al., 2014), which cannot be ignored. Although SARS and MERS (Kagan et al., 2020) were considered in 2017 and 2018 in WHO's R&D Blueprint priority infectious diseases presenting a threat to global health security, the research and public health investment rate did not grow relative to other diseases. The volume of research conducted on SARS and MERS, was minimal compared to other infectious diseases. Kagan et al., analysed more than 35 million articles from the past 20 years and demonstrated that previous coronavirus outbreaks had been neglected and grossly understudied (Kagan et al., 2020). In contrast, COVID-19 has seen an enormous flood of publications, although new data on diagnostics and treatments were slow in coming into updating national COVID-19 plans. The explosion of literature was often not properly vetted, and led to retraction from high impact journals (Bramstedt, 2020). The great noise of non-scientific "evidence" spread by social media, has contributed to generate confusion and has not supported the creation of adapted response strategies.

Action Required Now

We must act now to ensure a better mobilisation to end the current pandemic and to be prepared for the next global health emergency. We cannot wait until the next pandemic crisis to implement the essential changes. A multi-pronged, transdisciplinary strategy that integrates the assets of biomedical sciences, public health, medical research and environmental sciences, is urgently required to address the complex of emerging infectious diseases from individual and local level up to the global scale (European Commission Crisis management and Solidarity, 2020; WHO, 2020).

Key Actions Required to implement for an adequate epidemic preparedness in the European Union (EU):

1 Creation and stabilization of National Reference Centres in the field of high-impact infectious diseases, acting as a reference and guidance institution for civil health within National Health Protection Plans. These Centres of Excellence should be recognized accordingly, on the basis of internationally agreed specifications and standards. Governments should allocate resources for inter-epidemic and intra-epidemic research activities and frequent exercises involving realistic emergency mobilisations.

Main tasks of the National Reference Centre for infectious diseases, already foreseen as focal points by the EU and indeed the 2005 International Health Regulations, should be clinical case management; epidemiological surveillance and alert systems; interaction and coordination with national and international bodies responsible for the management of health emergencies; production and dissemination of technical guidance to standardize

and homogenize the national approach to an infectious diseases emergency; provision of specific ongoing training to face the particular logistic; diagnostic, therapeutic and infection prevention and control challenges posed by emerging or highly diffusible infectious agents; coordination and development of scientific research and development.

Rethinking the organization of the national health services, is possible even during the pandemic emergency, setting up dedicated and integrated pathways, with clear separation from the routine care pathways, to avoid falls in the overall care levels, a challenge of particular relevance in countries with decentralized health systems. The Reference Centres should be ultimately responsible for surge capacity mobilisation.

2 Increase laboratory capacity with a special focus on "new" infections and not only relying on routine diagnostics for known diseases. This should include adequate facilities, able to perform activities both during inter-epidemic and intra epidemic periods, well beyond preparing for identifying rare cases of unknown pathogens but readying for large scale testing in numerous locations, as was shown to be an early requirement in the current outbreak. In inter-epidemic period, the laboratory should perform routine diagnostic activities for infectious diseases considering that for several agents there are no effective or validated commercial diagnostic methods; ensure training and availability of relevant equipment; plan the production and distribution of reagents that contribute to the infectious disease surveillance system focused on internationally identified risks (e.g. possible influenza pandemic, haemorrhagic fever outbreaks). For this, reagent production by non-profit public production consortia should be envisaged. National Centres should coordinate with national and international partners (WHO, ECDC, EU Commission, OIE, and others.) for rapid response to outbreaks. In order to do so, they should be able to rapidly sequence pathogen genomes, to process information with advanced and flexible bioinformatics pipelines, and to support identification/diagnosis and molecular epidemiological surveillance. Moreover, they should promote and conduct research activities in the field of infectious diseases, including the development of new diagnostic, therapeutic and vaccination options.

In the epidemic period, the laboratory should perform routine diagnostic activities integrated with those specific to the epidemic. In the case of a large-scale epidemic, like currently Covid-19, it is necessary to support the national dissemination of diagnostic tests, the massive development of supplies by the commercial and non-commercial test industry and in general to increase the diagnostic capabilities to support not only selected inpatient groups but to cover the entire territory.

The contribution of the laboratory in the research activities is essential in developing appropriate diagnostic methods; in evaluating those produced by many actors; in studying the pathogenetic aspects of the infection including in special animal facilities, in order to identify new targets or therapeutic strategies; in testing molecules with pharmacological potential in order to discover possible therapeutic options; in supporting epidemiological studies; in supporting vaccines' development, not only by collaborating in their design, but also validating them on cellular and animal models; in supporting immunological studies and clinical trials in various phases.

The scaling-up of the routine sequencing activity of the agent responsible for the epidemic and the continuous monitoring of its evolution, is of paramount importance to support the global architecture of the surveillance systems, tracing the diffusion lines, and identifying transmission chains especially in the containment

phases of the epidemic. Each national laboratory should be able to support the control of the epidemic also in other countries, organizing missions abroad and sending mobile laboratories where needed, with the double aim to prevent the epidemic expansion and to acquire specific knowledge for their containment. These objectives can only be met with a substantial increase and maintenance of international collaboration reaching out to all territories and nations including the People's Republic of China and the Russian Federation.

- 3 Standardized protocols/definitions/strategies for the optimal clinical management** should be produced and constantly updated in order to improve the outcome of patients with severe emerging disease, and to improve the response during an emergency. In order to address any severe infectious outbreak with pandemic/epidemic potential, a syndromic approach is needed considering the main syndromes as models for respiratory, neurological, gastro-enteric and sepsis-like diseases. In this way, differently from the single pathogen-oriented approach, guidance and response may be rapidly adapted to any new severe emerging diseases, since integrated models of clinical, diagnostic, epidemiological management and control will already be available. Moreover, clinicians should contribute to standardize and optimize organizational practices, which are currently underdeveloped.
- 4 Research activities** should be developed within a pre-arranged, flexible, ready-to-apply methodological framework, anticipating also regulatory and ethical aspects, for the immediate implementation of clinical studies, with special focus on randomized controlled trials. The main aims of the research in the context of an epidemic are the understanding of causative agent pathogenesis, the development and testing of therapeutics and vaccine, the development and improvement of modelling capabilities. Therefore, research activities should be multidisciplinary, and cover not only clinical aspects but also epidemiological, diagnostic and translational issues. The development of clinical trials and other clinical studies should be implemented as soon as a new outbreak starts, based on the framework built during inter-epidemic periods. In this way, new outbreaks due to emerging diseases with pandemic/epidemic potential will be, since their beginning, a source of useful data for clinical management, and a problem-directed opportunity for research.

In fact, despite EU funding of many research preparedness projects and the setting up of self-advertising global research coordination to react to the outbreak, hundreds of minor clinical trials proliferated. This caused a waste of resources on otherwise poorly considered molecules, and with very little productive interaction with the private pharmaceutical sector, which apparently is withholding important new antiviral molecules for testing, as long as its shelf-warmer such as Remdesivir® have not been cleared out. In the absence of a real coordination and foresight planning among public research agencies, most trials are bound to fail, exposing participating patients to unnecessary risks and depriving them from advanced treatment perspectives.

An efficient coordination of clinical research activities will also avoid the risk of duplicating similar trials, thus allowing to spare resources and to diversify the trials to be run for answering many more crucial questions. The current international framework GLOPID R needs to be replaced by a more powerful instrument. A much higher contribution from the pharmaceutical industry in terms of new molecules to test must be delivered.

- 5 Development of an integrated One-Human-Environmental-Animal-Health (ONE-HEALTH) system**, to predict the emergence of zoonotic diseases by epidemiological modelling of

human and animal interfaces, enhancing wildlife and bio-surveillance methods, planning and development of new and robust outreach health systems to be activated in case of outbreaks, expanding to environmental and ecological assessments and intervention studies.

- 6 Development of capacity for Outbreak control** is less a matter of state-of-the-art technologies than a matter of state-of-the-art human resource capacity. Each country should develop and maintain a corps of well-trained decentralised public health community agents ready to be mobilised at short notice, and at scale for contact tracing and quarantine installations. This is where managerial/organizational training can make a difference. This Corps should be constituted ad hoc and not at the expense of the already weak general public health workforce that needs sustained reinforcements in the first place.

A good preparedness should ensure a system for rapid, possibly web-based training and an ongoing practical training and certification of an international pool of professionals, to improve proper skills and to initiate translational research under different scenarios.

Health and welfare, a pillar of a new Europe

This pandemic will pass, but a new one will come. We have been expecting for many years the arrival of a virus with pandemic potential: at the end, it was not an influenza virus, but a Coronavirus. At the very beginning, probably everyone underestimated its impact. However, after a few weeks, as news from Wuhan began to flow, the picture changed and concern grew. Nobody expected that there could be so many deaths in rich, industrialized countries. What has happened shows that it is necessary to be prepared for these situations, through research and proper investments. This experience teaches that being prepared "on paper" is not enough. We will never be ready to face emergencies of this type without adequate research facilities, well equipped with devices and sufficient supplies, without a systematic research and investments in a common European "preparedness" model, able to develop and produce in short time vaccines and diagnostic kits. Moreover, we can no longer depend for essential supplies solely on third-party countries which can block availability of essential goods for the sole benefit of themselves, nor can we entirely outsource their production with the risk that any disruption of logistic chains impacting on strategic supplies.

We are convinced that much of what we advocate here in term of development of essential diagnostic supplies, training and logistic coordination can be taken charge by the planned EU BARDA, an EU agency devoted to advanced biological research and development. On September 16th, State of the Union address to the European Parliament EU president Ursula Van der Leyen, announced the strengthened capabilities of ECDC and EU, but much responsibilities remained within the Member States. Moreover, another urgent task is revamping the ECDC structure created by the EU in the aftermath of the 2003 SARS outbreak. On line documents have shown a complete lack of pro-activity by the Agency's leadership, the high-jacking of the advisory bodies by promoters of the anti-scientific herd immunity theory as well as the inability to produce correct and timely technical advice. ECDC was shown to be inert for a long period of time and to lack the critical mass needed to develop meaningful scientific perspectives in proportion to the magnitude of the outbreak. While this issue has been plaguing EU research policy since the BSE outbreak in the UK, the Framework Programme instrument installed by the EU treaty was not able to coordinate early research response efforts, neither to address issues by meaningful call for proposals and to secure substantial funding opportunities. Regrettably, the outstanding

convening power of the EU research leadership was not used to gather pledges and concrete plans for collaboration from EU and world wide partners, some of which had collected significance advance experience during the outbreak. Instead, the European Commission locked itself into the totally useless Glolid R scheme and threw the key away.

We therefore strongly support the establishment of a new European model, with a revamped capability to issue centralized guidances, able to put the health issues at the center of the stage, while fostering a decentralized plans and programmes implementing capacity, adapting them to specific circumstances.

“The EU’s *raison d’être* was always prosperity – the belief, formed in the wake of the second world war, that greater economic interdependence would promote peace between European countries. This approach worked within Europe and the transatlantic relationship. However, economic interdependence has not protected all Europe’s security interests, in term of hard security or, as it has become increasingly apparent during the current crisis, in term of human security. Now it is the time for the EU to harness its transformational power – and to protect citizens without turning in on itself. It needs to define new protection, health, and social security standards for them. What better way to achieve this than to strengthen European sovereignty on health issues?” (WHO, 2020).

There is an alternative, in the European idea. If Europe invests in the health and well-being of its citizens, it can play a fundamental role in breaking this pattern and in proposing itself as the most advanced political model in the world: democracy and social protection, combining economic growth with impact on protection of health and well-being of citizens, guaranteed by the state through mainstreaming all public policies in support of health, education, social security.

These ideas should also be at the top of the agenda of the next G 7 Summit on Health under Italian Presidency next year (Ippolito et al., 2020).

We need the strength to follow these goals, and it would also honour as the memory of the many European citizens who lost their lives during this pandemic. However, this means a change of the current health policy mandate of the EU and the move towards a federated agenda of health protection in Europe. If there is to be a EU health sovereignty, it has to be a shared one and not a residual one.

Conflict of interest

All authors have an interest in infectious diseases epidemics and public health. Authors declare no conflicts of interest.

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References

Allin S., Mossialos E., McKee M., Holland W. Making decisions on public health: a review of eight countries. World Health Organization, 2004 on behalf of the European Observatory on Health Systems and Policies. Brussels, Belgium ISBN 92 890 1066 5. https://www.euro.who.int/__data/assets/pdf_file/0007/98413/E84884.pdf.

- Al-Tawfiq JA, Zumla A, Memish ZA. Travel implications of emerging coronaviruses: SARS and MERS-CoV. *Travel Med Infect Dis* 2014;12(5):422–8, doi:<http://dx.doi.org/10.1016/j.tmaid.2014.06.007>.
- Bramstedt KA. The carnage of standard research during the COVID-19 pandemic: a call for quality. *J Med Ethics* 2020;(October), doi:<http://dx.doi.org/10.1136/medethics-2020-106494>. Epub ahead of print.
- European Commission Crisis management and Solidarity. https://ec.europa.eu/info/live-work-travel-eu/health/coronavirus-response/crisis-management_en. [Accessed 19 October, 2020].
- European Council. Council of the European union. A Recovery Plan for Europe. <https://www.consilium.europa.eu/en/policies/eu-recovery-plan/>. [Accessed 19 October 2020].
- European Council on Foreign Relations. ECFR.EU. Covid-19 and European solidarity: The fight for who we are. https://www.ecfr.eu/article/commentary_covid_19_european_solidarity_and_the_fight_for_who_we_are. [Accessed 19 October 2020].
- Ezenwa VO, Prieur-Richard A-H, Roche B, Bailly X, Becquart P, García-Peña GE, et al. Interdisciplinarity and Infectious Diseases: An Ebola Case Study. *PLoS Pathog* 2015;11(8):e1004992, doi:<http://dx.doi.org/10.1371/journal.ppat.1004992>.
- Ippolito G, Lauria FN, Montaldo C, Vairo F, Curiale S, di Caro A, et al. Europe’s public-health systems gear up for future epidemics. *Nature* 2020;586(October (7831)) 674, doi:<http://dx.doi.org/10.1038/d41586-020-02966-2> PMID: 33110256.
- Jacobsen KH, Aguirre AA, Bailey CL, Baranova AV, Crooks AT, Croitoru A, et al. Lessons from the Ebola Outbreak: Action Items for Emerging Infectious Disease Preparedness and Response. *Ecohealth* 2016;13(March (1)):200–12.
- Kagan D, Moran-Gilad J, Fire M. Scientometric trends for coronaviruses and other emerging viral infections. *GigaScience* 2020;9(August (8)), doi:<http://dx.doi.org/10.1093/gigascience/giaa085>, [Accessed 12 October 2020].
- Kock RA, Karesh WB, Veas F, Velavan TP, Simons D, Mboera LEG, et al. 2019-nCoV in context: lessons learned?. *Lancet Planet Health* 2020;4(March (3)):e87–8, doi: [http://dx.doi.org/10.1016/S2542-5196\(20\)30035-8](http://dx.doi.org/10.1016/S2542-5196(20)30035-8).
- McCloskey B, Dar O, Zumla A, Heymann DL. Emerging infectious diseases and pandemic potential: status quo and reducing risk of global spread. *Lancet Infect Dis* 2014;14(October (10)):1001–10.
- Oreshkova N, Molenaar RJ, Vreman S, Harders F, Oude Munnink BB, Hakze-van der Honing RW, Gerhards N, Tolsma P, Bouwstra R, Sikkema RS, Tacken MG, de Rooij MM, Weesendorp E, Engelsma MY, Brusckie CJ, Smit LA, Koopmans M, van der Poel WH, Stegeman A. SARS-CoV-2 infection in farmed minks, the Netherlands, April and May 2020. *Euro Surveill* 2020;25(June (23)):2001005, doi:<http://dx.doi.org/10.2807/1560-7917.ES.2020.25.23.2001005> PMID: 32553059; PMCID: PMC7403642.
- WHO COVID-19 Dashboard. <https://covid19.who.int/>. [Accessed 19 October 2020].
- Zumla A, Hui DSC. Emerging and Reemerging Infectious Diseases: Global Overview. *Infect Dis Clin North Am* 2019;33(December (4)):xiii–xix, doi:<http://dx.doi.org/10.1016/j.idc.2019.09.001>.
- Zumla A, Ippolito G, McCloskey B, et al. Enhancing preparedness for tackling new epidemic threats. *Lancet Respir Med* 2017;5(8):606–8, doi:[http://dx.doi.org/10.1016/S2213-2600\(17\)30189-3](http://dx.doi.org/10.1016/S2213-2600(17)30189-3).

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