Major Indicators for Public Management Decision-Making during the COVID-19 Pandemic

Felipe Padilha[1]*, Eliane Morriesen[2], Juliane Retko Urban[2], Fernanda Hansch Beuren[2], Alexandre Borges Fagundes[2], Delcio Pereira[2], Débora Barni de Campos[2]

[1]Universidade do Vale do Itajaí, Rua Uruguai, Itajaí, Brasil

[2]North Plateau Education Center, State University of Santa Catarina, São Bento do Sul, SC, Brazil

Email: *felipe.padilha@univali.br, eliane.m.morriesen@gmail.com, juretko.urban@gmail.com, fernanda.beuren@udesc.com, alexandre.fagundes@udesc.com, delcio.pereira@udesc.com, deborabarni@gmail.com

Abstract

Within the COVID-19 pandemic scenario, social isolation and other safety measures have been rapidly implemented by World Health Organizations around the globe, directly impacting the daily lives of several people. The present study aimed to identify the most relevant factors in the Public Management decision-making process regarding social isolation and its impacts on the population. For this purpose, 7772 scientific articles from the Science Direct and Scopus databases were analyzed, composing a portfolio with the most relevant social, political, psychological, economic and health indicators to the decision-making process in Public Management during the COVID-19 pandemic.

Keywords

Decision-Making, Public Management, COVID-19

1. Introduction

Global-scale health emergency situations, such as the COVID-19 Pandemic, demand collaborative and well-coordinated approaches, which also need to consider the economic and social context, phenomena empirically evidenced by society.

Based on this, the lack of dialogue between the different parties and the administration of a variety of social, economic and health factors limits the potential participation of the responsible for the response actions (Khorram-Manesh

et al., 2022).

A proper response procedure in public emergencies depends on several inter-related factors. In some specific cases, such as hurricanes and earthquakes, which can be more accurately predicted through technology, vulnerable points can be previously identified and the decision-making process is supported not only by scientific models, but also by action plans implemented in preceding similar situations.

The COVID-19 Pandemic, however, involves living organisms, with a restricted prediction capability, and the impact of human behavior, political and social factors also limit the development of scientific and metric-based models, complicating the establishment of response protocols (Qiu, 2020).

Although some variables can be expected, such as standard hygiene habits always recommended by health organizations, for instance washing hands frequently and keeping physical distances, contradictory public authorities' speeches can lead to doubt on experts' recommendations and social-division, intensifying existing social tensions and creating scientifically immeasurable variables (Deps & Cassimiro, 2020).

Creating a response protocol to a global-scale crisis caused by a new virus as the SARS-CoV-2, one-variable models are not enough to handle the complexity of its impacts in different social fields. Ramadan et al. (2020) suggest multi-variable models for a more accurate and adequate projection of complex crisis.

A Systematic Bibliographic Review (SBR) is one of the best tools to elaborate a protocol with a scientific basis, identifying the main terms, keywords and prevalence indicators on the subject with robustness.

Therefore, the objective of this research was to identify the major indicators for the Public Management decision-making during the COVID-19 pandemic and its impacts on the population. The study was based on a Systematic Bibliographic Review (RBS) of the most relevant literature published to date.

2. Methodology

Systematic Bibliographic Review for Bibliometric Analysis

The present research is an exploratory and descriptive study, classified as survey research. Specifically, it is based on a sample survey (Gerhardt & Silveira, 2009), aimed to build new knowledge and expand the understanding of a topic, based on the collection of existing concepts and discussion through a Systematic Bibliographic Review (Pereira et al., 2018).

The data search was comprehensive without language restrictions, using the Scopus database, which is the largest database of abstracts and citations in the literature with peer review, and Science Direct, another research tool for researchers, professors, students, and Healthcare professionals.

All the entries used for search in the databases were English terms and their derivations. The language choice was based on a more comprehensive search, as the terms in English are always indexed regardless of the publication language. Table 1 shows the terms used in the Bibliographic Review.

For a more extensive investigation, a total of 18 different combinations of the terms were also used in both databases. Table 2 shows all the combinations used.

The combination of the keywords in both databases yielded a total of 14,136 results. These were analyzed in different stages, as follows. Stage 1: General research; Step 2: Selection of journal articles; Step 3: Duplicates removal; Step 4: Delimitation of publication period (2019-2022); Step 5: Reading of titles and abstracts; Step 6: Methodi Ordinatio application. Table 3 presents the results obtained in each database, including the selection process of the final articles listed for a deeper analysis.

Table 1. Keywords derivations.

Main term	Decision-Making	COVID-19	Social Isolation
Derivation 1	Decision making	COVID-19	Social Isolation
Derivation 2	-	Coronavirus	Social Distance
Derivation 3	-	SARS-CoV-2	Public Management
Derivation 4	-	-	Risk Management
Derivation 5	-	-	Public Health
Derivation 6	-	-	Quarantine

Own authorship.

Table 2. Keywords combinations.

Decision-Making		COVID-19		Social Isolation
Decision making	*AND*	COVID-19	*AND*	Social Isolation
Decision making	*AND*	COVID-19	*AND*	Social Distance
Decision making	*AND*	COVID-19	*AND*	Public Management
Decision making	*AND*	COVID-19	*AND*	Risk Management
Decision making	*AND*	COVID-19	*AND*	Public Health
Decision making	*AND*	COVID-19	*AND*	Quarantine
Decision making	*AND*	Coronavirus	*AND*	Social Isolation
Decision making	*AND*	Coronavirus	*AND*	Social Distance
Decision making	*AND*	Coronavirus	*AND*	Public Management
Decision making	*AND*	Coronavirus	*AND*	Risk Management
Decision making	*AND*	Coronavirus	*AND*	Public Health
Decision making	*AND*	Coronavirus	*AND*	Quarantine
Decision making	*AND*	SARS-CoV-2	*AND*	Social Isolation
Decision making	*AND*	SARS-CoV-2	*AND*	Social Distance
Decision making	*AND*	SARS-CoV-2	*AND*	Social Distance
Decision making	*AND*	SARS-CoV-2	*AND*	Public Management
Decision making	*AND*	SARS-CoV-2	*AND*	Risk Management
Decision making	*AND*	SARS-CoV-2	*AND*	Public Health

Own authorship.

Table 3. Results.

Databases	Step 1: General Research	Step 2: Selection of journal articles	Step 3: Duplicates removal	Step 4: Delimitation of publication period (2019-2022)	Step 5: Reading of titles and abstracts	Step 6: Methodi Ordinatio
Scopus	-	-	809	809	74	19
Science Direct	-	-	6891	6871	373	64
Total	**14,136**	**14,064**	**7702**	**7680**	**447**	**83**
Nr. of excluded titles	-	72	6362	22	7233	364
Scopus	-	-	809	809	74	19

Own authorship.

At the end of the search step in the databases (Step 1), the Mendeley® software was used to group and order the articles, which were then structured in Microsoft Office Excel®. Books and book chapters, conferences, congress articles and complementary results were excluded, leaving only journal articles (Step 2).

Following, duplicates, *i.e.*, articles indexed in both databases, were excluded (Step 3). In Step 4, the publication period was delimited, selecting only articles published between 2019 and 2022, including articles not yet published but accepted for publication.

Finally, after reading the titles and abstracts (Step 5), 447 articles that were closely related to the scope and objective of the present research were selected.

In a final step, a categorical algorithm Methodi Ordinatio (Step 6) by Pagani, Kovaleski & Resende (2015) was used to order and select the most relevant articles. This algorithm considers the impact factor of the journal in which the article was published, the year of publication, in addition to the number of citations in Google Scholar, as shown in Equation (1):

$$\text{InOrdinato} = \left(F_i / 1000 \right) \alpha \left[10 - \left(\text{Year}_{\text{search}} - \text{Year}_{\text{pub}} \right) \right] + \sum C_i . \tag{1}$$

where:

F_i : Impact Factor

$\text{Year}_{\text{search}}$: Year of search

Year_{pub} : Publication year

C_i : Number of citations in Google Scholar

Source: Pagani, Kovaleski & Resende (2015).

The alpha (α) is an index chosen by the authors to adjust, if necessary, the weight of a specific group for the SBR. In the present work, the same value was used for all the groups, as all share the same level of importance for the study. A graphical representation of the Methodi Ordinatio ranking application is shown in Figure 1. The X-axis shows the "Accumulated Index"—the sum of all the indexes obtained as per the Equation (1). The orange line is a graphical representation of the "Accumulated Percentage" of the results. The percentage selected by the authors defines the threshold that determines the number of articles selected for a deeper analysis. In the present research, the accumulated
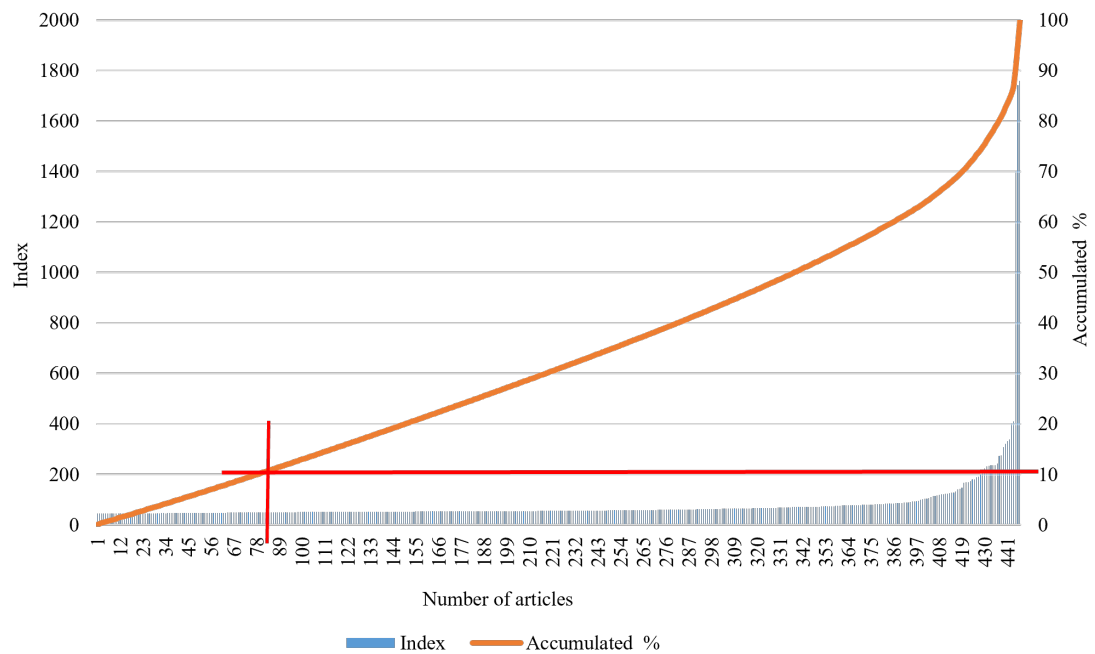
Figure 1. Number of articles selected based on Methodi Ordinatio ranking.

percentage threshold was set at 10.7%. Based on this, the total number of articles for further analysis is represented by the intersection of the red lines in the graph. In the present study, this meant 83 out of the 447 articles. A list of all the 83 articles is available in **Appendix 1.**

3. Results & Discussion

To elaborate a scientific model for decision making, the categorization of the collected inputs within groups based on similarity facilitates the process.

A wide variety of articles, authors, journals, and nationalities were found throughout the research. The first analysis performed was based on the keywords. The graphic in **Figure 2** displays the results linked to each group of keywords.

According to the graphic, the keywords combination "Decision; COVID-19; social distancing" presented the higher number of citations among the articles analyzed. As a result, over the years, there were a greater number of publications related to these keywords combinations when compared to the others.

The analysis of the articles allowed a compilation of the different indicators for Public Management Decision-Making during the pandemic. For analysis purposes, the primary indicators identified through the Systematic Bibliographic Review were grouped into indicators considered as relevant for the decision-making process, namely: political, health, social, psychological and economic factors. These indicators are summarized in **Appendix 2** and each indicator will be developed in more detail in the following sections.

The representativeness of each indicator in according to the Systematic Bibliographic Review is shown in **Figure 3**.
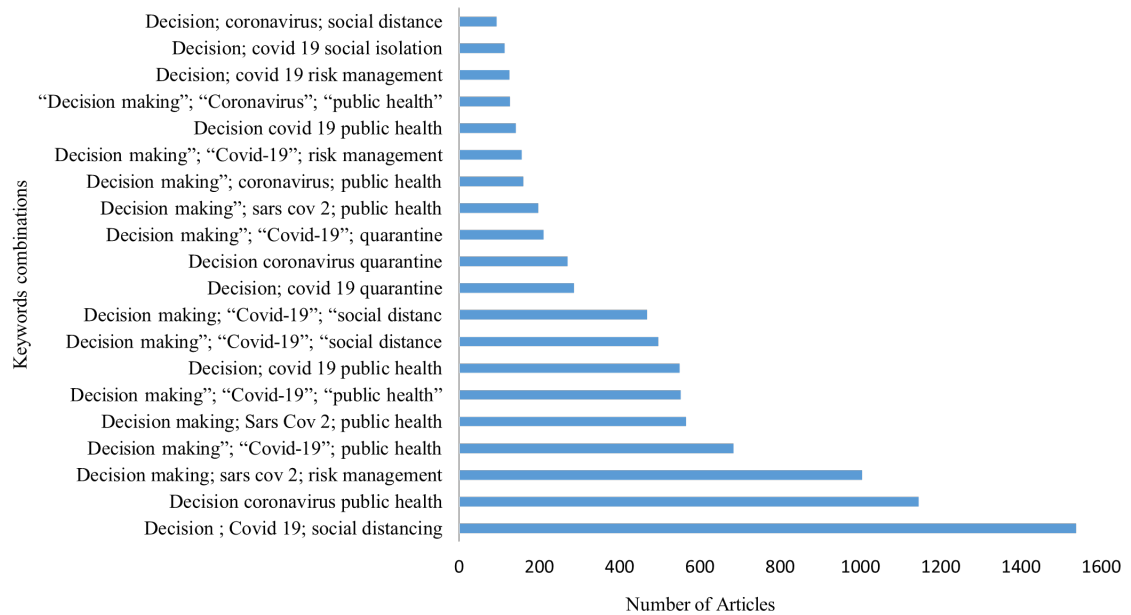
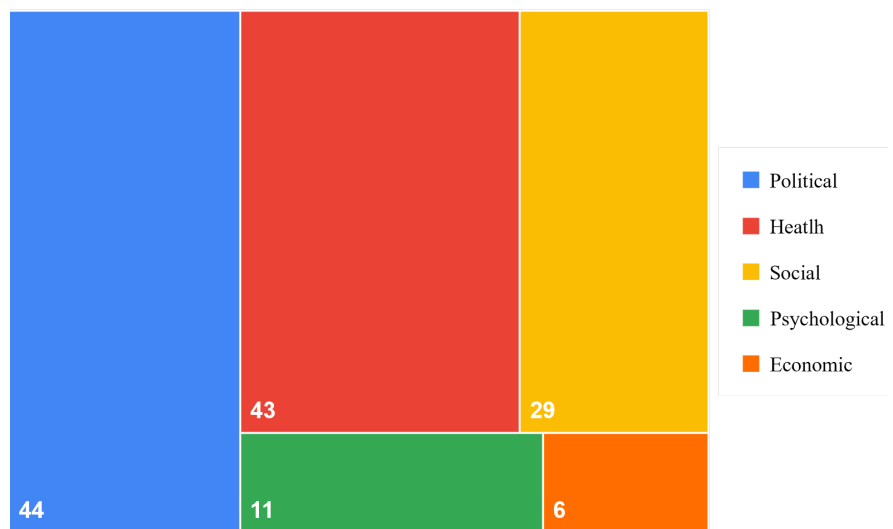**Figure 2.** Number of articles per keyword(s).

Figure 3. Major indicator groups found in the systematic bibliographic review.

The political indicator was the most recurrent, being mentioned in 48 articles. Within this group, the primary indicator "Government conduct" stands out. The increasing concern on the subject among the scientific field highlights the importance of the government in the decision-making process, especially during global-scale crisis. At the same time, as the government also needs to ensure economic protection, there is a necessity to evaluate the impacts of extreme measures, such as lockdown.

It is also worth mentioning that the primary indicators were grouped according to their relevance within the pandemic context. Undoubtedly, political issues encompass health and social issues, but the results were grouped by similarity to facilitate the analysis. Each main group of indicators is discussed in more details

in the following sections.

3.1. Political Indicators

The Federal and local Governments are responsible for ensuring the safety and health of the population. As many factors are related to the political and governmental elements, a predominance of political indicators, as found during the present research, is expected. The representativeness of each primary indicator within this group is shown in Figure 4.

An analysis of the graphic shows that the Government Conduct Indicator stands of not only as the main political indicator, but also as the major indicator for the decision-making process during COVID-19. The COVID-19 pandemic has led to reflection about how political pressures impact the population credibility on Science (Deps & Cassimiro, 2020). In fact, the government conduct, when aligned with the guidelines of the scientific field is a very important key to ensure an efficient response during crisis (Censon & Barcelos, 2020; Ney & Gonçalves, 2020).

Ney & Gonçalves (2020) point out important factors within political indicators, such as the existence of a Public Health System, as in the case of the Brazilian Unified System (in Portuguese "Sistema Unificado de Saúde"—SUS). As the authors also state, the government's interest in promoting the access to health is one of the main factors to ensure a good response to a pandemic, which was confirmed in COVID-19.

Furthermore, when aligned with collective interests, it also contributes to adequate risk communication, with transparency about the potential damages as well as the contingency policies (Habli, Alexander, Hawkins, Sujan, McDermid, Picard, & Lawton, 2020). A proper risk communication can mitigate damage and save lives (Beccari, 2020).

The combination of different experiences, knowledge and the synergy between institutions is also essential to solve complex challenges. Strong interaction
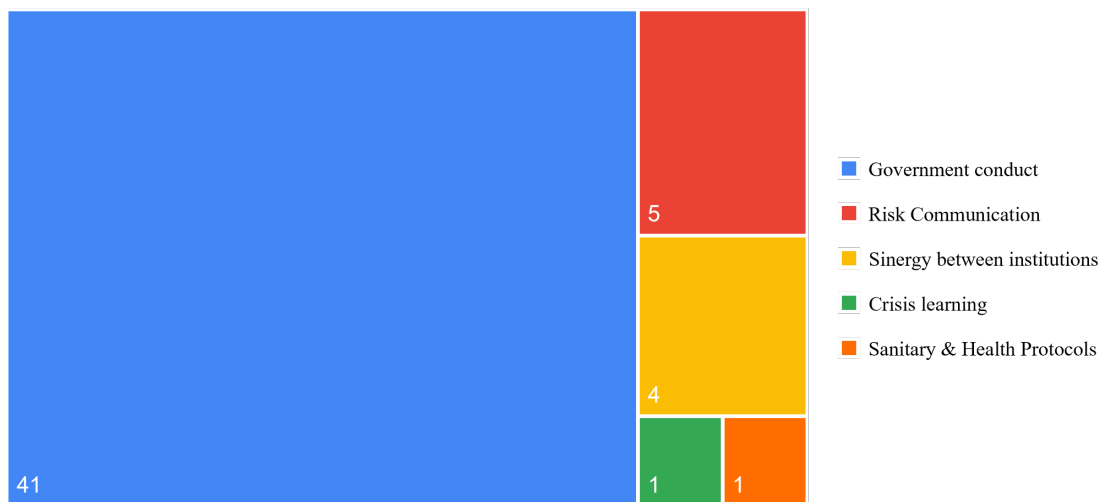

Figure 4. Political indicators.

between universities, governments, companies, and the society in general is an effective tool to minimize the impacts of future challenges, ensuring better risk management and adaptation (Amorim & Andrade, 2020).

Another important factor is the so-called response simulation, or crisis learning (Trachsler & Jong, 2020). Countries that practice disaster simulations usually respond to crisis in a much more robust and organized manner, when compared to those which lack the disaster simulations. Even without simulations, the existence of simple health response protocols can already ensure better safety for different professionals and leaders during large-scale emergencies (Coelho et al., 2020).

The decision-making process involves different fields of the society, but it remains highly dependent on the autonomy of the State. Thus, to ensure an efficient response to COVID-19, political leaders are key element, which is confirmed by the number of the countries aligned with the Science and Ethics guidelines.

3.2. Health Indicators

The Health Indicators assess the severity of the situation in a given location and evaluate the efficiency of the different responses. **Figure 5** illustrates the representativeness of each primary indicator within the Health Indicators Group.

Nazari, Shahriari, Dadgarmoghaddam, Saki, Nahidi, Mehrabian & Tabesh (2020) highlight the importance of identifying non-compliance factors and analyzing
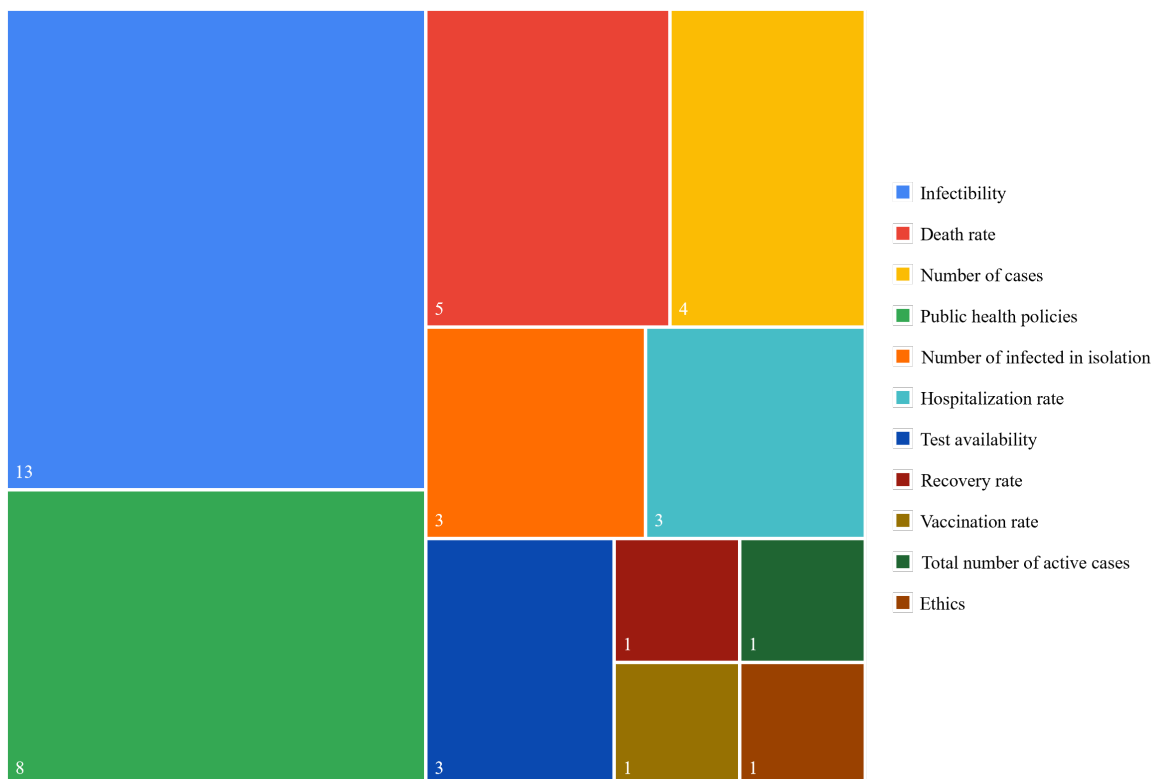

Figure 5. Health indicators.

the numbers related to the pandemic to ensure effective responses. At the beginning of the pandemic, computing the number of cases and deaths and forecasting economic impacts were the first measures for a quick response while waiting for treatment and vaccines (Sciortino & Saini, 2020; Stone & Scheib, 2021). However, as the infectibility rates proved to be 50 to 85 times higher than previously thought, also dependent on the dominant virus variant, these measures proved to be insufficient (Silva, Paz, Ribeiro, Freire, Oliveira, Leite et al., 2022).

Other factors, such as the availability of tests and number of tests performed, also influence the perception of response efficiency. The number of tests must be compatible with the population size and mobility, as a relevant forecast of the number of isolated people and the number of severe cases allows a better implementation of Public Health Policies and management of available resources, such as ICU beds and respirators (Sokolov & Sokolova, 2020).

Furthermore, some metrics must be tracked with higher frequency, as epidemiology parameters can help project future cases of COVID-19, deaths, and hospitalizations and admissions to ICUs, in addition to guiding social distancing and lockdown measures (Chhatwal, Dalgic, Mueller, Adee, Xiao, Ladd, Linas, & Ayer, 2020). Moreover, infectiology-related metrics always present a fluctuating pattern. Besides the existence of asymptomatic cases, the duration and power of protective immunity after recovery and/or vaccination is not an exact measure (Habli, Alexander, Hawkins, Sujan, McDermid, Picard, & Lawton, 2020).

The investigation and projection of these data must also comply with ethical standards within the Government, both in data treatment and dealing with resources, considering possible resources and manpower scarcity and other ethical dilemma (Nomani & Parveen, 2020). The data needs to be not only carefully processed, but also transmitted in a clear and non-biased manner to the population, also stimulating social distancing and other health practices from each citizen.

3.3. Social Indicators

Although the COVID-19 pandemic is ultimately caused by a virus, it is highly influenced and determined by human and social behavior. Therefore, understanding these social factors is fundamental. In Figure 6, the representativeness of each primary indicator within the Social Indicators Group can be seen.

Intervention responses to COVID-19 go far beyond public and state power, as its occurrence is not localized nor visible or palpable. The control of an agent with rapid transmission depends on human behaviors and social variables to happen effectively (Sciortino & Saini, 2020).

One of the first factors to be considered is the social infrastructure situation of a given location. The demographics of the population exposed to the COVID-19 virus, such as mobility rate and level of basic infrastructure, dictate the effects of counter-propagation. Therefore, populations within regions with higher infrastructure levels tend to observe quicker responses to global-scale crisis (Qiu, 2020).
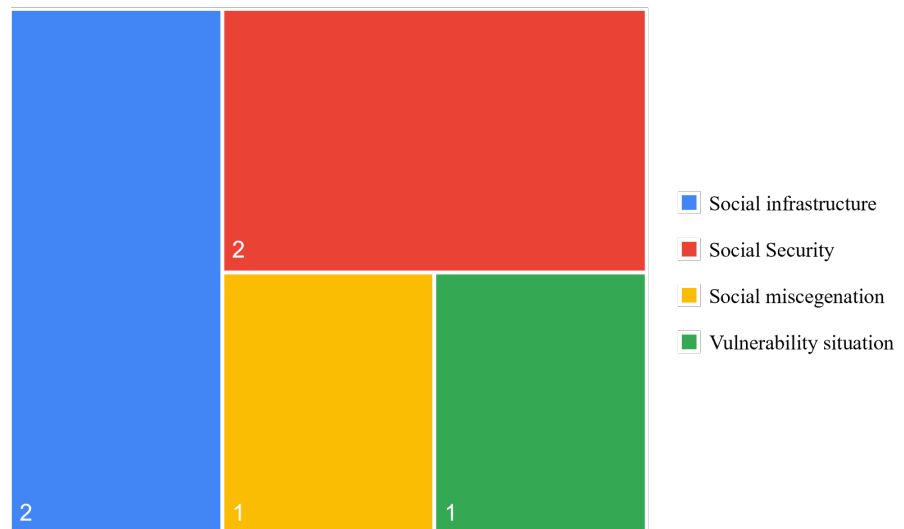
Figure 6. Social indicators.

In addition to infrastructure, issues such as social security felt by the population directly affect human behavior involved in prevention strategies, as other problems arise when a certain population has a lockdown enacted, for example. The level of resources, urbanization, security, infrastructure and even basic issues such as access to food, drinking water, hygiene instruments also directly dictate the impacts of a respiratory virus in a given place (Rodrigues, Carpes, & Raffagnato, 2020).

In addition to infrastructure, other factors, such as social security also directly affect human behavior and prevention strategies, as other problems arise during lockdown mandates, for example. The level of resources, urbanization, security, infrastructure, and access to basic needs, including food, potable water and hygiene products are determinant in the impacts of a pandemic as well (Rodrigues, Carpes, & Raffagnato, 2020).

During the decision-making process, cultural aspects also play an important role, as the diversity and lifestyle habits of a population highly influence the acceptance and adoption of health and safety guidelines.

These factors evidence the level of vulnerability of different regions. Although the COVID-19 pandemic has affected the entire planet, its effects are experienced differently depending on the region. Management issues become more exacerbated when extreme and non-popular decisions, such as lockdown measures, are crossed with structural problems, e.g., domestic violence or lack of access to basic needs, along with mental health-related problems, as anxiety and depression rates, more pronounced during isolation (Sokolov & Sokolova, 2020).

3.4. Psychological Indicators

Individuals play an important role in accepting crisis, as the COVID-19 pandemic. The Psychological Indicators allow the understanding of common human behaviors in relation to risk and the process of human adaptation. **Figure 7** shows the
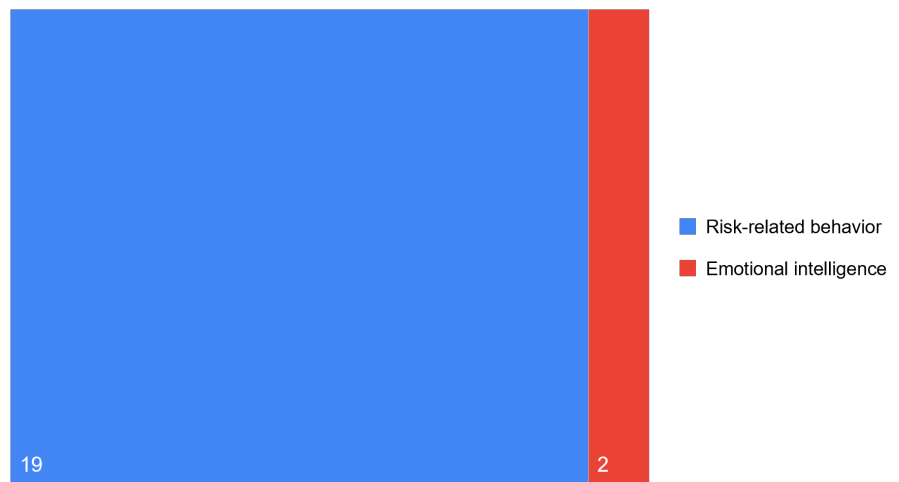
Figure 7. Psychological indicators.

representativeness of each primary indicator within the Psychological Indicators Group.

According to Sciortino & Saini (2020), the media sensationalism, broadcasting scenes of deaths and ICU patients, together with the increasing number of cases, promoted fear in the population. Although there was a need to create a sense of urgency and to stimulate people to follow safety measures and precautions, it also caused severe mental consequences among the population.

Several variables are related to why an individual or a group chooses to comply or not with individual and collective protection and prevention measures, namely: group herd behavior, the naturalization of risk and death, and the perspective of real-life risk. As the sense of risk is a non-tangible and non-measurable variables, it creates margin for disbelief (Habli, Alexander, Hawkins, Sujan, McDermid, Picard, & Lawton, 2020).

In addition to these, there are other correlated factors that influence large groups in complying with the norms imposed in response to the pandemic, such as the fear of unemployment, violence, stress, panic, and depression, which according to Becher (2020), can claim more lives than the virus itself.

The Psychological factors are subjective and fluctuating, as each society, each group and each individual behave in unique ways, which makes the impact of the pandemic more abstract, and data measurement more challenging.

Within this scenario, besides emotional adaptation, Khorram-Manesh et al. (2022) also highlight the importance of "flexible outbreak capacity" to enable collective learning in coping and to identify the most effective manners to promote conscious behavior among the population.

3.5. Economic Indicators

All global-scale crises, whether environmental or health-related, has an impact on local societies. The COVID-19 pandemic enhanced social inequality, in a phenomenon that some researchers classify as a "cascading disaster", to refer to

secondary crisis derived from a primary one. The representativeness of each primary indicator of the Economic Indicators Group is illustrated in Figure 8.

The COVID-19 pandemic feature a necessity to implement actions to reduce social inequalities, creating structures and policies that provide people and communities with the ability to create solutions in a community. When people's basic needs are met and functioning public infrastructure and support systems, they are more likely to cooperate in unpredictable situations when disruptions to these systems occur (Thomas, Jang, & Scandlyn, 2020).

The countries have been managing the pandemic consequences differently, with the low-income population being the most affected. Mitigation efforts have also created an imbalance between the health of the population, the capacity of the health system and economic prosperity.

The COVID-19 pandemic presents potential long-term social, political, economic, and cultural impacts, in addition to the immediate consequences for the individuals. Moving from recommendations and scientific evidence to a policy decision requires policymakers to consider assumptions, risk-taking beliefs, and tradeoffs. These are often not straightforward or measurable (Habli, Alexander, Hawkins, Sujan, McDermid, Picard, & Lawton, 2020). Therefore, governments' challenges to balance responsibility demands while rethinking policies have significantly increased (Boin, Lodge, & Luesink, 2020).

4. Final Considerations

The present study identified the most relevant indicators for the decision-making process of Public Management during the COVID-19 pandemic, but also identified the main political, health, social, psychological, and economic factors that need to be integrated for an assertive response in the epidemiological control of the COVID-19 pandemic.

In total, 24 primary indicators were identified, with Government Conduct being

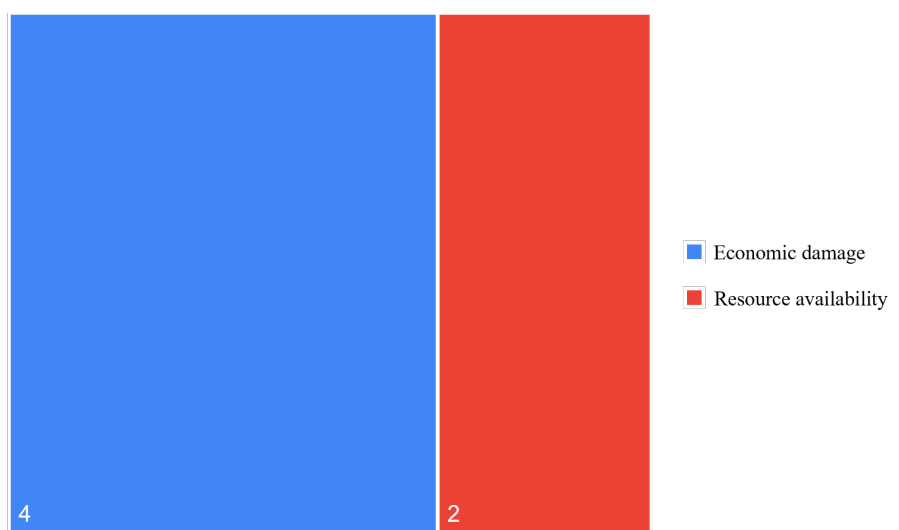■ Economic damage
■ Resource availability

Figure 8. Economic indicators.

the most important, mentioned in the majority of the articles analyzed. This supports the idea that the ethical and scientific responsibility of political managers at the local, federal, and international levels is essential for the protection of the population.

This research also provides inputs and resources for the elaboration of a multi-analysis modeling to assist in the decision-making process ensuring that the measures are constantly updated and adapted for each population, context and culture.

Based on the analyses carried out throughout the research, further studies to assist in the decision-making during the COVID-19 pandemic in different contexts are recommended. These studies shall deepen the understanding of the most effective measures to prepare for, and during, an emergency health crisis in different territories and also across the globe.

The contribution of the scientific community and universities, together with governments, companies, and society can optimize risk management and decision-making processes, thinking ahead to minimize the impacts of future challenges imposed by a pandemic or other large-scale crisis.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

Amorim, W. S., & Andrade, J. B. S. O. (2020). Pandemics, Global Risks and Adaptation: Challenges for a Changing World. *Research in Globalization, 2,* Article ID: 100023. https://doi.org/10.1016/j.resglo.2020.100023

Beccari, B. (2020). When Do Local Governments Reduce Risk? Knowledge Gaps and a Research Agenda. *Australian Journal of Emergency Management, 35,* 20-24.

Becher, S. (2020). Risikobewertung von COVID 19—Aus der Sicht der Versicherung (smedizin). *Zeitschrift für die Gesamte Versicherungswissenschaft, 109,* 255-266. https://doi.org/10.1007/s12297-020-00487-5

Boin, A., Lodge, M., & Luesink, M. (2020). Learning from the COVID-19 Crisis: an Initial Analysis of National Responses. *Policy Design and Practice, 3,* 189-204. https://doi.org/10.1080/25741292.2020.1823670

Censon, D., & Barcelos, M. (2020). O Papel do Estado na Gestão da Crise Ocasionada Pela COVID-19: Visões Distintas Sobre Federalismo e Relações entre União e Municípios. *Revista Brasileira de Gestão e Desenvolvimento Regional, 16,* 49-63.

Chhatwal, J., Dalgic, O., Mueller, P., Adee, M., Xiao, Y., Ladd, M. A, Linas, B. P., & Ayer, T. (2020). PIN68 COVID-19 Simulator: An Interactive Tool to Inform COVID-19 Intervention Policy Decisions in the United States. *Value in Health, 23,* S556. https://doi.org/10.1016/j.jval.2020.08.909

Coelho, F. D. S., Corrêa, V., Lisboa, R. L., & Resch, S. (2020). La 'Sala de Máquinas' de la administración pública en la lucha contra la COVID-19. *Revista de Administração Pública, 54,* 839-859. https://doi.org/10.1590/0034-761220200382

Deps, P., & Cassimiro, M. (2020). Ethical Principles in Decision-Making during the

COVID-19 Pandemic. *Ethics, Medicine, and Public Health, 15,* Article ID: 100572. https://doi.org/10.1016/j.jemep.2020.100572

Gerhardt, T. E., & Silveira, D. T. (2009). *Métodos de pesquisa.* Plageder.

Habli, I., Alexander, R., Hawkins, R., Sujan, M., McDermid, J., Picardi, C., & Lawton, T. (2020). Enhancing COVID-19 Decision Making by Creating an Assurance Case for Epidemiological Models. *BMJ Health & Care Informatics, 27,* e100165. https://doi.org/10.1136/bmjhci-2020-100165

Khorram-Manesh, A., Mortelmans, L. J., Robinson, Y., Burkle, F. M., & Goniewicz, K. (2022). Civilian-Military Collaboration before and during COVID-19 Pandemic—A Systematic Review and a Pilot Survey among Practitioners. *Sustainability, 14,* Article No. 624. https://doi.org/10.3390/su14020624

Nazari, E., Shahriari, M. H., Dadgarmoghaddam, M., Saki, A., Nahidi, M., Mehrabian, A., & Tabesh, H. (2020). Home Quarantine Is a Useful Strategy to Prevent the Coronavirus Outbreak: Identifying the Reasons for Non-Compliance in Some Iranians. *Informatics in Medicine Unlocked, 21,* Article ID: 100487. https://doi.org/10.1016/j.imu.2020.100487

Ney, M. S., & Gonçalves, C. A. G. (2020). Administrative Reforms and the Neoliberal Dismantling of the Brazilian State: Challenges for Facing the New Coronavirus. *Physis (Rio de Janeiro, Brazil), 30,* e300301.

Nomani, M. Z. M., & Parveen, R. (2020). COVID-19 Pandemic and Application of Disaster Management Act, 2005: Promises and Pitfalls. *International Journal of Pharmaceutical Research, 12,* 3730-3734. https://doi.org/10.31838/ijpr/2020.12.04.509

Pagani, R. N., Kovaleski, J. L., & Resende, L.M. (2015). Methodi Ordinatio: A Proposed Methodology to Select and Rank Relevant Scientific Papers Encompassing the Impact Factor, Number of Citation, and Year of Publication. *Scientometrics, 105,* 2109-2135. https://doi.org/10.1007/s11192-015-1744-x

Pereira, A. S., Sjitsuka, D. M., Parreira, F. J., & Sjitsuka, R. (2018). *Metodologia da Pesquisa Científica.* Universidade Federal de Santa Maria. https://www.ufsm.br/app/uploads/sites/358/2019/02/Metodologia-da-Pesquisa-Cientifica_final.pdf

Qiu, J. (2020). Pandemic Risk: Impact, Modeling, and Transfer. *Risk Management and Insurance Review, 23,* 293-304. https://doi.org/10.1111/rmir.12160

Ramadan, A., Kamel, A., Taha, A., El-Shabrawy, A., & Abdel-Fatah, N. A. (2020). A Multivariate Data Analysis Approach for Investigating Daily Statistics of Countries Affected with COVID-19 Pandemic. *Heliyon, 6,* e05575. https://doi.org/10.1016/j.heliyon.2020.e05575

Rodrigues, K. F., Carpes, M. M., & Raffagnato, C. G. (2020). Disaster Preparedness and Response in Brazil in the Face of the COVID-19 Pandemic. *Revista de Administração Pública, 54,* 614-634. https://doi.org/10.1590/0034-761220200291x

Sciortino, R., & Saini, F. (2020). Towards a Comprehensive Narrative and Response to COVID-19 in Southeast Asia. *Social Sciences & Humanities Open, 2,* Article ID: 100058. https://doi.org/10.1016/j.ssaho.2020.100058

Silva, F. C., Paz, J. F., Ribeiro, M. R. S., Freire, L. P. G., Oliveira, J. S., Leite, M. L. et al. (2022). Achados imaginológicos de Tomografia Computadorizada de Pacientes com COVID-19 no Período da Pandemia: Revisão de Literatura. *Brazilian Journal of Health Review, 5,* 1965-1979. https://doi.org/10.34119/bjhrv5n1-173

Sokolov, A. V., & Sokolova, L. A. (2020). COVID-19 Dynamic Model: Balanced Identification of General Biological and Country Specific Features. *Procedia Computer Science, 178,* 301-310. https://doi.org/10.1016/j.procs.2020.11.032

Stone, R., & Scheib, S. (2021). Advantages of, and Adaptations to, Enhanced Recovery Protocols for Perioperative Care during the COVID-19 Pandemic. *Journal of Minimally Invasive Gynecology, 28,* 481-489. https://doi.org/10.1016/j.jmig.2020.12.024

Thomas, D. S., Jang, S., & Scandlyn, J. (2020). The CHASMS Conceptual Model of Cascading Disasters and Social Vulnerability: The COVID-19 Case Example. *International Journal of Disaster Risk Reduction, 51,* Article ID: 101828. https://doi.org/10.1016/j.ijdrr.2020.101828

Trachsler, T., & Jong, W. (2020). Crisis Management in Times of COVID-19: Game, Set or Match? *Journal of Contingencies and Crisis Management, 28,* 485-486. https://doi.org/10.1111/1468-5973.12306

Appendix

Appendix 1. Most Relevant Articles for the Bibliographic Review

Article	Author(s) (year)	Year
Risikobewertung von COVID 19 – aus der Sicht der Versicherung (smedizin)	Becher (2020)	Zeitschrift fur die gesamte Versicherungswissenschaft
Disasters And Public Health Emergencies—Current Perspectives in Preparedness and Response	Khorram-Manesh & Burkle (2020)	Sustainability
Home Quarantine Is a Useful Strategy to Prevent the Coronavirus Outbreak: Identifying the Reasons for Non-Compliance in Some Iranians	Nazari, Shahriari, Dadgarmoghaddam, Saki, Nahidi, Mehrabian & Tabesh (2020)	Informatics in Medicine Unlocked
COVID-19 Dynamic Model: Balanced Identification of General Biological and Country Specific Features	Sokolov & Sokolova (2020)	Procedia Computer Science
Administrative Reforms and the Neoliberal Dismantling of The Brazilian State: Challenges to Confront the New Coronavirus	Ney & Gonçalves (2020).	Physis
O Papel do Estado na Gestão da Crise Ocasionada Pela COVID-19: Visões Distintas Sobre Federalismo e Relações entre União e Municípios	Censon & Barcelos (2020)	Revista Brasileira de Gestão e Desenvolvimento Regional
La "Sala De Máquinas" De La Administración Pública En La Lucha Contra La COVID-19	Coelho, Corrêa, Lisboa & Resch (2020)	Revista de Administração Publica
When do local Governments Reduce Risk? Knowledge Gaps and a Research Agenda	Beccari (2020)	Australian Journal of Emergency Management
Public Leadership in Times of Crisis: Lessons to Learn from A Crisis Communication Point of View	Jong (2020)	Communication Teacher
Public Management in the Activity of Educational Institutions in the Context of Autonomy of their Work (Under the Conditions of Crises and COVID-19)	Liana, Neyla, Oksana, Mykola, Anzhela & Irina (2020)	Systematic Reviews in Pharmacy
Information And Communication Technologies in Public Management of The Healthcare Institutions Network During COVID-19 Pandemics	Samofalov, Izhytska, Dragomyretska & Lyashenko (2020)	Wiadomosci lekarskie
A Multivariate Data Analysis Approach for Investigating Daily Statistics of Countries Affected with COVID-19 Pandemic	Ramadan, Kamel, Taha, El-Shabrawy & Abdel-Fatah (2020)	Heliyon
Advantages of, and Adaptations to, Enhanced Recovery Protocols for Perioperative Care during the COVID-19 Pandemic	Stone & Scheib (2021)	Journal of Minimally Invasive Gynecology
Prediction of COVID-19 Individual Susceptibility using Demographic Data: A Case Study on Saudi Arabia	Althnian, Elwafa, Aloboud, Alrasheed & Kurdi (2020)	Procedia Computer Science
Protocol for Partner2Lose: A Randomized Controlled Trial to Evaluate Partner Involvement on Long-Term Weight Loss	Voils, Shaw, Adler, Jeanes, Lewis, Sharp et al. (2020)	Contemporary Clinical Trials
Social Distancing as Social Engineering & Health Management: Applied Ethics Perspective to Global Management & Strategic Leadership	Mishra (2020)	Research in Globalization

Continued

PIN68 COVID-19 Simulator: An Interactive Tool to Inform COVID-19 Intervention Policy Decisions in the United States	Chhatwal, Dalgic, Müller, Adee, Xiao, Ladd, Linas, & Ayer (2020)	Value in Health
Ethical Principles in Decision-making During the COVID-19 Pandemic	Deps & Cassimiro. (2020)	Ethics, Medicine, and Public Health
Heterogeneidades das Políticas Estaduais de Distanciamento Social Diante da COVID-19: Aspectos Políticos e Técnico-Administrativos	Pereira, Oliveira & Sampaio (2020)	Revista de Administração Pública
COVID-19 Pandemic and Application of Disaster Management Act, 2005: Promises And Pitfalls	Nomani & Parveen (2020)	International Journal of Pharmaceutical Research
Enhancing COVID-19 Decision-making by Creating an Assurance Case for Epidemiological Models	Habli, Alexander, Hawkins Sujan, McDermid, Picard & Lawton (2020)	BMJ Health and Care Informatics
Pandemic Risk: Impact, Modeling, and Transfer	Qiu (2020)	Risk Management and Insurance Review
Disaster Preparedness and Response in Brazil in the Face of the COVID-19 Pandemic	Rodrigues, Carpes & Raffagnato (2020)	Revista de Administração Publica
Elective Surgery in Times of COVID-19: A Two-centre Analysis of Postponed Operations and Disease-related Morbidity and Mortality	Metelmann & Busemann (2020)	Zeitschrift für Evidenz, Fortbildung und Qualität im Gesundheitswesen
Towards a Comprehensive Narrative and Response to COVID-19 in Southeast Asia	Sciortino & Saini (2020)	Social Sciences & Humanities Open
Analysis of "earlyR" Epidemic Model and Time Series Model for Prediction of COVID-19 Registered Cases	Kanagarathinam, Algehyne & Sekar (2020)	Materials Today: Proceedings
COVID-19 and Emergency Department Volume: The Patients Return but Have Different Characteristics	Heppner, Shreffler, Polites, Ross, Thomas & Huecker (2021)	The American Journal of Emergency Medicine
Reflecting On Prediction Strategies for Epidemics: Preparedness and Public Health Response	Yildirim, Serban, Shih & Keskinocak (2021)	Annals of Allergy, Asthma & Immunology
Response to SARS-CoV-2 Pandemic in a Non-COVID-19 Designated Latin-American Neurosurgery Department	Núñez-Velasco, Mercado-Pimentel, Ochoa-Plascencia, Rodríguez-Arias, Lopez-Espinoza, González-González et al. (2020)	World Neurosurgery
Public Health Decision-making in the Real World: Four Points to Reshape It after COVID-19	Torri & Nollo (2020)	Disaster Medicine and Public Health Preparedness
COVID-19: The Need for an Australian Economic Pandemic Response Plan	Higginson, Milovanovic, Gillespie, Matthews, Williamns, Wall et al. (2020)	Health Policy and Technology
Letter to the Editor: Time-Out Protocol to Ensure Understanding and Implementation of the Storm of Instructions and Protocols During the COVID-19 Pandemic	Kobo-Greenhut, Arad, Levi-Hevroni & Shlomo (2020)	American Journal of Medical Quality
Lessons Learned in Managing Risk: Tools and Strategies for Confident Operations from the CLEAN 2020 Summit	Martinez & Morrow (2020)	Toxicology and Industrial Health
Beyond COVID-19: Five Commentaries on Expert Knowledge, Executive Action, and Accountability in Governance and Public Administration	Boin, Brock, Craft, Halligan, Hart et al. (2020)	Canadian Public Administration

Continued

Public Policy in a Pandemic: A Hazard-Control Perspective and a Case Study of the BCG Vaccine for COVID-19	Gosavi & Marley (2020)	IEEE Engineering Management Review
Economic Instruments to Support the Population and Eliminate the Consequences of Applying Emergency Measures To Protect The Country's Security	Kaliakparova, Gridneva, Assanova & Syzdykova (2020)	Journal of Security and Sustainability Issues
Protecting Scientific Integrity and Public Policy Pronouncements on COVID-19	McAleer (2020)	Advances in Decision Sciences
COVID-19, Black Swan events and the Future of Disaster Risk Management in India	Mishra (2020)	Progress in Disaster Science
Sustainable Ambient Environment to Prevent Future Outbreaks: How Ambient Environment Relates to COVID-19 Local Transmission in Lima, Peru	Kuo, Pacheco, Iswara, Dermawan, Andhikaputra & Hsieh (2020)	Sustainability
Light-based Technologies for Management of Pandemic Crisis: COVID-19	Sabino, Ball, Baptista, Dai, Hamblin, Ribeiro et al. (2020)	International Journal of Research in Pharmaceutical Sciences
Survey Data on Government Risk Communication and Citizen Compliance During the COVID-19 Pandemic in Vietnam	Thanh (2020)	Data in Brief
Understanding clinical decision-making during the COVID-19 pandemic: A cross-sectional worldwide survey	Martínez-Sanz, Pérez-Molina, Moreno, Zamora & Serrano-Villar (2020)	EClinicalMedicine
Lessons from the COVID-19 Pandemic—Unique Opportunities for Unifying, Revamping and Reshaping Epidemic Preparedness of Europe's Public Health Systems	Ippolito, Lauria, Locatelli, Magrini, Montaldo, Sadun et al. (2020)	International Journal of Infectious Diseases
COVID-19: Combined Supply-side and Demand-side Shocks, so Lift restrictions (carefully) Lest GPD Declines Ultimately Kill More than COVID-19	Grech & Grech (2020)	Early Human Development
Learning to Think Together: Creativity, Interdisciplinary Collaboration and Epistemic Control	Gardiner (2020)	Thinking Skills and Creativity
Does it Make a Difference? Exploring the Value of Combining Public = Health and Nursing Education	Roepke, D'Ambrosia, Harmon & Fasso (2021)	Journal of Professional Nursing
A National Fight Against COVID-19: Lessons and Experiences from China	Wang, Yan & Boasson (2020)	Australian and New Zealand Journal of Public Health
India's Response to Coronavirus Pandemic: Nine Lessons for Effective Public Management	Trivedi (2020)	American Review of Public Administration
Risk-Informed Decision Making: More Critical Today Than Ever before	Watson & Mullen (2020)	Health Security
Choosing Not to Follow Rules That Will Reduce the Spread Of COVID-19	Stapleton (2020)	Journal of Contextual Behavioral Science
Reflexiones Sobre Cómo Evaluar y Mejorar la Respuesta a la Pandemia de COVID-19	Martín-Moreno, Arenas, Bengoa, Borrell, Franco, García-Besteiro et al. (2020)	Gaceta Sanitaria

Continued

Adaptive and Turbulent Governance. Ways of Governing that Foster Resilience. The Case of the COVID-19 Pandemic	Țiclău, Hintea & Andrianu (2020)	Transylvanian Review of Administrative Sciences
Positive Control Synthesis Method for COVID-19 Diagnosis by One-Step Real-Time RT-PCR	Cho, Jung, Cho, Kim, & Kim (2020)	Clinica Chimica Acta
Impact of Novel Coronavirus Disease (COVID-19) Lockdown on Ambient Air Quality of Saudi Arabia	Aljahdali, Alhassan & Albeladi (2021)	Saudi Journal of Biological Sciences
Benchmarks for INGOs' Effective Responses During COVID-19 Pandemic	Saleh & Karia (2020)	Benchmarking
Learning Before and During the COVID-19 Outbreak: A Comparative Analysis of Crisis Learning in South Korea and the US	Lee, Yeo & Na (2020)	International Review of Public Administration
A Taxonomy of Crisis Management Functions	Tagarev & Ratchev (2020)	Sustainability
Audit Institutions in The European Union: Public Service Promotion, Environmental Engagement and COVID Crisis Communication Through Social Media	Hancu-Budui, Zorio-Grima, & Blanco-Veja (2020)	Sustainability
Tackling COVID-19: Insights from the Qinghai Province Plague Prevention and Control (PPC) Model	Wu, Zhang, Wu, Tian, Cui, Qi et al. (2020)	Biosafety and Health
Modeling Social Distancing Strategies to Prevent SARS-CoV-2 Spread in Israel: A Cost-Effectiveness Analysis	Shlomai, Leshno, & Sklan (2020)	Value in Health
Mathematical Analysis of the Effects of Controls on Transmission Dynamics of SARS-CoV-2	Asamoah, Bornaa, Seidu, & Jin (2020)	Alexandria Engineering Journal
The COVID-19 Pandemic: Yet Another Catalyst for Governmental Mass surveillance?	Barriga, Martins, Simões & Faustino (2020)	Social Sciences & Humanities Open
Response of Practicing Chiropractors during the Early Phase of the COVID-19 Pandemic: A Descriptive Report	Johnson, Green, Bart, Konaraski-Hart, Karen, Hewitt et al. (2020)	Journal of Manipulative and Physiological Therapeutics
Pandemics, Global Risks and Adaptation: Challenges for a Changing World	Amorim & Guerra (2020)	Research in Globalization
"Ten years of war! You expect people to fear a 'germ'?": A Qualitative Study of Initial Perceptions and Responses to the COVID-19 Pandemic Among Displaced Communities in Opposition-controlled Northwest Syria	Douedari, Alhaffar, Al-Twaish, Mkhallalati, Alwany, Ibrahim et al. (2020)	Journal of Migration and Health
Development of an Enhanced Acute Care Surgery Service in Response to the COVID-19 Global Pandemic	Mathur, Ng, Koh, Cai, Palaniappan, Linn et al. (2020)	Injury
Mathematical modelling on diffusion and control of COVID-19	Krishna (2020)	Infectious Disease Modelling
Response of Chiropractic Organizations to the COVID-19 Pandemic: A Descriptive Report	Johnson, Little, Sterling, Gojkovich, Boghosian & Ciolfi (2020)	Journal of Manipulative and Physiological Therapeutics
Lessons from COVID-19: How Human Behaviour May Influence the Science	Ceriello (2020)	Diabetes Research and Clinical Practice
On Pandemic Preparedness: How Well is the Modeling Community Prepared for COVID-19?	Desai, Druyts, Yan & Balijepalli (2020)	Pharmaco Economics

Continued

Proceedings of the OMS COVID-19 Response Conference	Wang, Moon, Le & Panchal (2020)	Journal of Oral and Maxillofacial Surgery
Supporting the Well-Being of Health Care Providers During the COVID-19 Pandemic: The CopeColumbia Response	Mellins, Mayer, Glasover, Devlin, Albano, Nash et al. (2020)	General Hospital Psychiatry
The Dangers of Performative Scientism as The Alternative to Anti-Scientific Policymaking: A Critical, Preliminary Assessment of South Africa's COVID-19 Response And Its Consequences	Muller (2021)	World Development
The CHASMS Conceptual Model of Cascading Disasters and Social Vulnerability: The COVID-19 Case Example	Thomas, Jang & Scandlyn (2020)	International Journal of Disaster Risk Reduction
COVID-19 Situation in Honduras: Lessons Learned	Fuentes-Barahona, Henriquez-Márquez, Muñoz-Lara, Palou, Alvarado, Lorenzana et al. (2020)	Gaceta Medica de Caracas
Risk management in the System of Tourist Business Control	Tsapova, Kadochnikova, Kendyukh, & Gorkovenko (2021)	Journal of Environmental Management and Tourism
Success in Combating a Pandemic: Role of Fast Policy Responses	Tung (2021)	World Development Perspectives
Bikeshare and Safety: Risk Assessment and Management	Kim, Gimire, Pant & Yamashita (2021)	Transportation Research Interdisciplinary Perspectives
Recovery during a crisis: facing the challenges of risk assessment and resilience management of COVID-19	Menoni & Schwarze (2020)	Environment Systems and Decisions
OxCGRT-Based Evaluation of Anti-COVID-19 Measures Taken by Japanese Prefectures	Kumagai, Aoyama, Ino & Watanabe (2021)	Journal of Disaster Research
A Proposal For COVID-19 Applications Enabling Extensive Epidemiological Studies	Ravizza, Sternini, Molinari, Santoro & Cabitza (2021)	Procedia Computer Science
Advancing International Cooperation as a Strategy for Managing Pandemics	You (2021)	Asian Pacific Journal of Public Administration
From a "super spreader of MERS" to a "super stopper" of COVID-19: Explaining the Evolution of South Korea's Effective Crisis Management System	Oh (2020)	Journal of Asian Public Policy

Appendix 2. Indicators and Primary Indicators

Indicator	Primary Indicator	Author(s) (year)	Nr. of Articles
Economic	Resource availability	Khorram-Manesh & Burkle (2020); Stone & Scheib (2021).	2
	Economic Damages	Becher (2020); Habli, Alexander, Hawkins, Sujan, McDermid, Picard & Lawton (2020); Qiu (2020); Rodrigues, Carpes e Raffagnato (2020).	4
Political	Sanitary & Health Protocols	Watson & Mullen (2020).	1
	Sinergy between Institutions	Amorin & Guerra (2020); Martinez & Morrow (2020); Khorram-Manesh & Burkle (2020); Saleh & Karia (2020).	4

Continued

	Gorvernment Conduct	Kaliakparova, Gridneva, Assanova & Syzdykova (2020); Gardiner (2020); Villela (2021); Higginson, Milovanovic, Gillespie, Matthews, Williamns, Wall et al. (2020); Boin, Brock, Craft, Halligan, Hart et al. (2020); Sabino, Ball, Baptista, Dai, Hamblin, Ribeiro et al. (2020); Lee, Yeo & Na (2020); Tagarev & Ratchev (2020); Muller (2021); You (2021); Khorram-Manesh & Burkle (2020); Nazari, Shahriari, Dadgarmoghaddam, Saki, Nahidi, Mehrabian & Tabesh (2020); Censon & Barcelos (2020); Coelho, Corrêa Lisboa & Resch (2020); Jong (2020); Mishra (2020); Chhatwal, Dalgic, Müller, Adee, Xiao, Ladd, Linas, & Ayer (2020); Deps & Cassimiro (2020); Pereira, Oliveira & Sampaio (2020); Qiu (2020); Rodrigues, Carpes & Raffagnato (2020); Menoni & Schwarze (2020); Kumagai, Aoyama, Ino & Watanabe (2021); Trivedi (2020); Ţiclău, Hinţea & Andrianu (2020); Fuentes-Barahona, Henriquez-Márquez, Muñoz-Lara, Palou, Alvarado, Lorenzana et al.(2020); Sciortino & Saini (2020); Liana, Neyla, Oksana, Mykola, Anzhela & Irina (2020).	31
	Crisis Learning	Lee, Yeo & Na (2020).	1
	Risk Communication	Hancu-Budui, Zorio-Grima & Blanco-Veja (2020); Stapleton (2020); Tung (2021); Nazari, Shahriari, Dadgarmoghaddam, Saki, Nahidi, Mehrabian & Tabesh (2020); Sciortino & Saini (2020); Gosavi & Marley (2020); Mcaleer (2020); Johnson, Little, Sterling, Gojkovich, Boghosian & Ciolfi (2020); Jong (2020); Deps & Cassimiro (2020); Rodrigues, Carpes & Raffagnato (2020).	11
Psychological	Emotional Intelligence	Martín-Moreno, Arenas, Bengoa, Borrell, Franco, García-Besteiro et al. (2020); Khorram-Manesh & Burkle (2020);	2
	Risk-related Behavior	Ceriello (2020); Habli, Alexander, Hawkins Sujan, McDermid, Picard & Lawton (2020); Rodrigues, Carpes & Raffagnato (2020); Sciortino & Saini (2020); Kobo-Greenhut, Arad, Levi-Hevroni & Shlomo (2020).	7
Health	Public Health Politicies	Grech & Grech (2020); Wu, Zhang, Wu, Tian, Cui, Qi et al. (2020); Asamoah, Bornaa, Seidu, & Jin (2020); Nomani & Parveen (2020); Samofalov, Izhytska, Dragomyretska & Lyashenko (2020); Rodrigues, Carpes & Raffagnato (2020); Sciortino & Saini (2020); Khorram-Manesh & Burkle (2020).	8
	Test Availability	Cho, Jung, Cho, Kim, & Kim (2020); Chhatwal, Dalgic, Müller, Adee, Xiao, Ladd, Linas, & Ayer (2020); Sokolov & Sokolova (2020);	3
	Number of infected in isolation	Shlomai, Leshno, & Sklan (2020); Sokolov & Sokolova (2020); Habli, Alexander, Hawkins, Sujan, McDermid, Picard & Lawton (2020).	3
	Hospitalization rate	Becher (2020); Chhatwal, Dalgic, Müller, Adee, Xiao, Ladd, Linas, & Ayer (2020); Ramadan, Kamel, Taha, El-Shabrawy & Abdel-Fatah (2020).	3
	Death rate	Becher (2020); Ramadan, Kamel, Taha, El-Shabrawy & Abdel-Fatah (2020); Chhatwal, Dalgic, Müller, Adee, Xiao, Ladd, Linas, & Ayer (2020); Habli, Alexander, Hawkins, Sujan, McDermid, Picard & Lawton (2020); Qiu (2020);	5

Continued

	Ethics	Khorram-Manesh & Burkle (2020).	1
	Number of cases	Ramadan, Kamel, Taha, El-Shabrawy & Abdel-Fatah (2020); Chhatwal, Dalgic, Müller, Adee, Xiao, Ladd, Linas, & Ayer (2020); Habli, Alexander, Hawkins, Sujan, McDermid, Picard & Lawton (2020); Desai, Druyts, Yan & Balijepalli (2020).	5
	Total number of active cases	Ramadan, Kamel, Taha, El-Shabrawy & Abdel-Fatah (2020).	1
	Infectibility	Althnian, Elwafa, Aloboud, Alrasheed & Kurdi (2020); Habli, Alexander, Hawkins, Sujan, McDermid, Picard & Lawton (2020); Qiu (2020); Becher (2020); Oh (2020); Khorram-Manesh & Burkle (2020); Sokolov & Sokolova (2020); Chhatwal, Dalgic, Müller, Adee, Xiao, Ladd, Linas, & Ayer (2020).	9
	Recovery rate	Habli, Alexander, Hawkins, Sujan, McDermid, Picard & Lawton (2020).	1
	Vaccination rate	Qiu (2020).	1
Social	Vulnerability situation	Thomas, Jang, & Scandlyn (2020).	1
	Social Security	Becher (2020).	1
	Social Infrastructure	Rodrigues, Carpes & Raffagnato (2020).	1
	Social Miscegenation	Sciortino & Saini (2020).	1