PoliMap: A taxonomy proposal for mapping and understanding the global policy response to COVID-19

The COVID-19 PoliMap collaborating group (see Annex 1 for the authors' affiliations):

Sebastián Peña, Cristóbal Cuadrado, Ariadne Rivera-Aguirre, Rebecca Hasdell, José Ignacio Nazif-Munoz, Mohamed Yusuf, Felipe Vera, Jaime Peña, Hugo Vásquez, Marjorie Borgeat, Francisco Valenzuela, Mauricio Soto, José Incio, Cecilia Castillo, Diego Moreno, Gabriel Carrasco-Escobar, Andrés Vecino, Macarena Martínez, Sol Hersh, Cristian González, María Jesús Vega, Jaime Jiménez Pernet, Arianna Maever L. Amit, Maja Nikšić, Omar El-Shahawy, Julius Otis, Francisco Espinoza, Lizbeth Tolentino-Mayo, Jerusa Brignardello, Fernanda Gutiérrez, Mauricio Duarte, Fernanda Cimini, Claudia Sanhueza, María S Martínez-Gutierrez, J. Jaime Miranda

Corresponding author:

Sebastián Peña

Finnish Institute for Health and Welfare

Mannerheimintie 166

Helsinki

FINLAND

sebastian.pena.fajuri@thl.fi

Abstract

The Coronavirus disease 2019 (COVID-19) pandemic is challenging societies, governments and economies at an unprecedented scale. Policy responses to face the epidemic virus had varied greatly among countries, from massive testing, large scale lockdowns to more voluntary approaches for social distancing. The analysis of such policies has been framed mainly with the sole aim of reducing virus transmission (“Flatten the curve” strategies), such as suppression and mitigation approaches.

In this article, we argue that the overarching goal of the policy response should not be reducing the viral spread but to ultimately reduce the negative impacts on health and wellbeing of the COVID-19 pandemic. This requires not only interventions to reduce virus transmission, but also policies aimed at increasing the capacity of the health system’s response (“Raising the line” strategies), mitigating the negative consequences of the epidemic and potential adverse effects of interventions to tackle the outbreak (Mitigation strategies) and increasing governmental capacities to respond to the crisis (Strengthening Governance strategies). We propose PoliMap, a comprehensive taxonomy addressing these four policy domains. We present an overview of potential policies in each domain and discuss cross-cutting dimensions of policy responses as the dynamic nature of policymaking, alignment of policy responses at different levels, types of policy instruments, coverage of interventions and gendered-impact of policies. This taxonomy could be used to systematically map, monitor and compare policy responses across countries and over time, in conjunction with morbidity, mortality and demographic data, used to obtain a broad view of the societal effects of COVID-19 pandemic.

What was already known about the topic concerned

The COVID-19 pandemic has served as a litmus test for public health and health systems worldwide. Existing literature has focused on the strategies to reduce viral transmission, yet these strategies do not reflect the wide-ranging objectives of the policy instruments that countries have deployed.

What new knowledge the manuscript contributes

We argue for the need to shift the focus from reducing the viral transmission to reducing the negative impact on population health and wellbeing of the pandemic. We propose a taxonomy that allows a comprehensive mapping of policy responses to COVID-19 pandemic. The taxonomy is structured in four domains: policies aimed at reducing viral transmission (“flattening the curve” strategies), policies aimed at increasing the capacity of the health system’s response (“raising the line” strategies), policies aimed at mitigating the negative consequences of the epidemic and potential adverse effects of interventions to tackle the outbreak and policies aimed at strengthening governance.

Introduction

The Coronavirus disease 2019 (COVID-19) pandemic is rapidly spreading throughout the world. The SARS-CoV-2, a novel enveloped RNA coronavirus, was initially identified after exposure to live animals at the Seafood Wholesale Market in Wuhan, Hubei province, China.¹ The first known cases of pneumonia of unknown origin were reported on December 31, 2019,² followed by a rapid increase in the Hubei province in China during the first weeks of January 2020, expanding in continental China and neighbouring countries. By 15 January, there were reported cases in Thailand and Japan.³ The first case in Europe was reported in Bordeaux, France on 24 January, 2020, then spread rapidly in Italy, Spain and France. The World Health Organization declared COVID-19 a public health emergency of international concern on January 30, 2020⁴ and a pandemic on March 11, 2020.⁵ As to 12 April 2020, there are 1,807,939 cases and 112,241 deaths worldwide.⁶

The COVID-19 pandemic has served as a litmus test for public health and health systems worldwide. The initial policy responses to contain the virus varied greatly in different Asian countries, ranging from large scale lockdowns (as in Wuhan, China)⁷ to mass testing to identify, isolate and track patients infected with SARS-CoV-2 (as in South Korea).⁸ National policy responses in the rest of the world have been heterogeneous, while some countries apply statutory policies (e.g. Italy and Spain), others follow a voluntary approach (e.g. Sweden and Mexico). Policy responses in the US and the UK have been framed as a choice between two fundamental strategies: suppression versus mitigation.⁹ However, these strategies do not reflect the wide-ranging objectives of the policy instruments that countries

have deployed, with different intensities and at different points in the evolution of the pandemic. This suppression vs mitigation approach assumes that the sole goal of policy responses is to reduce virus transmission, frequently measured as the number of secondary cases each infected person generates (the reproduction number R_0), without considering relevant interventions aimed to increase health systems' capacity to meet the increasing demand for healthcare. As an example, heavily affected countries, such as China, Italy and Spain, combined public health measures to reduce virus transmission with policy responses to strengthen their health systems' capacity such as the creation of temporary hospitals¹⁰ or constructing new hospitals,¹¹ transform operation theatres into intensive care units (ICUs)¹² or recruit medical students to increase the availability of healthcare workers.¹³

Countries are also concerned about the wider negative impact of the epidemic and the unintended consequences of the interventions aimed to reduce viral transmission, many of whom are shouldered by large portions of society. The COVID-19 pandemic is starting to show negative consequences on the economy and it is anticipated that economic slowdown will impact a range of psycho-social determinants of health.^{14, 15} To buffer the negative impact of the COVID-19 epidemic on the economy, countries have started deploying important fiscal stimulus packages, among other policies, as an integral part of the response to the epidemic. Finally, responding to a large-scale public health emergency also requires countries to concentrate or delegate power, as needed, to streamline decision-making,¹⁶ increase or reallocate resources and build trust through establishing reliable communication channels and accountability mechanisms with their citizens.¹⁷

Whilst the scientific community strives to find effective treatments for COVID-19, it has also the imperative to map and characterize the diversity of policy responses, so that adequate information and lessons learnt can be shared with policymakers facing different stages of the epidemic. In this article, we propose a taxonomy to classify policy responses considering the wide variety of policies countries may adopt to alleviate the effects of the epidemic. We shift from a narrower focus aimed at reducing the viral transmission to a broader perspective that seeks to minimize the negative impacts of the pandemic on health and wellbeing of the population. We reframe the problem from an infectious disease dynamic to a complex society-wide challenge. Our proposed taxonomy has four core domains: interventions to reduce viral transmission (“flatten the curve” strategies); interventions to improve the health systems’ capacity (“raise the line” strategies); interventions to mitigate the negative consequences of the pandemic and the interventions (mitigation strategies); and governance interventions to increase their power, resources and streamline decision-making (strengthening governance strategies). In so doing, we contribute to advancing the field of public health moving beyond anecdotal responses towards tools where comparative approaches of policies can be considered, and also to support the future evaluation of such responses.

The taxonomy

Development process

We draw on concepts derived from the infectious diseases literature, epidemiology, health services, social and political sciences. Our starting point was the guidance on

nonpharmaceutical interventions provided by the Center for Disease Control (CDC)^{18, 19} and the World Health Organization for the influenza pandemic.²⁰ Both organizations emphasise the need to slow the acceleration of the number of cases and reduce the peak number of cases, to prevent a strain in the health system due to a sudden rise in demand for hospitalizations and health care. The goal is to shift the distribution from a narrow curve with a high peak to a flatter curve where new cases are distributed in a longer period (i.e. “flatten the curve” interventions). The impact of these interventions is dynamic and depends on the prevention, detection and response capacity, as well as the organization of health care.²¹ Additionally, health systems are resilient and, at a certain degree, can adapt to emerging situations. Therefore, it is possible to increase the health systems’ capacity to care for a concurrent maximum number of cases (i.e. “raise the line”).^{22, 23}

These aforementioned strategies are implemented in a wider and complex social, political, economic and cultural environment. Governments seek for a balance between the effectiveness of the interventions to reduce viral spread and the potential negative economic, political and social consequences of the epidemic and of the interventions on societal wellbeing.^{24, 25} **Figure 1** displays the proposed taxonomy as two triangles. The first triangle has the domains to reduce viral transmission, increase the health system’s capacity and mitigation of negative consequences. These are forces to reduce the negative impact on health and wellbeing and to address social determinants of health which place some populations at increased risk of infection. A second triangle represents governance as a contributory force that facilitates policy change and implementation over the other three domains.

We developed this taxonomy following a three-step process. First, we identified relevant literature using a search strategy oriented towards a rapid overview of previous taxonomies and frameworks to analyze infectious disease control policies [MEDLINE/PubMed ("infectious diseases" OR "epidemic" OR "outbreak") AND polic* AND (framework OR taxonomy)] limited to title and abstract and with no date restrictions). We consulted emergent documents from international organizations such as OECD, WHO, IMF on policy responses to COVID-19 pandemic.^{14, 26-28} From this evidence, a first draft of the taxonomy was proposed by an iterative process conducted by authors with experience in health policy and health systems research (SP, CC, SM, JJM). The taxonomy was then tested by a group of ten authors (SP, CC, FV, MS, MB, AR-A, FV, DM, JI, HS) who identified and reviewed official policy documents on national responses implemented in nine countries or territories (Argentina, Chile, Finland, Mexico, New Zealand, Peru, Canada [Quebec], Spain, United Kingdom). All policy interventions occurred between 1 January and 1 April in the context of the COVID-19 pandemic response. Finally, based on the experience of this pilot implementation, authors proposed changes to the framework and a new round of revision followed to ensure that the domains and subdomains adequately represented the variety of policies observed.

Shifting the focus to wider policy-making objectives: The four domains

The COVID-19 epidemic forced countries to respond under high levels of uncertainty. These decisions, however, were likely constrained to the political environment, economic conditions and social and cultural preferences. Governments have to consider the most

effective ways to reduce viral transmission, the negative consequences of the virus on health, and ways to reduce the negative impacts of potential interventions (e.g. unemployment or mental health).²² Facing the menace of a catastrophic global pandemic such as the 1918 influenza pandemic, governments are expected to provide timely evidence-based policies to protect populations' health and wellbeing. We identified four main domains where the wide variety of policy interventions implemented at national and subnational levels can be classified as follows.

Flattening the curve

These policies aimed at reducing viral transmission. We departed from existing classifications based on ecological levels^{18, 20} and instead used the “Susceptible-Exposed-Infectious-Removed” (SEIR) framework^{29, 30} to characterise the different infection status. Interventions to flatten the curve included actions to protect susceptible populations from viral exposure (i.e. restrictions to mobility, social distancing, individual hygienic measures, public space hygienic measures), identify exposed contacts and prevent potential recurrent exposure (i.e. case isolation, tracing and quarantines of contacts) to the early identification of the infected population (i.e. active screening strategies, reducing financial barriers for testing). We specifically included interventions to improve adherence to quarantine and identification of contact and case management, as these are policy tools that can potentially improve their effectiveness (**Table 1**). These measures may also address the socioeconomic disparities for adhering to social distancing measures and ultimately benefit suppression efforts by providing the resources required to follow guidelines.³¹

Raising the line

These policies aim at increasing the capacity of the health care system to deliver quality care to COVID-19 patients. We structured this domain drawing on Donabedian's (1980) structure-process-outcome framework of quality of health care.³² We classified structure interventions into those that expand infrastructure and technologies (i.e. testing capacity, intensive care units) and human resources (i.e. recruitment of new personnel, protect health personnel from virus exposure)³³ and process interventions to improve health delivery arrangements (i.e. treatment protocols, reorientation of non-essential services and new methods of delivery and organization).

Mitigating the negative impacts

Mitigation addresses a set of policies aiming to minimize the negative consequences of the epidemic and potential adverse effects of interventions to tackle the outbreak across sectors and not limited to health. Potential negative consequences of the epidemic such as an increase in educational inequalities,³⁴ unemployment,³⁵ food insecurity²⁴, economic recession³⁶ and financial and monetary instability¹⁴ can be counteracted by interventions that provide direct economic and social assistance (i.e. public subsidies to wages, access to pension funds, control prices and/or distribution of goods), protection of households' budget (i.e. direct subsidies, vouchers or postponing payments), reduce uncertainty for workers (i.e. restrictions for the layoff of workers) or liquidity to the markets or economic sectors (i.e. emergency rescue packages).³⁷

Strengthening governance

The last domain corresponds to an overarching dimension related to the institutional capacity to effectively and efficiently respond to the epidemic. We incorporated interventions that increase the efficacy and delegation of power of the government (i.e. streamline decision-making),¹⁶ align different actors (i.e. establishing processes for community participation in decision-making), ensure the availability of required resources (i.e. fiscal measures)¹⁴ and build trust through information sharing and accountability mechanisms.³⁸ All these actions are designed to contribute to the effective implementation of needed policies from the previous domains.

Cross-cutting dimensions

We incorporate four cross-cutting dimensions in the policy-making process that complement the taxonomy of policy responses and are critical to understanding the potential effects on the viral spread as well as the societal effects of the COVID-19 pandemic (see **Table 2**).

Dynamic nature of policymaking

Policy-making is a dynamic endeavour, however, it typically occurs over long time-frames. The current public health emergency presents a unique challenge to the policy-making process. To use Kingdon's terminology,³⁹ rapid alignment has occurred between problems, policies, and politics that opens windows of opportunity for policy-change. During the pandemic, most societies are willing to provide the State with an exceptional amount of

power to restrict the citizens' civil rights, including freedom of movement or the right to education and health care.¹⁶ The debate over which policy responses to choose has been often heated.^{40, 41} In this context, understanding the evolution of policies which are rapidly evolving is as critical as classifying them appropriately.

Alignment of policy responses at different levels of implementation

Examining policy responses for COVID-19 should take into account different levels of decision-making. Subnational levels, such as states, regions, municipalities, cities or districts, have jurisdiction to introduce interventions to curb the pandemic. For example, national governments may direct citizens to stay at home, while measures to restrict access to collective infrastructure (e.g. parks) or to determine essential services are often implemented through local ordinances. Policies can also be misaligned between national and subnational levels⁴² and there can be conflicting advice to the population emerging from the national and subnational levels due to divergent perceptions about the risks or speed of the epidemic, different perceptions of the negative consequences or resistance due to decisions at the national level that have an economic impact at the subnational level.

Different types of policy instruments

Governments have a wide array of policy instruments at their disposal.⁴³ It is essential to take into account the type of policy instrument, as they often convey different incentives for behavioural change and levels of enforceability.^{44, 45} The NATO framework categorises instruments into those that deliver information or advice (nodality), regulatory measures (authority), financial incentives (treasury) and organizational change (organization).⁴⁴

While nodality measures are more often voluntary and regulatory measures are more often compulsory, the same policy response (e.g. self-isolation) can have a very different impact for societal wellbeing based on the regulatory approach adopted.

Coverage

Another dimension to take into account is the coverage of the policy. Policies that are universal (i.e. benefiting the whole population) or targeted (i.e. a certain population group) can produce widely different impacts. Targeted universalism tries to combine the best of both worlds: provide universal coverage of public policies while addressing baseline inequities to avoid leaving the most vulnerable groups behind.⁴⁶ There is consistent evidence for inequitable distribution in the conditions that promote wellbeing based on income, gender and race. The COVID-19 pandemic might result in an excessive burden of population groups that live in overcrowded conditions, lack access to personal hygiene measures or lack access to health care.⁴⁷ Moreover, policies to tackle the impact of the epidemic might have disproportionate negative consequences among those in precarious socioeconomic conditions, for example, in low-income countries or those with a large share of informal economy, where governmental social protection is non-existent, observing measures such as social-distancing may be a privilege that is reserved to those who are fortunate if no effective social protection is offered concomitantly³⁵

Gendered impact of policies

Some policies to tackle COVID-19 could affect men and women differently. Strict social distancing, for example, could result in a higher strain over mothers and wives who would

experience an increase in their daily demands,⁴⁸ or might experience a higher risk of domestic violence due to alcohol use by their partners.⁴⁸ Analyses of policies to tackle COVID-19 should take into account the potential disproportionate negative impact on women.⁴⁹

Discussion

In a rapidly changing environment, we proposed a comprehensive taxonomy to map and compare policy responses to reduce the negative impacts on health and wellbeing of the COVID-19 pandemic. Among its strengths, the taxonomy proposed could be used systematically to monitor policy responses across countries and over time, in conjunction with other cross-cutting morbidities, mortality and demographic data, used to obtain a broad view of the societal effects of COVID-19 pandemic. To do so, our group started an open crowdsourced data collection of policies implemented around the world based on this taxonomy (www.polimap.org). As such, PoliMap and the approach used can be a much-needed resource to learn for the ongoing and future pandemics. Understanding research done globally and its limitations and implications, what impact different policies produced, how interventions interact with each other and whether they are complementary, what can be considered a timely response and implementation considerations across context are high-priority future research efforts that could benefit from an integrated and comprehensive view of policy responses to COVID-19.

To capture the complexity of ongoing policies to tackle COVID-19 a comprehensive approach is needed. Some initiatives are already in place focusing primarily on the

macroeconomic repercussions of the pandemic and prioritizing a limited number of indicators [Cite OECD, Oxford indicators]. Our tool has the advantage of framing multiple angles relevant for policy-making and population wellbeing in general. We are also cognizant and aware that the proposed taxonomy can be improved as some policies may be adapted, enhanced or retired at any given time. In the same vein, the unintended consequences of certain policies may become more evident the longer the duration of certain responses, e.g. domestic violence and impairments to the mental health of populations. If anything, COVID-19 is calling for rapid decision making and PoliMap can support during the initial stages of the epidemic and evolve to better accommodate additional relevant indicators as the pandemic progresses, where anticipating to ‘newer’ challenges beyond the acute phase becomes necessary.

In summary, the COVID-19 pandemic has already triggered several policy responses worldwide, and a systematic characterization using the proposed taxonomy can be implemented through simple, real-time crowdsourcing efforts globally. A comprehensive approach such as PoliMap can serve decision-makers to consider the most adequate responses for their particular settings and overall to compare ongoing responses across countries.

Acknowledgements

The authors are thankful to other members of the COVID-19 PoliMap collaborative network for their overall contribution to the project: Andrea Albagli, Huyen Dinh Thi Thanh, Gary Asperas, Salah Daak, Sharon Kapambwe, Diggos Amra, Javier A. Bustos, Javiera Menay, Sahar Khodabakhsh, Ana Ortega, Andrea Ortiz Bulnes, Narayan Bhatta, Pamela Cortez, Tomás Pantoja, Tahar Lekhoua, Elena Zuñiga, Shirin Hakim.

Funding

None

Conflicts of interest

No competing interests to declare

References

1. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *The Lancet*. 2020;395(10223):497-506.
2. World Health Organization. Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19) 2020 March 26, 2020. Available from: <https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-final-report.pdf>.
3. World Health Organization. Novel Coronavirus (2019-nCoV) Situation Report 1 - 21 January 2020 2020 March 26, 2020. Available from: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200121-sitrep-1-2019-ncov.pdf?sfvrsn=20a99c10_4.
4. World Health Organization. Statement on the second meeting of the International Health Regulations (2005) Emergency Committee regarding the outbreak of novel coronavirus (2019-nCoV). 2020 [March 30, 2020]; Available from: <https://www.who.int/news-room/detail/30-01-2020-statement-on-the-second-meeting-of->

[the-international-health-regulations-\(2005\)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-\(2019-ncov\).](#)

5. World Health Organization. WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020 April 4, 2020. Available from: <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020>.
6. Center for Systems Science and Engineering. Coronavirus COVID-19 Global Cases. Baltimore: John Hopkins University; 2020 [April 3, 2020]; Available from: <https://www.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6>.
7. Lau H, Khosrawipour V, Kocbach P, Mikolajczyk A, Schubert J, Bania J, et al. The positive impact of lockdown in Wuhan on containing the COVID-19 outbreak in China. *Journal of Travel Medicine*. 2020.
8. Shim E, Tariq A, Choi W, Lee Y, Chowell G. Transmission potential and severity of COVID-19 in South Korea. *International Journal of Infectious Diseases*.
9. Ferguson NM, Laydon D, Nedjati-Gilani E, N. I, Ainslie K, Baguelin M, et al. Impact of non-pharmaceutical interventions (NPIs) to reduce COVID19 mortality and healthcare demand 2020 March 26, 2020. Available from: <https://www.imperial.ac.uk/media/imperial-college/medicine/sph/ide/gida-fellowships/Imperial-College-COVID19-NPI-modelling-16-03-2020.pdf>.
10. Meng L, Qiu F, Sun S. Providing pharmacy services at cabin hospitals at the coronavirus epicenter in China. *International Journal of Clinical Pharmacy*. 2020.
11. Wu Z, McGoogan JM. Characteristics of and Important Lessons From the Coronavirus Disease 2019 (COVID-19) Outbreak in China: Summary of a Report of 72 314 Cases From the Chinese Center for Disease Control and Prevention. *JAMA*. 2020;323(13):1239-42.
12. Zangrillo A, Beretta L, Silvani P, Colombo S, Scandroglio AM, Dell'Acqua A, et al. Fast reshaping of intensive care unit facilities in a large metropolitan hospital in Milan, Italy: facing the COVID-19 pandemic emergency. *Crit Care Resusc*. 2020. Epub 2020/04/02.
13. Amante A, Balmer C. Italy rushes new doctors into service as coronavirus deaths rise above 2,500. *Reuters*. 2020.
14. International Monetary Fund. Policy Responses to COVID-19. IMF; 2020 [April 2, 2020]; Available from: <https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19>.
15. Bozorgmehr K, Saint V, Kaasch A, Stuckler D, Kentikelenis A. COVID and the convergence of three crises in Europe. *The Lancet Public Health*.
16. Ferejohn J, Pasquino P. The law of the exception: A typology of emergency powers. *International Journal of Constitutional Law*. 2004;2(2):210-39.
17. Organization for Economic Co-operation and Development. Good Governance for Critical Infrastructure Resilience, OECD Reviews of Risk Management. Paris, France: OECD Publishing; 2019.
18. Qualls N, Levitt A, Kanade N, Wright-Jegede N, Dopson S, Biggerstaff M, et al. Community Mitigation Guidelines to Prevent Pandemic Influenza — United States, 2017. *MMWR Recomm Rep*. 2017;66:1-34.

19. Center for Disease Control. Interim Pre-Pandemic Planning Guidance: Community Strategy for Pandemic Influenza Mitigation in the United States. Early, Targeted, Layered Use of Nonpharmaceutical Interventions 2007 April 2, 2020. Available from: https://www.cdc.gov/flu/pandemic-resources/pdf/community_mitigation-sm.pdf.
20. World Health Organization. Non-pharmaceutical public health measures for mitigating the risk and impact of epidemic and pandemic influenza. Geneva: WHO; 2019.
21. Commonwealth of Australia. National Framework for Communicable Disease Control. Canberra, Australia: Commonwealth of Australia; 2014.
22. Madhav N, Oppenheim B, Gallivan M, Mulembakani P, Rubin E, Wolfe N. Pandemics: Risks, Impacts, and Mitigation. In: Jamison D, Gelband H, Horton S, Jha P, Laxminarayan R, Mock C, et al., editors. Disease Control Priorities: Improving Health and Reducing Poverty 3rd edition. Washington, United States: The International Bank for Reconstruction and Development / The World Bank; 2017.
23. Crawford JM, Stallone R, Zhang F, Gerolimatos M, Korologos DD, Sweetapple C, et al. Laboratory surge response to pandemic (H1N1) 2009 outbreak, New York City metropolitan area, USA. *Emerg Infect Dis*. 2010;16(1):8-13.
24. Smith KM, Machalaba CC, Seifman R, Feferholtz Y, Karesh WB. Infectious disease and economics: The case for considering multi-sectoral impacts. *One Health*. 2019;7:100080-.
25. Delivorias A, Scholz N. Economic impact of epidemics and pandemics 2020 April 4, 2020. Available from: [https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/646195/EPRS_BRI\(2020\)646195_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/646195/EPRS_BRI(2020)646195_EN.pdf).
26. Organization for Economic Co-operation and Development. Tackling coronavirus (COVID-19): Contributing to a global effort. Paris, France: OECD; 2020 [April 3, 2020]; Available from: <https://www.oecd.org/coronavirus/en/>.
27. Europe WROf. COVID-19 Health System Response Tracker. Copenhagen, Denmark: World Health Organization, Regional Office for Europe; 2020 [April 3, 2020]; Available from: <https://www.covid19healthsystem.org/mainpage.aspx>.
28. Hale T, Petherick A, Phillips T, Webster S. Variation in Government Responses to COVID-19" Version 3.0. Blavatnik School of Government Working Paper 2020 April 3, 2020. Available from: <https://www.bsg.ox.ac.uk/research/publications/variation-government-responses-covid-19>.
29. Prem K, Liu Y, Russell TW, Kucharski AJ, Eggo RM, Davies N, et al. The effect of control strategies to reduce social mixing on outcomes of the COVID-19 epidemic in Wuhan, China: a modelling study. *The Lancet Public Health*.
30. Lin Q, Zhao S, Gao D, Lou Y, Yang S, Musa SS, et al. A conceptual model for the coronavirus disease 2019 (COVID-19) outbreak in Wuhan, China with individual reaction and governmental action. *International Journal of Infectious Diseases*. 2020;93:211-6.
31. Webster RK, Brooks SK, Smith LE, Woodland L, Wessely S, Rubin GJ. How to improve adherence with quarantine: Rapid review of the evidence. *Public Health*. 2020.
32. Donabedian A. Explorations in quality assessment and monitoring: The definition of quality and approaches to its assessment. Ann Arbor, Michigan: Health Administration Press; 1980.

33. World Health Organization. Rational use of personal protective equipment (PPE) for coronavirus disease (COVID-19) 2020 April 4, 2020. Available from: https://apps.who.int/iris/bitstream/handle/10665/331498/WHO-2019-nCoV-IPCPPE_use-2020.2-eng.pdf.
34. United Nations Educational SaCO. 290 million students out of school due to COVID-19: UNESCO releases first global numbers and mobilizes response 2020 April 11, 2020. Available from: <https://en.unesco.org/news/290-million-students-out-school-due-covid-19-unesco-releases-first-global-numbers-and-mobilizes>.
35. International Labour Organization. International Labour Organization (ILO) Note. COVID-19 and the world of work: Impact and policy responses 2020; (April 3, 2020). Available from: https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/briefingnote/wcms_738753.pdf.
36. Baldwin R, Weder di Mauro B, editors. Mitigating the COVID Economic Crisis. London, United Kingdom: Centre for Economic Policy Research; 2020.
37. Earley T, Bradshaw J, Ditch J, Gough I, Whiteford P. Social Assistance in OECD Countries: Synthesis Report 1996 April 6, 2020. Available from: <http://eprints.whiterose.ac.uk/73427/1/>.
38. Kickbusch I, Gleicher D. Governance for health in the 21st century Copenhagen, Denmark: WHO Regional Office for Europe; 2012.
39. Kingdon J. Agendas, Alternatives and Public Policies. Boston, USA: Little, Brown & Co; 1984.
40. Alwan NA, Bhopal R, Burgess RA, Colburn T, Cuevas LE, Smith GD, et al. Evidence informing the UK's COVID-19 public health response must be transparent. The Lancet. 2020;395(10229):1036-7.
41. Martinez-Gutierrez S, Cuadrado C, Peña S. Chile's response to the coronavirus pandemic. 2020 [April 12, 2020]; Available from: <https://www.cambridge.org/core/blog/2020/04/11/chiles-response-to-the-coronavirus-pandemic/>.
42. Pisano G, Sadun R, Zanini M. Lessons from Italy's Response to Coronavirus. Harvard Business Review [Internet]. 2020 April 11, 2020. Available from: <https://hbr.org/2020/03/lessons-from-italys-response-to-coronavirus>.
43. Hassel A. Public Policy. In: Wright J, editor. International Encyclopedia of the Social & Behavioral Science 2nd edition: Elsevier; 2015.
44. Howlett M. Managing the "hollow state": procedural policy instruments and modern governance. Canadian Public Administration. 2000;43(4):412-31.
45. Bemelmans-Videc M, Rist R, Vedung E, editors. Carrots, Sticks, and Sermons: Policy Instruments and Their Evaluation. New Jersey: Transaction Publishers; 1998.
46. Marmot M. Fair society, healthy lives : the Marmot Review : strategic review of health inequalities in England post-2010. London: Department of Health, England, 2010.
47. United Nations. UN working to ensure vulnerable groups not left behind in COVID-19 response. New York, United States: UN; 2020 [April 3, 2020]; Available from: <https://www.un.org/en/un-coronavirus-communications-team/un-working-ensure-vulnerable-groups-not-left-behind-covid-19>.
48. Wenham C, Smith J, Morgan R. COVID-19: the gendered impacts of the outbreak. The Lancet. 2020;395(10227):846-8.

49. United Nations Conference on Trade and Development. COVID-19 requires gender-equal responses to save economies. Geneva, Switzerland: UNCTAD; 2020 [April 3, 2020]; Available from: <https://unctad.org/en/pages/newsdetails.aspx?OriginalVersionID=2319>.

Tables and Figures

Figure 1. Four categories of policy responses

The first triangle has the domains to reduce viral transmission, increase the health system's capacity and mitigation of negative consequences. These are forces to reduce the negative impact on health and wellbeing, and to address social determinants of health which place some populations at increased risk of infection. A second triangle represents governance as a contributory force that facilitates policy change and implementation over the other three domains.

Table 1. Proposed taxonomy of policy responses to tackle COVID-19 pandemic

Domain	Sublevel 1	Sublevel 2	Sublevel 3
Interventions to reduce virus transmission (“flatten the curve” strategies)	Prevent the susceptible population from viral exposure	Regulations over mobility	<p>Travel advice</p> <p>Restrictions for international travelling (i.e. air, land or water transport)</p> <p>Restrictions for subnational mobility</p>
		Social distancing	<p>Closure of educational institutions</p> <p>Restrictions of contact in workplace institutions (i.e. stimulate teleworking, closures, regulation of physical space)</p> <p>Closure of leisure and religious institutions</p> <p>Restrictions to public gatherings</p> <p>Lockdown</p> <p>Curfew</p> <p>Reducing viral exposure to vulnerable groups (i.e. quarantine of older adults, chronic disease patients, prisoners)</p>
		Incentivize individual hygienic measures	<p>Price control for essential products (medication and hygiene products), border management measures and retail</p> <p>Price subsidies</p> <p>Media campaigns</p> <p>Public provision</p> <p>Mandatory dispensing on institutions</p>

		Public space hygienic measures	Disinfection (transport, streets, etc) Hazardous waste management
		Case management	Imposing case isolation
	Identify exposed contacts and prevent recurrent exposure from infected patients	Contact management	Tracing of contacts Quarantine of contacts Quarantine for travelers coming from countries with high incidence
		Interventions to increase adherence to case-isolation and quarantines	Sanctions Active surveillance by health authorities, police or armed forces Active surveillance based on technologies Compensation for loss of income due to isolation or quarantine (sick-leave and other subsidies)
	Interventions to identify carriers of the virus	Passive identification	Passive testing in hospital and ER health care facilities Drive-in testing Primary health care testing Domiciliary testing
		Active identification	Active screening strategies (fever controls, thermal cameras, etc) Testing asymptomatic population Testing contacts Self-assessment tools (e.g. web-based questionnaires, apps, surveys)
		Interventions to incentivize the identification of infected cases	Reducing financial barriers for testing
Increasing capacity of the health systems, response (“raise	Infrastructure and technology	Expanding testing capacity	Procurement of equipment, reagents and tests Reorientation of equipment used

the strategies)	line”		for other purposes (e.g. research)
		Increase primary care capacity	
		Increase emergency care capacity	
		Increase the inpatient capacity	Basic care beds Critical care beds
		Research and development of new diagnostics and therapeutics	Vaccines Diagnostics Drugs Medical devices
	Human resources	Increase the number of health care personnel	Recruitment of new health personnel Recruitment of students Recruitment of retired personnel recruitment Recruitment of non-certified medical providers
		Training of health care personnel	
		Redistribute functions among health providers (task shifting)	
		Protect health personnel (prevent exposure and increase case identification)	Training on personal protection equipment Optimize access to personal protection equipment Reducing the mental health burden of health personnel Organization of hospital ward strategies to reduce contagion Testing of exposed health workers Expanded access of care for infected health workers

	Health care services processes	National treatment guidelines (protocols)	
		Reorientation of service provision (cancel elective activities, such as non-essential outpatient care and elective surgeries and telemedicine for evaluation of other health conditions]	
		State administration of private health care providers	
		Geographic organization of care	Interventions to ensure patients remain in their enrolled areas (prevent overburden of health services in areas of cottages or second homes)
Mitigation of the consequences of the epidemic and interventions	Macroeconomic interventions	Financial stability	Bailouts/Temporary restructuring of loan terms for the most-affected borrowers Nationalization of economic sectors
		Monetary policy	Regulation of exchange rates Change on Monetary Policy Rate Credit financing from the Central Bank/Injecting liquidity
		Industrial Policy	Production increases in key sectors Conversion of industrial production
		International trade exchange	Closure of export of certain products
	Increase social protection for citizens	Reduce household costs	Reduction of payments Subsidies for essential goods and services Control prices
		Protecting employment	Changing existing rules workers layoff Subsidies for employers to pay salaries

			Partial reductions of salaries
		Protecting household income	Universal Social Assistance Social Insurance Resource (or mean) tested social assistance
Governance	Delegation of power and implementation structures	Strengthening national authority	Declaring State of Emergency
		Designating a high-level committee for decision-making	
		Establishing processes for informed decision-making	
		Establishing processes for community participation in decision-making	
	Information-sharing and accountability	Establishing an emergency surveillance mechanism	
		Providing daily accounts of the epidemiological situation	
		Releasing open-access data and code	
		Anonymised detailed information shared publicly to avoid speculation	
		Development of information systems and visualization tools	
	Resource mobilization	Increasing budget	
		Reallocating from other sources	
		Tax reform	
		Increase in fiscal debt	
		Use of Economic Stabilisation Fund	

		Use sovereign wealth funds	
--	--	----------------------------	--

Note: The PoliMap mapping exercise also includes a 4th sublevel. The taxonomy for that level is available upon request.

Table 2. Examples of cross-cutting dimensions

Domain	Dynamic nature of policy-making	Alignment of policy responses	Types of policy instruments	Coverage	Gendered impact of policies
Interventions to reduce virus transmission (“flatten the curve” strategies)	Countries and international organizations have changed their views as evidence grows, e.g. WHO and CDC advised against the use of face masks. Later on, they supported their use in the general public.	Mayors decided to close schools and shopping centres against the advice of the Central Government at an initial phase of the epidemic in Chile.	Stay at home measures varied substantially between countries with some appealing more to advice (nodality) while others to regulatory measures (authority) to enforce preventive quarantines.	Ecuador introduced a total quarantine and forbid cuts in basic services such as water, electricity and internet to help lower socioeconomic groups to stay at home	Increase on gender-violence and increased has been reported in the context mandatory quarantines.
Increasing capacity of the health systems, response (“raise the line” strategies)	Quick solutions are needed to face pressing health needs, e.g. France implemented a high-speed train as a hospital to transfer patients from regions without ICU capacity.	Local governments or health districts could adopt different treatment guidelines or conflicting criteria to admission or transfer protocols.	Different policy instruments such as financial incentives to providers such as guaranteed fee-for-service (treasury), national treatment guidelines (organization) or mandatory central administration of private health care providers (authority).	A combination of universal and targeted interventions were implemented in Germany. Universal access to health benefits (e.g. COVID-19 testing) with targeted extra contributions for health centres serving vulnerable population.	Female health professionals face increased demands at both work and home during the COVID-19 epidemic. Being female was associated with higher odds of depressive and anxiety symptoms in Wuhan, China.
Mitigation of the consequences of the epidemic and interventions	While some countries implemented extensive economic relief packages (Germany, France, Italy) others started with minimal social protection and macroeconomic interventions (India, Ecuador, Japan). This	Ecuador on 03/31 implemented a system of traffic lights to show the cities where you can have a normal working day and those that cannot work. Provinces like Napo or Orellana may have normal	Mitigation interventions include financial incentives (Treasury) to increase financial security or regulatory actions (authority) linked to macroeconomic interventions (e.g. monetary policy).	Policy responses to mitigate economic consequences of the epidemic ranged from policies focus on vulnerable groups through means-tested cash transfer (e.g. Chile) to universal basic income initiatives (e.g. Denmark).	Social protection benefits directed to women have shown to empower them and to increase its effectiveness in other settings.

	is likely determined by local politics and changes in the agenda in each country.	working hours. This to lessen the economic effects and was part of a decision between the provincial managers and the government.				
Strengthening governance	Chile gathered a small Expert Committee to support decision making. Open disagreements between the Government and the Expert Committee, alongside criticism from different political actors, pushed the President to convey a High-Level Committee involving members of the Cabinet, representatives of the Mayors Associations and the Chilean Medical Association.	Subnational levels like the States in the U.S. can adopt very different implementation structures that can be synergic or in opposition with the Federal Government.	Interventions to strengthen governance can include financial interventions (e.g. fiscal reforms) such as have been proposed in Europe, authority changes (e.g. Declaring a State of Emergency) or organization such as conveying high-level committees for decision making.	Argentina, in its preparation and response plan to COVID-19, generated an intersectoral network led by the Ministry of Health and made up of all ministries, local governments and representatives of private health. This is to generate common interventions that allow coverage of measures throughout the country.	Governance structures that exclude women can produce biased public policies reproducing gender inequities. As an example, the High-Level Advisory Committee on the U.S. included almost entirely white males.	
References	can	be	found	in	the	Supplementary Appendix

Annex 1

Affiliations of the COVID-19 PoliMap collaborating group

Sebastián Peña, Department of Public Health Solutions, Finnish Institute for Health and Welfare, Finland

Cristóbal Cuadrado, Escuela de Salud Pública, Universidad de Chile, Chile

Ariadne Rivera-Aguirre, New York University Grossman School of Medicine, United States

Rebecca Hasdell, Basic Income Lab, Stanford University, United States

José Ignacio Nazif-Muñoz, Faculté de Médecine et des Sciences de la Santé, Université de Sherbrooke, Canada

Mohamed Yusuf, Department of Sport and Exercise Sciences, Manchester Metropolitan University, UK

Felipe Vera, University of Sheffield, United Kingdom

Jaime Peña, Faculty of Medicine, University of Santiago, Chile

Hugo Vásquez, MD, PhD, Public Health Agency of Barcelona - Sant Pau Institute of Biomedical Research, Spain

Marjorie Borgeat, Centro Interdisciplinario de Estudios en Salud, Facultad de Odontología, Universidad de Valparaíso, Chile

Francisco Valenzuela, Department of Public Health, Pontifical University Catholic of Chile, Chile

Mauricio Soto, MD, MSc, Department of Family Medicine, Pontificia Universidad Católica de Chile; École de Santé Publique, Université de Montréal, Canada

José Incio, Department of Political Science, University of Pittsburgh, United States

Cecilia Castillo-L, MD, MPH, PhD (Pediatrician and public health practitioner), Chile

Diego Moreno, University of Auckland, New Zealand

Gabriel Carrasco-Escobar, Health Innovation Lab, Institute of Tropical Medicine “Alexander von Humboldt”, Universidad Peruana Cayetano Heredia, Peru

Andrés Vecino, John Hopkins University, United States

Macarena Martínez, MPH/MCH, Escuela de Obstetricia, Universidad San Sebastián, Chile

Sol Hersh, UX/UI Designer, United States

Cristian González, MD, School of Public Health, University of Chile, Chile

María Jesús Vega-Salas, Centre for Nutrition, Exercise and Health, School for Policy Studies, University of Bristol, United Kingdom

Jaime Jiménez Pernet, Escuela Andaluza de Salud Pública, Spain

Arianna Maever L. Amit, Bloomberg School of Public Health, Johns Hopkins University;
and University of the Philippines Manila, Philippines

Maja Nikšić, London School of Hygiene and Tropical Medicine, United Kingdom

Omar El-Shahawy, School of Medicine, New York University, United States

Julius Simon Otim, Ministry of Health, Uganda

Francisco Espinoza, Division of Nursing, Midwifery and Social Work, University of
Manchester, United Kingdom

Lizbeth Tolentino-Mayo, Instituto Nacional de Salud Pública, México

Jerusa Brignardello, Faculty of Medicine, Imperial College London, United Kingdom

Fernanda Gutiérrez, Pontificia Universidad Católica de Chile, Chile

Mauricio Duarte, Departamento de Matematicas, Universidad Andrés Bello, Chile

Fernanda Cimini, Faculty of Economics, Federal University of Minas Gerais, Brazil

Claudia Sanhueza, MA, PhD, Centre for Economics and Social Policy and Faculty of
Humanities, Universidad Mayor, Chile

Maria S. Martínez-Gutierrez, Escuela de Salud Pública, Universidad de Chile, Chile

J. Jaime Miranda, MD, PhD, School of Medicine, Universidad Peruana Cayetano Heredia,
Peru