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Impact of health policy on COVID-19 pandemic: a perspective framework

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ABSTRACT

Background: Academic researchers and clinicians play a critical role in shaping public health policies to address the effects of the corona virus infectious disease (coronavirus disease 2019 [COVID-19]). The aim of this study was to determine the impact of public health policies during the COVID-19 pandemic as described in published articles and develop an operational framework for the analysis of health policy that may be carried out via specific research on the pandemic.
Methods: There were 4 databases used: PubMed, MEDLINE, Ovid-Embase and ScienceDirect. We searched for articles published in English during the period of February to December 2020.
Results: There were 10 articles selected and synthesized. Public health policy strategies and responses were divided according to 7 main themes: Find (early detection, track, trace and monitoring, communication), Foster (public education, social distancing, lockdown, crowd control, care facilities and medical equipment), Focus (socioeconomic needs, financial aid, ecological, biological, change point models), Form (capacity building, decision-making, leadership, partnerships), Function (organizational structure, information system, hospital and clinical facilities) and Foreknowledge (research and clinical trials, preparedness).
Conclusions: Understanding the impact of public health policy during the COVID-19 pandemic could help in ensuring that we are adequately prepared to address future health crises. Policymakers and communities must remain diligent and flexible in responding to current needs and preparing for future policy changes due to COVID-19.

Keywords: COVID-19; Coronavirus; Pandemics; Public health; Health policy

INTRODUCTION

As a result of the outbreak of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) or coronavirus disease 2019 (COVID-19), a pandemic was declared by the World Health Organization (WHO) in March 2020.[1] The potential impacts of the COVID-19 pandemic become a terrible incident and increasing public health issue till today.

South Korea is currently regarded as delivering one of the most successful responses to COVID-19, with transparent risk communication and the voluntary participation of citizens in non-pharmaceutical interventions such as social distancing.[2] Since the first confirmed

patient was identified on 20 January 2020, the Korean government has taken a vigilant and aggressive approach, with a test and trace protocol in place to identify individuals who have potentially been exposed to COVID-19, and with confirmed patients treated in designated facilities depending on their medical conditions; this proactive approach has been remarkably successful in tackling COVID-19.[3] As the virus continues to spread, it is crucial for countries that are already affected by COVID-19 and those still planning their responses to the pandemic to learn from South Korea's response strategy.[4]

National and international responses to COVID-19 have provided several examples of how effectively science and politics can interact to protect or reinvent the public health of their countries as well as their economies.[5] COVID-19 has significantly shifted public health policy worldwide. Policymakers are continuing to create and develop new strategies to respond to the pandemic.[6] Balancing the direct response to COVID-19 with the need for the continued delivery of other health services is a universal dilemma for policymakers.[7] Most health policy experts agree that the pre-pandemic healthcare system was inefficient. This has partly become apparent as a result of media attention, which is known to affect public health policy and practice.[8] However, there is no consensus as to the optimal delivery system for the diversity of health plans. Developing responses to outbreaks is one of the most routine and important tasks of public health professionals and policymakers.[9]

South Korea is expecting an increased number of COVID-19 cases during the long 'lunar new year holiday' in the middle of February; consequently, the government has designated the 2-week holiday as a "special period" during which strong, nationwide efforts are required to protect citizens from the virus.[10] However, disease outbreaks can vary greatly; they can be complex and complicated, prompting a discussion about when an outbreak becomes a public health emergency. Therefore, resources and co-services may need to be redirected from core public health programs towards the public health policy response.

The aims of this study were to determine the impact of public health policies on the COVID-19 pandemic and to develop an operational framework supporting health policy analysis that may be carried out by specific research that describes the effects of the pandemic on the implementation of policy.

METHODS

Research approach
This study focused the literature review approach in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines.

Data collection
In this study electronic databases were used to search updated public health policy on COVID-19 related articles published in the year of February to December 2020, including PubMed, MEDLINE, Ovid-Embase and ScienceDirect by the keywords as ["Public Health" OR "Health Policy" OR "preventive medicine"] AND ["COVID-19" OR "Novel Coronavirus," OR "2019-nCoV" OR "SARS-CoV-2"] AND ["social distancing" OR "quarantine" OR "isolation" OR "tracing"].

Inclusion and exclusion criteria

The inclusion criteria were (1) articles published in English, (2) articles published during the COVID-19 outbreak, (3) articles focused on public health policy, (4) original articles, (5) availability of full text. The exclusion criteria were (1) non-English articles, (2) articles which discuss public health in combination with other topics.

Data evaluation and reduction

During the data extraction process, the articles were selected, and data were extracted by using a form that included the following fields: author's name, publication year, data collection methods, policies, and main results. As in the selection process, the extracted data were reviewed by 2 researchers to ensure data reliability.

RESULTS

Article search results

The electronic search identified 110 articles and an additional 6 articles were found based on the database source. The total number of retrieved articles was 110 and 68 articles remained after removal of duplicate articles. Then, 47 articles were extracted which did not meet the eligibility criteria and 21 articles were screened for eligibility. In the eligibility step, 15 articles were considered for in-depth review; however, 5 articles were excluded due the non-availability of the entire text. Finally, a total of 10 articles which were recommended and suggested by policymakers were selected for the data synthesis (**Fig. 1**).

Characteristics of articles

There were 10 articles selected for the data synthesis. A description of the reviewed articles is presented in **Table 1**. All of the articles were published in 2020, during the COVID-19 pandemic. Most of the articles were published in the USA (n = 3), followed by France (n = 2) and South Korea (n = 1), Canada (n = 1), Iran (n = 1), Singapore (n = 1) and the UK (n = 1).

Themes of the framework

The development of the framework was based on the identified strategies of the 6 "F"s, as shown in **Fig. 2**. The article search revealed 6 themes based on public health policy related to the COVID-19 pandemic and its impact were: Find (early detection, track, trace and monitoring, communication), Foster (public education, social distancing, lockdown, crowd control, care facilities and medical equipment), Focus (socioeconomic needs, financial aid, ecological, biological, change point models), Form (capacity building, decision-making, leadership, partnerships), Function (organizational structure, information system, hospital and clinical facilities) and Foreknowledge (research and clinical trials, preparedness). In addition, this review considered the most recently published articles and focused on public health policy during the pandemic.

DISCUSSION

The findings of the review revealed the following themes: Finding the cases, Fostering awareness, Focus on socioeconomic and biological needs, Form and build capacity with partnerships, Functions of organizations in information system and hospital facilities, Foreknowledge of research, clinical trials and preparedness including precaution-related measures to avoid the recurrence of outbreaks.
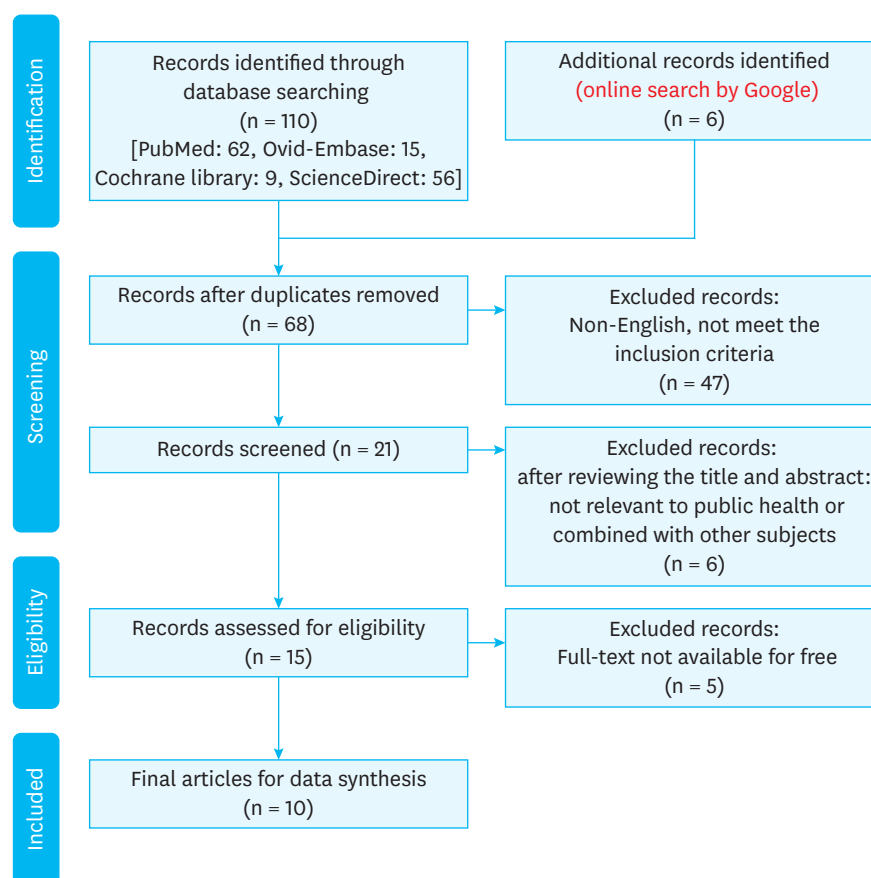
Fig. 1. Flow diagram for the literature search and article selection process.

Early detection by tracking and tracing[17,20] was an important prevention method and recommended as part of the monitoring,[14,17,20] communication,[17,19] mobility[11,20] and triage.[12,14,17] It was reported that the identification of COVID-19 cases represented the recognition of the threat and rapid activation of national response protocols led by national leadership; rapid establishment of diagnostic capacity; scale-up of measures for preventing community transmission; and redesigning the triage and treatment systems, mobilizing the necessary resources for clinical care.[21] South Korea, which has a stringent detect, test, isolate, treat, and contact trace policy, has reportedly had the greatest success in containing COVID-19.[21] Many other countries adapted South Korea's strategies of prevention, early detection, and rapid response to the pandemic.

Encouraging public awareness of the COVID-19 situation is an important strategy to avoid cross- and community-based transmission. National and international public awareness was ensured via public education,[11] lockdown,[8,9] crowd controlling,[11] reliance on healthcare facilities and testing and medical equipment.[11] The change point model with the C-spine model[20] to monitor COVID-19 surveillance data could help to provide trace detection of incidence change patterns and reveal the impact of public health policy implementation. Public health approaches have included a portfolio of measures including border controls, restrictions on national and international travel, isolating the public at home (except for essential workers) and the quarantining contacts of affected patients, complemented by diagnostic testing, health screening, contact tracing and the use of surveillance apps.[3] South

Table 1. Description of the articles included for synthesis

Serial No.	Author	Purpose	Data	Method	Policy	Comments
1	Bargain and Aminjonov (2020; France)[11]	To reduce social interaction and limit contagion	Human mobility and political trust at regional level in Europe	Analysis of public health policy	· Mobility · Trust and policy stringency · COVID-related deaths and control variables	The effect of political trust on mobility, graphical evidence by difference-in-difference estimations

2	Raoofi et al. (2020; Iran)[12]	To compare the policies and strategies that Iran is adopting, with the experience and recommendations of China and WHO to combat COVID-19	Systematic document content analysis: content analysis of available policy documents, programs, action plans, reports, websites and official news in Iran, China and WHO	Qualitative content analysis of health policy triangle	Contextual-based policies
					· Context
					  - Pre-epidemic
					  - Post-epidemic measures
					· Process
					  - Agenda setting
					  - Formulation
					  - Implementation
					  - Evaluation
					· Content
					  - Situational and structural
					  - Socio-cultural and international factors
						Policy learning is crucial to formulate appropriate policies and recommended to implement them accordingly

3	Andrew et al. (2020; Canada)[13]	To discuss both challenges to gaining full understanding of the impact of COVID-19 in LTCF settings and the importance of frailty, an easily ascertained clinical factor and to inform risk and care planning	· CFS · Data used from the LTCF	Measurement of CFS	Ecological framework · Individual to families · Caregivers, institutions · Health services and systems · Communities, and contextual government policies	Requirement of strong & coordinated surveillance and research focused on LTCFs

4	Wang et al. (2020; USA)[14]	To focuses on global health pandemic and how mitigation of the virus relies heavily on health behavior change to slow its spread, highlighting how the pandemic specifically affects the most socially and economically disadvantaged populations	· Cross-sectional study
			· Pandemic related morbidity, and mortality records USA
				Analysis of number of death records in USA during pandemic and analysis morbidity, and mortality on the underserved populations	Research and policy action
					· Research practices
					  - Social determinants and health equity
					  - Lens on monitoring
					  - Evaluation
					  - Clinical trials activities on COVID-19
					· Policy actions dedicating resources
					  - To prioritize high-risk communities for testing
					  - Treatment and prevention
					  - Approaches and implementing organizational, institutional, and legislative policies
						Prioritizing the high-risk communities

5	Ronquillo et al. (2020; USA)[15]	To guide better public health decision-making	· Cross-sectional study · Public and federal government datasets	Biomedical informatics and data visualization tools, public and federal government datasets	Informatics policy · Use of Information system in public health to find cluster of infections	National preparedness ability requires to predict, manage and balance public health needs all stages of a pandemic
6	Woo (2020; Singapore)[16]	To assess the presence and deficiencies of Singapore's different policy capacities, and how these have impacted its COVID-19 policy responses	Review of literature	Policy capacity building	Capacity-driven approach · Operational capacity · Analytical capacity · Fiscal capacity · Political capacity	Capacity-driven approach may need a rethink of existing approaches to public policy and administration

(continued to the next page)

Korea's strategies of the identification of cases, rapid testing, the use of mobile services in testing and equipment facilities and care of travelers arriving from areas with substantial COVID-19 transmission were considered as a change point model.[18]

There were 3 models derived from the article review, including the epidemiological model and biological model,[19] to present a holistic approach, accounting for several objectives and different time steps that are required to manage lockdown-lifting focused on Ostrom's "diagnostic approach," to protect the public from lockdown shock and economic crisis by

Table 1. (Continued) Description of the articles included for synthesis

Serial No.	Author	Purpose	Data	Method	Policy	Comments

7	Nicola et al. (2020; UK)[17]	To compartmentalize leadership aspects, allowing a closer examination of published reports and the analysis of current outcomes	Literature review	Predictive mathematical modelling	Planning and coordination policy
					· Ethical dilemmas
					· Situation monitoring and assessment, communication
					· Funding, personal productive equipment
					· Testing
					· Mitigation and containment
					Ethical dilemmas
					· De-escalation strategies
					  - Exemplar leadership be prepared and acting quickly, testing, tracing
					  - Transparent communication
					· Lesson learned
					  -Open public communicates
					  - An early and decisively
					  - Test trace and isolate
					  - Invest in pandemic preparedness
						Compassionate, open, and highly communicative leaders foster a sense of purpose that can act to strengthen a unified public health approach

8	Lee et al. (2020; South Korea)[18]	To analyze how the Korean government has been effective in taming COVID-19 without forced interruptions of citizens' daily lives and to examines critical factors to effective learning organizations such as leadership, information and transparency, as well as citizen participation and governance	Adaptive approach based on effective interactions of backstage and frontstage of policy processes	Quadruple-loop learning model	Quadruple-loop learning and factors
					· The backstage
					  - Time
					  - Target
					  - Context
					  - The frontstage
					· Critical factors
					  - Actors and leaders
					  - Information and transparency
					  - Decision-making processes and governance
						Continuous interaction between frontstage and backstage quadruple-loop learning mechanism to be identify in different governments

9	Raboisson and Lhermie (2020; France)[19]	To lay down the characteristics of a holistic approach, accounting for several objectives and different time steps, that is required managing lockdown-lifting and the COVID-19 endemic situation	Ostrom's "diagnostic approach," the social-ecological system	Epidemiological modeling and bio-economic modeling	Bio-economic model
					· Context of lockdown-lifting
					  - Biological and economic constraints
					  - Biological and economic uncertainty
					  - Management in an uncertain context due to novelty in biological terms (large-scale shock)
					Epidemiological model
					· Holistic approach: observations, data, tests, previous knowledge
					· Principle 1: integrate multiple and heterogeneous information to diagnose and act with accuracy
					· Principle 2: navigate with uncertain information, and communicate it to the population
					· Principle 3: adjust the strategies dynamically
					· Principle 4: manage clusters with a multi-scalar spatialized policy
						Evidence-based policy would be precision and avoids any political shock

10	Coughlin et al. (2020; USA)[20]	To monitor COVID-19 surveillance data could help provide early detection of incidence change pattern and reveal the impact of public health policy implementation	Data from 20 countries in Europe, the Americas, Africa, Eastern Mediterranean and West Pacific region	Analytical approach · B-spline trend fitting and prediction · Statistical change point models	Early detection of incidence model and policy · EU: Identification of people infected with SARS-CoV-2, contact tracing, and isolation of people with proven exposure · USA: the identification of cases and contacts of persons with COVID-19, and the assessment, monitoring, and care of travelers arriving from areas with substantial COVID-19 transmission · South Korea: extensive contact tracing and use of mobile apps to monitor people who were quarantined · Other countries: stringent lockdown policies	Globally, social distancing measures may have been most effective in smaller countries with single governmental and public health organizational structures

COVID = coronavirus disease; COVID-19 = coronavirus disease 2019; LTCF = Long-Term Care Facilities; CFS = Clinical Frailty Scale; SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2; WHO = World Health Organization; EU = European Union.
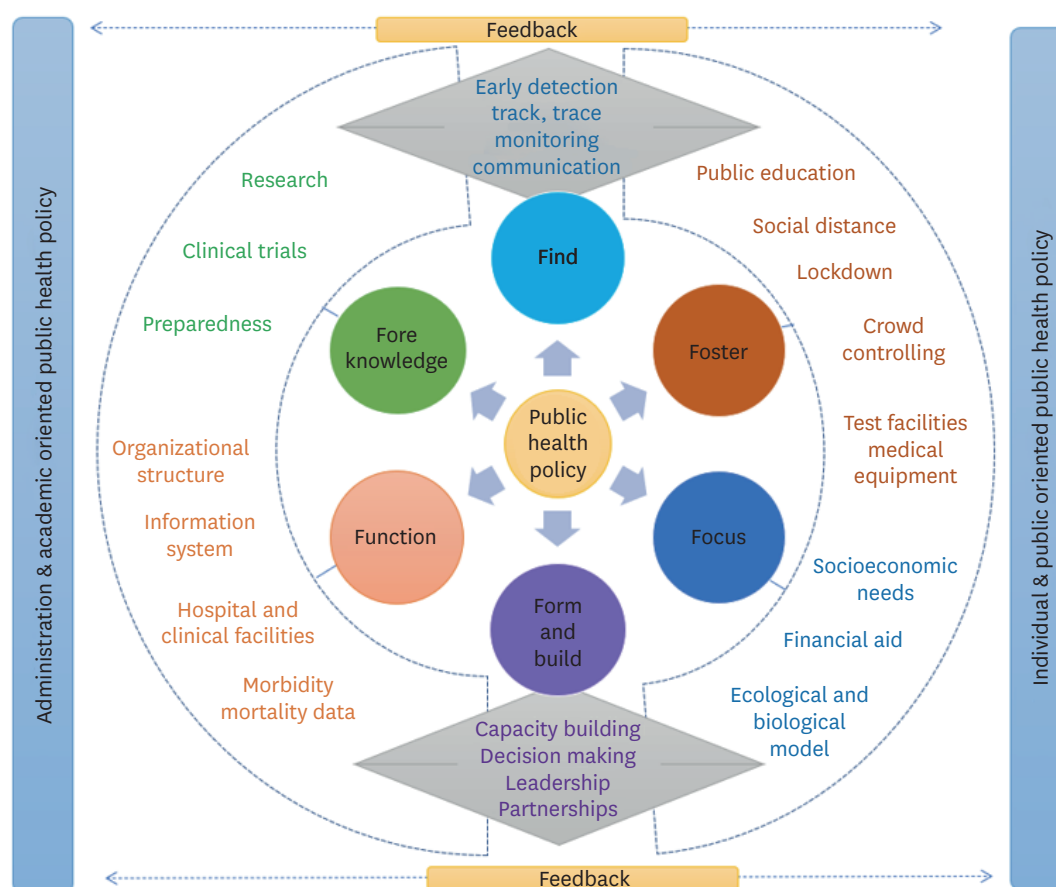
Fig. 2. Framework of public health policy derived from the review articles. The central part represents the public health policy themes derived from the article review. The right semi-circle denotes the recommended public health polices related to administration and academic. The left semi-circle represents the individual and public oriented public health policies for coronavirus disease 2019. Top and down diamond polices are interrelated between individual or public and administrative public health policies. Feedback would be adjustable action among individual or public health policies based on organizational policy changes directly or indirectly.

adopting a holistic approach. Another review presented a sociocultural model[12] to compare the policies and strategies of Iran, which adapted the policies and recommendations of China and WHO to combat COVID-19, based on context, process and content. Learning from recommended policies is crucial to formulate appropriate policies and implement them accordingly. The ecological framework was developed by Andrew et al.[13] to discuss the challenges to gaining a full understanding of the impact of COVID-19 in Long-Term Care Facilities settings by using the Clinical Frailty Scale. There is a significant amount of literature which discusses systemic approaches in public health.[22,23] The quadruple-loop learning model[18] can be used to assess the socioeconomic needs of the citizens during the COVID-19 pandemic. Verity et al.[24] reported that there are serious gaps in some nations' responses to the pandemic, even in highly developed economies and healthcare systems, such as UK and USA.

The capacity building study involved a review of the literature focused on the fiscal, political, analytical, and operational capacity to assess the presence and deficiencies of Singapore's different policy strategies and how these have impacted its COVID-19 policy responses.[16] A capacity-driven approach may require a significant reconsideration of our existing approaches to public policy and administration. Another study sought to compartmentalize leadership aspects, allowing a closer examination of published reports with the analysis of

current outcomes, and focused on a predictive mathematical model.[17] The decision-making policy aimed to guide the citizens during a pandemic through the implementation of an information policy and the national requirement of predicting, managing, and balancing public health needs throughout all stages of a pandemic.[25]

The functions of the public health policy as described in the reviewed articles showed the reported organizational structure[18] how the Korean government has been effective in responding to the COVID-19 pandemic without forced interruptions of citizens' daily lives, through aspects such as leadership, information, and transparency, as well as citizen participation and governance. This study recommended the examination of how different institutional, cultural, technological, and environmental factors can improve the quadruple-loop learning mechanism in different governments.

The experience of COVID-19 across the world indicates that pandemic preparedness in most countries appears at best to have been a paper exercise.[16] It also led to the recommendation of research practices related to social determinants and health equity, evaluation and clinical trials and activities regarding COVID-19. In addition, policy actions have focused on dedicating resources to the prioritization of high-risk communities for testing, treatment and prevention approaches, educational training, and disaster management awareness, implementing organizational, institutional, and legislative policies focused on the global health pandemic. The stockpiling of essential medical supplies and the maintenance of the health service's capacity are undoubtedly costly.[23] Choi[25] reported that systematic education and training relating to COVID-19 should be given to public health professionals to enhance their preparedness and expertise, as their education and training have been based on personal pursuits without systematic support.

The impact of public health policy on pandemic outbreaks is a challenge among policymakers. Individual countries' different approaches to managing the COVID-19 pandemic and the remarkably different outcomes indicate the importance of public health policies. Though lockdown, isolation, tracking, tracing, communication, and monitoring are proposed as effective interventions to control the pandemic, they might result in different outcomes in different contexts due to the particular features of COVID-19 as well as geographical and genetic factors, climatic factors, asymptomatic individuals, family and community transmission and occurrence and recurrence. On the other hand, context-specific factors such as socioeconomic conditions, sociocultural context, population density and social interactions as well as system-level factors such as government financial support influence the implementation of public health policy and strategies.

This study has some limitations that should be highlighted. Firstly, according to the recent evidence, the same public health policies have been included in multiple publications without providing obvious explanations. To address this issue, in forthcoming studies, we will make a particular effort to identify public health policies which are repeatedly reported. Secondly, we have only included studies published in English, so a large number of studies published in languages other than English were not considered.

REFERENCES

1. Coronavirus disease 2019 (COVID-19) situation report – 70. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200330-sitrep-70-covid-19.pdf?sfvrsn=7e0fe3f8_2. Updated 2020. Accessed September 9, 2022.

2. Moon MJ. Fighting against COVID-19 with agility, transparency, and participation: wicked policy problems and new governance challenges. *Public Adm Rev* 2020;80(4):651-6.
   PUBMED | **CROSSREF**

3. Bedford J, Enria D, Giesecke J, Heymann DL, Ihekweazu C, Kobinger G, et al. COVID-19: towards controlling of a pandemic. *Lancet* 2020;395(10229):1015-8.
   PUBMED | **CROSSREF**

4. How South Korea flattened the curve. https://www.nytimes.com/2020/03/23/world/asia/coronavirus-south-korea-flatten-curve.html. Updated 2020. Accessed August 20, 2022.

5. Singer D. Clinical and health policy challenges in responding to the COVID-19 pandemic. *Postgrad Med J* 2020;96(1137):373-4.
   PUBMED | **CROSSREF**

6. Posid JM, Bruce SM, Guarnizo JT, O'Connor RC JrPapagiotas SS, Taylor ML. Public health emergencies and responses: what are they, how long do they last, and how many staff does your agency need? *Biosecur Bioterror* 2013;11(4):271-9.
   PUBMED | **CROSSREF**

7. Krubiner C, Keller JM, Kaufman J. *Balancing the COVID-19 Response With Wider Health Needs: Key Decision-making Considerations for Low- and Middle-income Countries*. Washington, D.C., USA: Center for Global Development (CGD); 2020.

8. Fuchs VR. Health care policy after the COVID-19 pandemic. *JAMA* 2020;324(3):233-4.
   PUBMED | **CROSSREF**

9. Zhang L, Liu Y. Potential interventions for novel coronavirus in China: a systematic review. *J Med Virol* 2020;92(5):479-90.
   PUBMED | **CROSSREF**

10. Policy responses to COVID-19: health care industry approaches. https://www.kihasa.re.kr/english/publications/eng_brief/view.do?menuId=103&tid=38&bid=24&aid=74&ano=1&pageIndex=1. Updated 2020. Accessed September 9, 2022.

11. Bargain O, Aminjonov U. Trust and compliance to public health policies in times of COVID-19. *J Public Econ* 2020;192:104316.
    PUBMED | **CROSSREF**

12. Raoofi A, Takian A, Akbari Sari A, Olyaeemanesh A, Haghighi H, Aarabi M. COVID-19 pandemic and comparative health policy learning in Iran. *Arch Iran Med* 2020;23(4):220-34.
    PUBMED | **CROSSREF**

13. Andrew M, Searle SD, McElhaney JE, McNeil SA, Clarke B, Rockwood K, et al. COVID-19, frailty and long-term care: Implications for policy and practice. *J Infect Dev Ctries* 2020;14(5):428-32.
    PUBMED | **CROSSREF**

14. Wang ML, Behrman P, Dulin A, Baskin ML, Buscemi J, Alcaraz KI, et al. Addressing inequities in COVID-19 morbidity and mortality: research and policy recommendations. *Transl Behav Med* 2020;10(3):516-9.
    CROSSREF

15. Ronquillo JG, Lester WT, Zuckerman DM. Using informatics to guide public health policy during the COVID-19 pandemic in the USA. *J Public Health (Oxf)* 2020;42(4):660-4.
    PUBMED | **CROSSREF**

16. Woo JJ. Policy capacity and Singapore's response to the COVID-19 pandemic. *Policy Soc* 2020;39(3):345-62.
    PUBMED | **CROSSREF**

17. Nicola M, Sohrabi C, Mathew G, Kerwan A, Al-Jabir A, Griffin M, et al. Health policy and leadership models during the COVID-19 pandemic: a review. *Int J Surg* 2020;81:122-9.
    PUBMED | **CROSSREF**

18. Lee S, Hwang C, Moon MJ. Policy learning and crisis policy-making: quadruple-loop learning and COVID-19 responses in South Korea. *Policy Soc* 2020;39(3):363-81.
    PUBMED | **CROSSREF**

19. Raboisson D, Lhermie G. Living with COVID-19: a systemic and multi-criteria approach to enact evidence-based health policy. *Front Public Health* 2020;8:294.
    PUBMED | **CROSSREF**

20. Coughlin SS, Yiğiter A, Xu H, Berman AE, Chen J. Early detection of change patterns in COVID-19 incidence and the implementation of public health policies: a multi-national study. *Public Health Pract (Oxf)* 2021;2:100064.
PUBMED | CROSSREF

21. Dighe A, Cattarino L, Cuomo-Dannenburg G, Skarp J, Imai N, Bhatia S, et al. Response to COVID-19 in South Korea and implications for lifting stringent interventions. *BMC Med* 2020;18(1):321.
PUBMED | CROSSREF

22. Golden SD, Earp JA. Social ecological approaches to individuals and their contexts: twenty years of health education & behavior health promotion interventions. *Health Educ Behav* 2012;39(3):364-72.
PUBMED | CROSSREF

23. Brownson RC, Burke TA, Colditz GA, Samet JM. Reimagining public health in the aftermath of a pandemic. *Am J Public Health* 2020;110(11):1605-10.
PUBMED | CROSSREF

24. Verity R, Okell LC, Dorigatti I, Winskill P, Whittaker C, Imai N, et al. Estimates of the severity of coronavirus disease 2019: a model-based analysis. *Lancet Infect Dis* 2020;20(6):669-77.
PUBMED | CROSSREF

25. Choi S. A hidden key to COVID-19 management in Korea: public health doctors. *J Prev Med Public Health* 2020;53(3):175-7.
PUBMED | CROSSREF