



**University of
Zurich**^{UZH}

**Zurich Open Repository and
Archive**

University of Zurich
University Library
Strickhofstrasse 39
CH-8057 Zurich
www.zora.uzh.ch

Year: 2022

Addressing Volatile Ethical Issues of Covid-19 with the Core Five Enduring Values List for Health Care Professionals

Biller-Andorno, Nikola ; Spitale, Giovanni

Abstract: From an ethical perspective, the Covid-19 pandemic is like a prism: It helps us see the spectrum of issues clearly and distinctly. Here, the authors outline what they consider top ethics concerns, grouped around five moral and societal core values: autonomy, privacy, equity, proportionality, and trust. They probe these concerns with some examples related to vaccination of health care professionals, contact tracing, global access to vaccines, lockdowns, and crisis communication. The authors recognize that the dynamic, cross-sectoral, multilevel impacts of both the coronavirus itself and the clinical and societal measures taken to contain it are too complex to be fully captured without an exhaustive accounting. Instead, they propose a value-based topic list, centered around five core moral values that are unlikely to change over time and that will allow health care leaders to systematically analyze ethical issues arising in their institutions. For each of the items on the Core Five Enduring Values List, the authors include a dynamic presentation of emerging topics (in the form of a word cloud or any other suitable format) that can and will change; these are generated with a natural language processing approach, using an open-source topic tracking algorithm as a means of tackling the exploding volume of literature on bioethics and Covid-19, allowing for quick overview of thematic priorities.

DOI: <https://doi.org/10.1056/CAT.22.0108>

Posted at the Zurich Open Repository and Archive, University of Zurich

ZORA URL: <https://doi.org/10.5167/uzh-219755>

Journal Article

Published Version

Originally published at:

Biller-Andorno, Nikola; Spitale, Giovanni (2022). Addressing Volatile Ethical Issues of Covid-19 with the Core Five Enduring Values List for Health Care Professionals. *NEJM Catalyst Innovations in Care Delivery*:online.

DOI: <https://doi.org/10.1056/CAT.22.0108>

COMMENTARY

Addressing Volatile Ethical Issues of Covid-19 with the Core Five Enduring Values List for Health Care Professionals

Nikola Biller-Andorno, Dr Med, Dr Phil, MHBA, Giovanni Spitale, MA

DOI: 10.1056/CAT.22.0108

From an ethical perspective, the Covid-19 pandemic is like a prism: It helps us see the spectrum of issues clearly and distinctly. Here, the authors outline what they consider top ethics concerns, grouped around five moral and societal core values: autonomy, privacy, equity, proportionality, and trust. They probe these concerns with some examples related to vaccination of health care professionals, contact tracing, global access to vaccines, lockdowns, and crisis communication. The authors recognize that the dynamic, cross-sectoral, multilevel impacts of both the coronavirus itself and the clinical and societal measures taken to contain it are too complex to be fully captured without an exhaustive accounting. Instead, they propose a value-based topic list, centered around five core moral values that are unlikely to change over time and that will allow health care leaders to systematically analyze ethical issues arising in their institutions. For each of the items on the Core Five Enduring Values List, the authors include a dynamic presentation of emerging topics (in the form of a word cloud or any other suitable format) that can and will change; these are generated with a natural language processing approach, using an open-source topic tracking algorithm as a means of tackling the exploding volume of literature on bioethics and Covid-19, allowing for quick overview of thematic priorities.

For more than 2 years, the Covid-19 pandemic has taken center stage, pretty much anywhere around the world. Not only has it caused death and suffering, but it has also absorbed our energy and attention. Other global issues, such as climate change or the privatization of space, have been subordinated. For ethics, the pandemic is like a prism: It helps us see the spectrum of issues clearly

and distinctly. Here, we outline what we consider top ethics issues, grouped around five moral and societal core values, and probe them a bit further with some examples.

The pandemic affects not only our physical, but also our mental and social well-being. It affects individuals, groups, and the global community. It has triggered the rapid development and accelerated deployment of new technologies, many of which involve digital and artificial intelligence (AI) components such as tracing apps and triaging algorithms. We are quite aware that the dynamic, cross-sectoral, multilevel impact of both the SARS-CoV-2 virus and the measures taken to contain the pandemic it caused are too complex to be completely addressed without a deeper dive into the plethora of Covid-19–related moral questions.

To support such comprehensive efforts, we do provide an [Appendix](#) with a value-based topic list that allows health care leaders to systematically analyze ethical issues arising in their institutions. In addition, we suggest an open-source digital topic tracker as a means of tackling the exploding volume of literature in bioethics, allowing for quick overview of thematic priorities and gaps in the existing literature. One day, hopefully in the not-too-distant future, we will be looking back at the pandemic and trying to understand how well we performed. This assessment should not be limited to parameters such as excess mortality, but also include questions such as: How well did we handle ethical issues that arose? How well did we protect and care for our citizens, in particular the vulnerable and underprivileged? Did we manage to strengthen our democracies and the confidence of our citizens? Have we understood how we can build resilient institutions and societies that can withstand crises? This questioning will have a fundamental value, not only as a retrospective evaluation, but most important as a prospective set of lessons to keep in mind not to be unprepared for future crises.

The Covid-19 pandemic is a huge challenge for health care professionals and leaders. To keep a clear and current overview of this moving target, we propose a value-based topic list centered around five core moral values that are unlikely to change over time: autonomy, privacy, equity, proportionality, and trust. As they play a pro-ethical role in pursuing justice — intended as fairness¹ — acknowledging these core moral values and their role in pandemic management is a way to guarantee that even in a time of crisis, when it is easy to be driven only by urgency and epidemiological metrics, liberal democracies stay true to their foundational values. Our value-based topic list will allow health care leaders to systematically analyze ethical issues as they arise in their institutions.

The Covid-19 Core Five Ethical Issues

Autonomy: The Role of Autonomy, Individual Rights, and Freedom in a Pandemic

Individuals around the globe have been subjected to serious restrictions of their liberties: quarantine requirements, closed borders, and curfews have limited our ability to move freely; events and gatherings including political demonstrations have been banned; we have been denied access to visit family members even when they were seriously sick or dying; we have been required to reveal personal information (for instance, when going to a restaurant) to enable contact tracing; we have been required to wear masks; and many have not been able to attend schools or go to

work.^{2,3} Vaccine mandates have been discussed and, in some countries, applied⁴; and nudging strategies, such as limiting access to public spaces or facilities to vaccinated individuals, have been enforced, not without controversy.⁵

All of this has happened, of course, for good reason. Still, there is some uneasiness around the sudden — albeit temporary — loss of personal liberties that had been taken for granted by citizens in many countries. Careful legitimization of restrictions as subsidiary to individual responsibility and restoration of civil liberties as soon as possible will be important from an ethical and human rights perspective.^{6,7}

“ *One day, hopefully in the not-too-distant future, we will be looking back at the pandemic and trying to understand how well we performed. This assessment should not be limited to parameters such as excess mortality.* ”

Consider the example of weighing one’s individual freedom and autonomous choice against the public health concerns surrounding vaccination against Covid-19. Whereas the speed with which vaccines have been developed surpassed most people’s expectations, there is surprisingly widespread hesitancy to get vaccinated.^{5,8-10} For some, this hesitancy may be rooted in a principled anti-vax stance, while others may be skeptical because of the great speed with which vaccines were tested and approved.¹¹⁻¹³ Whereas an argument can be made for every person to carry a responsibility to contribute to herd immunity through mass vaccination of individuals, matters get even more acute in the case of health care workers. Interestingly, early on, in March 2021, among surveyed U.S. frontline health care workers, this group, which not only was particularly exposed to the virus, but also at risk of spreading the disease among vulnerable patients, seemed to be in large part unwilling to receive the vaccine.¹⁴

There is a spectrum of possible responses from acceptance of refusals to nudging to indirect pressure (e.g., vaccination requirement for certain activities) to compulsory vaccinations. Finding the least invasive measure that is still effective enough to protect the health patients will be a task that needs to be tackled in the context of national regulations, considering a range of empirical factors, including the urgency of the intervention, the availability of alternatives, and likely reactions.

Privacy: Personal Privacy versus Efficient and Effective Pandemic management

A second set of ethical issues revolves around privacy, another core value in liberal democracies. The availability of data is key to fight a pandemic. Very different kinds of data can be helpful to understand the impact of the pandemic and the measures taken to contain it on population groups.¹⁵ Among those data are, for instance, proximity and contact tracing, flow modelling, and quarantine compliance. Proximity and contact tracing is a way of trying to follow and break infection chains. Tracing apps were developed in many countries, requiring difficult trade-offs between effectiveness and data protection and thorough pondering of potential risks, such as

repurposing of the tracing systems or of the data after the pandemic, data access, possibilities of re-identification using collateral datasets, security vulnerabilities, and (im)possibility to withdraw consent and erase personal data.^{16,17} But again, voluntary uptake of the apps was not overwhelming in many countries.¹⁸⁻²⁰ Indeed, the voluntary use of a tracking device presupposes significant trust not only in the technology, but also in the government and other players who may access the data. This trust might be put at risk if choice architecture is used to make people use such tools (e.g., through opt-out schemes) against their conviction.

Ethical questions such as “Should police enter a home against residents’ will if they suspect a gathering with more than the permitted number of participants?” can also emerge in low-tech settings. However, digitalization has greatly enhanced the potential for effective surveillance, for instance, using Internet of Things (IoT) devices for live tracking, employing personal movement data to model potential disease activity, tasking AI applications with detection of Covid-19 from chest imaging,^{21,22} or even using robotic dogs to enforce social distancing.²³ In analogy to restriction of autonomy and individual freedom, privacy intrusions need to be very carefully justified, transparently communicated, secured against abuse, and abolished as soon as no longer required. Finally, as emerged from a recent study on no-green-pass groups (opposed to mandatory health pass use), a clear communication on the scope, duration, and limitation of measures that compress the space of individual privacy could be a crucial factor to improve the uptake of these measures.⁵

“ *We propose a value-based topic list centered around five core moral values that are unlikely to change over time: autonomy, privacy, equity, proportionality, and trust.* ”

Equity: Finding Fairness and Solidarity Under Conditions of Resource Scarcity

From an ethical point of view, it seems fairly straightforward that ending a pandemic requires global cooperation and that scarce resources should be allocated according to need. Equitable distribution of resources such as vaccines or intensive care beds (and equitable access) plays a role at every level, from local to global. Yet, it has proven a highly complex issue.²⁴ Over the course of the pandemic, numerous guidelines have been developed that define allocation criteria and procedural rules.²⁵ Key considerations that have emerged relate to maximizing utility, nondiscrimination, fairness, and protection of vulnerable groups.

In 2022, the struggles regarding the distribution of still-scarce vaccines show that implementation of seemingly simple rules and criteria is not easy in real life. Although an international mechanism for the global distribution of vaccines has been established,^{26,27} governments are securing supplies through bilateral agreements with pharmaceutical companies. While the vaccine stock of some countries by far exceeded their need, others were unable to start vaccination programs due to a lack of vaccines.^{13,28,29} Whereas moral consensus can easily be reached that hoarding is not defensible in the face of resource scarcity, there is a lively ongoing debate between nationalist and cosmopolitan views. A further level of complexity is added by the fact that not all vaccines are

equally safe, effective, and easy to transport and store. The debate is fueled by the expectation that vaccinated individuals or societies will have restrictions lifted and go back to normal more quickly than those not protected by a vaccine. Given the tremendous societal and economic impact of measures such as closed shops and travel restrictions, the speed of vaccination administration is highly significant for many countries.

Proportionality: Assessment of Measures, Legitimation and Procedures

Governments struggle with the giant task of how best to maneuver through the crisis. There are different perspectives on how much of a top-down approach is needed, how much controversy can be afforded, and to what extent citizens should be involved in evaluating and prioritizing options. It has become clear, however, that building resilience involves a multilevel network of interconnected drivers and health, social, economic, and environmental systems and — at least in democratic societies — needs to rely on participation, communication, coordination, learning, and polycentricity as governance principles.³⁰

How proportionality is to be established in concrete cases — e.g., such as shutting down hotels based on a certain incidence level — is a question that is intensely debated among legal scholars. Although the issue is disputed,³¹ there are voices from within the academic community in various countries who question the proportionality of protracted lockdowns, contending that such actions may eventually cause comparable or even greater damage to populations than the pandemic would have had.³²⁻³⁴ How proportionality should be established, by whom, and according to which criteria and procedure is a field of contention. In bioethics, there is a clear distinction between the descriptive and normative level, i.e., it is not given that *what people believe* is, per se, *the right thing to do*. Nevertheless, empirical data collected through citizen science approaches can greatly contribute to informing this debate with contextual information, e.g., on acceptability thresholds.

Trust: Establish and Maintain Trust and Trustworthiness

The pandemic and its management have put high demands on public trust. Particularly in the early phase, little evidence was available on crucial matters such as infection rate, available treatment, effective preventive measures, case fatality rate, or risk factors. The paucity of high-quality evidence contrasted with the abundance of mis- and disinformation, especially on social media.³⁵⁻³⁷ At the same time, the pandemic and subsequent public health measures have severely affected the lives of most people around the globe. Crisis communication, therefore, plays a key role in maintaining trust and enhancing the likelihood of compliance with hygiene and other rules.

“

In 2022, the struggles regarding the distribution of still-scarce vaccines show that implementation of seemingly simple rules and criteria is not easy in real life.”

Communication, however, has tended to be quite directive and unilateral. Whereas this tactic may have been appropriate in the early phase of the pandemic, a more bidirectional approach is

needed in the longer run. Not only do citizens need to know what health authorities want them to do, but health authorities also need to know how citizens perceive the situation, how they react emotionally, how they are likely going to behave, and what stance they take on moral questions such as the allocation of scarce vaccines. Such a nuanced, comprehensive understanding is necessary to tailor information and policy responses. Again, digitalization provides excellent opportunities to build interactive platforms that allow for real-time analyses.³⁸

Trust, however, is only a good if it is justified. Authorities should, therefore, not only try to obtain citizens' trust, but to also deserve it as trustworthy institutions doing their best at correctly informing them; this can be done by devising appropriate measures that take into account what parts of the population will be affected and how, and ensuring conflicts of interest do not get in the way of the overall aim of reducing the harm caused by the pandemic — either directly, through its health impact, or indirectly, through measures taken to contain it. An important challenge for authorities relates to the question of how to deal with radical dissenters who might influence others with unfounded conspiracy theories and open opposition to public health measures. Although certain measures might be justified to maintain public order, oppressing diversity of opinion through overreaching censorship might encourage societal polarization. Prudent judgment must be in place to respect freedom of expression without compromising social stability.

A Covid-19 Value-Based Ethics Topic List

Although we are confident that we have captured key values and moral tensions exemplified by concrete examples, we do see some added value in ongoing systematic review of the published international literature (in English) to get a sense of where priorities have emerged, and to investigate which topics may have received less attention. Our goal is to complement the theoretical reflection from which we developed the Core Five with a topic list of concrete issues in which those five enduring values play a pivotal role. As health care leaders need to keep abreast of their Covid-19 management, and issues have become so manifold, it is important to keep an overview that may guide appropriate modifications. Therefore, we propose an up-to-date analysis of current issues structured around the Core Five, generated through an innovative digital tool.

This approach has an important added value: This analysis can be rapidly and dynamically updated with a rerun and re-analysis of the same queries, a crucial feature when dealing with fast-paced situations subject to rapid evolution — as proven by the sheer number of papers captured by our queries.

“*Our goal is to complement the theoretical reflection from which we developed the Core Five with a topic list of concrete issues in which those five enduring values play a pivotal role.*”

Table 1. Total Count of Published Studies Related to Core Five Enduring Values, Identified by Keywords and MeSH Terms Using the TopicTracker Tool, January 2019 – March 2022

Query	Papers
The role of autonomy, rights, and freedom in a pandemic	2,215
Privacy versus efficient and effective pandemic management	895
Equity, fairness, and solidarity under conditions of resource scarcity	2,659
Proportionality of measures: legitimization and procedures	55
Trust and trustworthiness	2,311

Note: Search of PubMed for studies published between January 2019 and March 2022. Normalized all the frequencies by dividing the count per year by the number of articles published in the same year captured by the query. Source: The authors

The TopicTracker: Navigating through the Flood

For this purpose, we have developed a digital tool to search, download, and explore PubMed entries. The TopicTracker is written in Python and structured in a collection of three Jupyter notebooks to provide together the code and its explanation. The first notebook allows the capability to build PubMed queries, download entries, parse them, and save the results. The output of the first notebook can be explored with the second and third notebooks of this collection. The second notebook allows the tool to perform simple natural language processing analysis on the trends of entities (keywords, MeSH terms, authors, journals, lemmas in title/abstract, number of conflict-of-interest (COI) statements, lemma trends in COI statements). The third notebook allows fully interactive exploration of the data sets preprocessed with the second notebook. The whole package is available through the Zenodo repository under a Creative Commons Attribution 4.0 International license.³⁹

Strategy

To determine the core areas of discussion about the interplay between the Core Five and the Covid-19 pandemic, we ran a set of five queries in the TopicTracker ([Appendix](#), TopicTracker Search Strategies). Each query collects articles regarding Covid-19 and one of the Core Five Enduring Values, published between January 2019 and March 2022. Medline files resulting from the queries and TopicTracker logs are available for further research ([Appendix](#), Multimedia).⁴⁰

To develop a dynamic topic list, we focused our analysis on keywords and MeSH terms. To correct for the different number of publications per year (especially keeping in mind that the query has been run in March 2022) we normalized all the frequencies dividing the count per year by the number of articles published in the same year captured by the query. Keywords and MeSH terms cannot be duplicated, so they can be understood as percentages (100% = every article uses that keyword/MeSH term).

Results

Although we consider each of the Core Five Enduring Values of equal importance, some topics appear to be more discussed than others, suggesting that in some specific areas further research is needed, especially on proportionality and on privacy (Table 1).

Detailed output (normalized data frames of keywords and MeSH terms, word clouds, and plots of the top 5 entities in each data frame) is provided for further analysis ([Appendix](#), [Multimedia](#)).⁴⁰

Covid 19: A Catastrophe and a Chance to Learn

Someday, soon we hope, we all will be looking back at the Covid-19 pandemic to consider how well we performed. Standard metrics such as excess mortality will be relevant, of course, but it is important for health care leaders to assess our moral and ethical response. The Core Five Enduring Values List and the TopicTracker serve as useful tools to support not only a retrospective evaluation but, importantly, as a prospective set of lessons to keep in mind for future crises.

Tackling the pandemic requires the cooperation of many actors — health care institutions, governments, citizens, international organizations, companies, and others. Working toward a joint understanding of who carries what responsibility to uphold our ethical core values and to resolve unavoidable moral tension and disagreement will help us to improve our pandemic preparedness so we can look confidently ahead. Smart digital tools can support leaders and decision-makers in keeping track of emerging ethical issues even when times become particularly challenging.

Nikola Biller-Andorno, Dr Med, Dr Phil, MHBA

Director, Institute of Biomedical Ethics and Professor, History of Medicine, University of Zurich, Switzerland Vice-President, Clinical Ethics Committee, University Hospital Zurich, Switzerland

Giovanni Spitale, MA

Research Data Manager, Institute of Biomedical Ethics, University of Zurich, Switzerland
[TopicTracker Search Strategies and Word Cloud Exhibits](#)

Disclosures: Nikola Biller-Andorno and Giovanni Spitale have nothing to disclose.

References

1. Rawls J. Justice as fairness: political not metaphysical. *Philos Public Aff.* 1985;14(6):223-51
2. Secretary General of the Council of Europe. The impact of the sanitary crisis on freedom of expression and media freedom. July 7, 2020. Accessed August 1, 2022. <https://rm.coe.int/16809ef1c7>.
3. Secretary General of the Council of Europe. Respecting democracy, rule of law and human rights in the framework of the COVID-19 sanitary crisis: A toolkit for member states. April 7, 2020. Accessed August 1, 2022. <https://rm.coe.int/sg-inf-2020-11-respecting-democracy-rule-of-law-and-human-rights-in-th/16809e1f40>.
4. Druml C, Czech H. A pandemic is no private matter: the COVID-19 vaccine mandate in Austria. *Lancet Respir Med.* 2022;10(6):322-4
5. Spitale G, Biller-Andorno N, Germani F. Concerns around opposition to the green pass in Italy: social listening analysis by using a mixed methods approach. *J Med Internet Res.*

6. Studdert DM, Hall MA. Disease control, civil liberties, and mass testing — calibrating restrictions during the Covid-19 Pandemic. *N Engl J Med.* 2020;383(6):102-4
7. Flood CM, MacDonnell V, Thomas B, Wilson K. Reconciling civil liberties and public health in the response to COVID-19. *FACETS.* November 12, 2020. <https://www.facetsjournal.com/doi/10.1139/facets-2020-0070>.
8. Barello S, Nania T, Dellafiore F, Graffigna G, Caruso R. ‘Vaccine hesitancy’ among university students in Italy during the COVID-19 pandemic. *Eur J Epidemiol.* 2020;35(6):781-3
9. Peretti-Watel P, Seror V, Cortaredona S. A future vaccination campaign against COVID-19 at risk of vaccine hesitancy and politicisation. *Lancet Infect Dis.* 2020;20(6):769-70
10. Dror AA, Eisenbach N, Taiber S. Vaccine hesitancy: the next challenge in the fight against COVID-19. *Eur J Epidemiol.* 2020;35(6):775-9
11. Murphy J, Vallières F, Bentall RP. Psychological characteristics associated with COVID-19 vaccine hesitancy and resistance in Ireland and the United Kingdom. *Nat Commun.*
12. Puri N, Coomes EA, Haghbayan H, Gunaratne K. Social media and vaccine hesitancy: new updates for the era of COVID-19 and globalized infectious diseases. *Hum Vaccin Immunother.* 2020;16(6):2586-93
13. Wouters OJ, Shadlen KC, Salcher-Konrad M. Challenges in ensuring global access to COVID-19 vaccines: production, affordability, allocation, and deployment. *Lancet.* 2021;397(6):1023-34
14. Kirzinger A, Kearney A, Hamel L, Brodie M. KFF/The Washington Post Frontline Health Care Workers Survey. Kaiser Family Foundation. April 6, 2021. Accessed June 19, 2022. <https://www.kff.org/coronavirus-covid-19/poll-finding/kff-washington-post-health-care-workers/>.
15. Gasser U, Ienca M, Scheibner J, Sleigh J, Vayena E. Digital tools against COVID-19: taxonomy, ethical challenges, and navigation aid. *Lancet Digit Health.* 2020;2(6):e425-34
16. Ahmed N, Michelin RA, Xue W. A survey of COVID-19 contact tracing apps. *IEEE Access.* 2020;8(6):134577-601
17. Braithwaite I, Callender T, Bullock M, Aldridge RW. Automated and partly automated contact tracing: a systematic review to inform the control of COVID-19. *Lancet Digi Health* 2020;2:e607-e621. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7438082/>.
18. Walrave M, Waeterloos C, Ponnet K. Adoption of a contact tracing app for containing COVID-19: a health belief model approach. *JMIR Public Health Surveill.*
19. Munzert S, Selb P, Gohdes A, Stoetzer LF, Lowe W. Tracking and promoting the usage of a COVID-19 contact tracing app. *Nat Hum Behav.* 2021;5(6):247-55

20. Jonker M, de Bekker-Grob E, Veldwijk J, Goossens L, Bour S, Rutten-Van Mölken M. COVID-19 contact tracing apps: predicted uptake in the Netherlands based on a discrete choice experiment. *JMIR Mhealth Uhealth*.
21. Ting DSW, Carin L, Dzau V, Wong TY. Digital technology and COVID-19. *Nat Med*. 2020;26(6):459-61
22. Budd J, Miller BS, Manning EM. Digital technologies in the public-health response to COVID-19. *Nat Med*. 2020;26(6):1183-92
23. Nalewicki J. Singapore Is Using a Robotic Dog to Enforce Proper Social Distancing During COVID-19. *Smithsonian Magazine*. May 21, 2020. Accessed August 1, 2022. <https://www.smithsonianmag.com/smart-news/singapore-using-robotic-dog-enforce-proper-social-distancing-during-covid-19-180974912/>.
24. Holzer F, Luna F, Manriquez T, Biller-Andorno N. A matter of priority: equitable access to COVID-19 vaccines. *Swiss Med Wkly*.
25. Jöbges S, Vinay R, Luyckx VA, Biller-Andorno N. Recommendations on COVID-19 triage: international comparison and ethical analysis. *Bioethics*. 2020;34(6):948-59
26. World Health Organization. COVAX: Working for global equitable access to COVID-19 vaccines. 2022. Accessed August 1, 2022. <https://www.who.int/initiatives/act-accelerator/covax>.
27. World Health Organization. COVAX: The vaccines pillar of the access to COVID-19 tools (ACT) Accelerator. November 9, 2020. Accessed June 19, 2022. [https://www.who.int/publications/m/item/covax-the-vaccines-pillar-of-the-access-to-covid-19-tools-\(act\)-accelerator](https://www.who.int/publications/m/item/covax-the-vaccines-pillar-of-the-access-to-covid-19-tools-(act)-accelerator).
28. Coalition for Epidemic Preparedness Innovations. CEPI COVID-19: Manufacturing Survey Results Analysis. June 29, 2020. Accessed August 1, 2022. https://cepi.net/wp-content/uploads/2020/08/CEPI-Survey-of-global-drug-substance-and-drug-product-landscape-June-2020_RELEASED-1.pdf.
29. Khamsi R. If a coronavirus vaccine arrives, can the world make enough? *Nature*. 2020;580(6):578-80
30. Antulov-Fantulin N, Biller-Andorno N, Böttcher L, et al. Building societal resilience to COVID-19 and future pandemics: a synthesis of the literature and a governance framework for action. *Geneva Science-Policy Interface*. Preprint. January 2021. https://www.researchgate.net/profile/Didier-Wernli/publication/348333495_Building_societal_resilience_to_COVID-19_and_future_pandemics_a_synthesis_of_the_literature_and_a_governance_framework_for_action/links/5ff85a49299bf140887e15d2/Building-societal-re.
31. Prati G, Mancini AD. The psychological impact of COVID-19 pandemic lockdowns: a review and meta-analysis of longitudinal studies and natural experiments. *Psychol Med*. 2021;51(6):201-11
32. Luo M, Guo L, Yu M, Jiang W, Wang H. The psychological and mental impact of coronavirus disease 2019 (COVID-19) on medical staff and general public - A systematic review and meta-analysis. *Psychiatry Res*.

33. Salari N, Hosseini-Far A, Jalali R. Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: a systematic review and meta-analysis. *Global Health*.
34. Vindegaard N, Benros ME. COVID-19 pandemic and mental health consequences: Systematic review of the current evidence. *Brain Behav Immun*. 2020;89(6):531-42
35. World Health Organization. Coronavirus disease (COVID-19) advice for the public: Mythbusters. January 19, 2022. Accessed August 1, 2022. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public/myth-busters>.
36. World Health Organization. Novel Coronavirus(2019-nCoV) Situation Report – 13. February 2, 2020. Accessed August 1, 2022. <https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200202-sitrep-13-ncov-v3.pdf>.
37. Gallotti R, Valle F, Castaldo N, Sacco P, De Domenico M. Assessing the risks of ‘infodemics’ in response to COVID-19 epidemics. *Nat Hum Behav*. 2020;4(6):1285-93
38. Spitale G, Merten S, Jafflin K, Schwind B, Kaiser-Grolimund A, Biller-Andorno N. [Protocol] PubliCo. A new risk and crisis communication platform to bridge the gap between policy makers and the public in the context of the COVID-19 crisis. Zenodo. November 30, 2020. <https://zenodo.org/record/4551386#.YrBWmOzMJPY>.
39. Spitale G, Biller-Andorno N. TopicTracker: a Python pipeline to search, download and explore PubMed entries. (1.3.0). Zenodo. February 8, 2021.
40. Spitale G, Biller-Andorno N. TopicTracker Medline files and query logs generated retrieving papers on autonomy, equity, privacy, proportionality and trust in the context of Covid-19 [Data set]. Zenodo. June 24, 2022.