Distribution Agreement

In presenting this thesis or dissertation as a partial fulfillment of the requirements for an advanced degree from Emory University, I hereby grant to Emory University and its agents the non-exclusive license to archive, make accessible, and display my thesis or dissertation in whole or in part in all forms of media, now or hereafter known, including display on the world wide web. I understand that I may select some access restrictions as part of the online submission of this thesis or dissertation. I retain all ownership rights to the copyright of the thesis or dissertation. I also retain the right to use in future works (such as articles or books) all or part of this thesis or dissertation.

Signature:

_____ _____

Eliot England Date

Exploring Public Health Science and Political Leadership Through the Eyes of the Public

By

Eliot England
Master of Public Health
Hubert Department of Global Health

_____

Scott JN McNabb, PhD, MS
Thesis Advisor

Exploring Public Health Science and Political Leadership Through the Eyes of the Public

By

Eliot England
Bachelor of Science in Neurobiology and Sociology
University of Wisconsin-Madison
2018

Thesis Advisor: Scott JN McNabb, PhD, MS

An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in the Hubert Department of Global Health
2021

Abstract

Exploring Public Health Science and Political Leadership

Through the Eyes of the Public

By Eliot England

In the midst of the COVID-19 pandemic, the significance of the role of science and political leadership has become apparent. As our world continues to grow and diversify, we cannot wait idly by for the next, inevitable, public health crises to occur. The importance of a collaborative relationship between public health leaders and political representatives needs to be appreciated if we want to effectively improve the health of our nations and globe. The siloed nature of the two spheres of influence has resulted in tension, disorganization, and mistrust among leaders and within populations in the face of infectious disease outbreaks on both global and national scales. This systematic review takes a unique approach to better understand the relationship between science and politics by examining the available literature that reflects public knowledge, perceptions, and behaviors during pandemics. Using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis extension for Scoping Reviews (PRISMA-ScR) framework as a guide for search methods and analyses, this paper seeks to answer the questions: 1) What is the relationship among science, political leadership, and public knowledge and behavior during pandemics that impacts public health action? And 2) How can proper intersectoral leadership be illustrated by public response? Through the public's eyes, this project combines, describes, and reflects upon the complexity of the relationship between science, politics, leadership, and public response during public health crises. Based on identified themes, correlations, and gaps in knowledge, it exposes where more research is needed and suggests how politicians, public health scientists, and communities can improve the collaboration, cohesion, and effectiveness of the intersectorality between science and politics.

Exploring Public Health Science and Political Leadership Through the Eyes of the Public

By

Eliot England
Bachelor of Science in Neurobiology and Sociology
University of Wisconsin-Madison
2018

Thesis Advisor: Scott JN McNabb, PhD, MS

A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in the Hubert Department of Global Health
2021

Acknowledgments

I want to express my sincerest appreciation and thanks to my thesis advisor, Dr. Scott McNabb, for his unwavering support and encouragement throughout this project. I am grateful for his mentorship and I look forward to continuing our collaboration in the coming years. I also want to thank Carol Haley for all her help in the initial stages of writing and her ongoing support in my work.

Infinite thanks to Shenita Peterson for countless meetings and endless insight and guidance. She kept me motivated and enthusiastic throughout the entire process.

I owe an enormous thanks to my ADAP, Flavia Traven, for her continuous support throughout my two years at RSPH.

To my friends, old and new, thank you for keeping a smile on my face and my spirits high. And finally, my family, mom and dad, I would not have made it to where I am today without you. Thank you for being my sources of inspiration, tireless cheerleaders, and the voices that keep telling me to shoot for the moon.

Table of Contents

CHAPTER 1: INTRODUCTION

Background and Significance

Emerging and re-emerging infectious diseases have precipitated many public health crises that date back thousands of years. Notably, the Athenian plague of 430-425 BCE marked the beginning of recorded pandemics with disease surveillance through clinical and epidemiologic methods.[1] Since then, the burdens from various pandemics have only intensified. Human populations continuously expand and diversify around the globe. People and communities now inhabit new geographical regions and live in more intimate conditions with increasingly direct contact with domestic animals and wildlife. The changes in climate, land use, trade, and travel impacted by globalization has led to a spillover of infectious agents within and between ecosystems. Today, at least one new infectious disease emerges each year and approximately 64% of human diseases are caused by pathogens transmissible across species.[2]

We cannot prevent the world from developing and expanding; therefore, we cannot expect nature to do so either. The burdens of infectious diseases will persist throughout the foreseeable future, and as history has shown, the way to effectively manage these crises is through appropriate leadership and public health responses. In the midst of COVID-19 and the wake of other public health crises, the relationship between science and political leadership has been a recurring trope at the forefront of public health management and discussions. To improve how we navigate the volatile circumstances of and responses to pandemics, we must analyze and gain a better understanding of

the power, decision-making, and interface between science (and scientists) and their political counterparts in the context of public health responses.

Statement of the Problem

Public health leaders and political representatives find themselves now at a crucial moment in history where they must acknowledge the significance of their intersectorality, cohesion, and collaboration; we must act now before the next (unavoidable) pandemic. To produce effective and mutually engaged relationships between politicians and public health professionals, leaders and their citizenry must engage with science; and conversely, the scientific community should not stand on perceived objective superiority.[3] Both spheres must recognize the benefit of cross-sector integration and the consequences of their tension.

As seen clearly in the current pandemic, the relationship between public health and politics has been distorted. It has led to a general lack of understanding and trust in both science and politics, and it has challenged countries' ability to fight against COVID-19. This antagonism between politics and science fosters a sense of uncertainty and threatens the success and well-being during public health crises.

If a population is to be led out of a crisis, we must address the interface between the science that underpins public health and the art of political leadership. As of today, there is minimal research or review about this relationship, especially in the context of pandemics. To address what may need to change in national and global health governance, a more specific background and insight into the relationship between science and politics should be established.

Statement of Purpose

For the purpose of this thesis, a systematic literature review was conducted to uncover, synthesize, and examine the current publications that explicitly refer to concepts of public perceptions and behaviors, science, and political leadership during a pandemic or infectious disease outbreaks. The influence of science and political leadership during public health crises is an untouched area of research; there are many aspects to the nature of their relationship.

Public knowledge about a crisis may serve as an indicator of the quality of risk communication and the persuasiveness of scientific messages on societal responses. And patterns in perception about political leadership and government could illustrate the relationship between science and politics in countries' responses to pandemics. How do people behave? How do leaders behave? Does the public adhere to public health guidelines? The answers to these questions reflect societal trust and respect for both (or either) leadership and public health science.

This study presents an alternative approach to understanding of the relationship between scientific knowledge, political leadership, and public responses in the face of an infectious outbreak. Through the lens of the public, the goal is to identify gaps in our knowledge and acceptance as to what constitutes effective leadership and gain better insight for how balanced intersectionality – or the lack thereof – can influence the trajectory of a public health crisis.

Research Questions

This work answers these two questions.

- What is the relationship among science, political leadership, and public knowledge and behavior during pandemics that impacts public health action?
- How can proper intersectoral leadership be illustrated by public response?

CHAPTER 2: LITERATURE REVIEW

Science and political leadership during pandemic times is a topic with scarce scholarly literature. Review articles and theoretical analysis of real-life examples help build a conceptual foundation to understand the interaction between science and politics and illustrate its significance.

Science and Politics

Before discussing science and politics in the context of leadership during infectious disease crises, we must describe the relationship. We should recognize and appreciate the reality that these seemingly diverse spheres are inherently similar and interconnected. Each has a purpose within the other's realm of influence.

At a system's level, the interaction between science and politics is clear. The political system should be the vehicle in which public health science effectively initiates local, state, national, and international change. However, politics can derail and hinder scientific development and recommendations (e.g., climate change, gun control). In the United States scientists once avoided using the phrase "climate change" in proposals and replaced it with "geochemical cycling"; this was to ensure congress would be receptive. Gun control politics (i.e., the Dickey Amendment) hindered the Centers for Disease Control and Prevention from conducting research to advocate or promote gun control.[3, 4]

In contrast, science makes an impact in politics. Scientific knowledge is politicized when it becomes a tool used to garner support and authority. When politicians change stances supported by scientific evidence, they take advantage that science is accepted

as fact and independent. Science and politics have been and continue to be linked at the systematic level.

Looking at politics and science at an individual level, there are important similarities and differences in their purposes and decision-making processes. First, consider what it means to be a politician. It is associated with power, power dynamics, and relationships within and between power(s); politicians navigate the realm of decision making and often act to gain, transfer, or exert power to achieve specific interests.[3] They are the source of order and leadership within societies and naturally identified through their values, assumptions, and biases.

When considering political decision making, there are overwhelming factors that influence the process. Science and public health play critical roles in governance as a nation's overall success is dependent on its health; but, many times politicians must acknowledge and put greater value on elements beyond science.[4] The art of politics involves sacrifices and requires managing an array of economic, social, diplomatic, ideologic, and personal aspects that have competing priorities and values.[4] Even if politicians want to follow science, many officials have limited science or public health training, and when presented with intricate, multileveled models, they do not always know how to deal with them appropriately. Further, while public health officials appreciate and are familiar in the long game of activism, politicians champion short-term initiatives (due to their more defined ruling terms) with tangible results.[4]

Scientists, in contrast, are typically seen as advocates of objectivity and empiricism. Power and relationships play a role in science (as in politics), but objectivity and empiricism are unique characteristics that manifest the separate identity for scientists

that foster their independence from politicians.[3] There is a tendency for scientists to view themselves and their professional capacity as separate from mainstream society – they sometimes see their reasoning as immune from systemic problems and regard their analyses as apolitical. It is through the rigorous scientific method that the scientific community aspires to uphold these values while being transparent and acknowledging the reasons, methods, and limitations that led them towards certain understandings.[3] Yet, despite best effort to remain neutral and objective, scientists are inextricable from the institutions and society that they are part of. People and places in the scientific sphere come from and exist within a dynamic society – a society that is shaped by politics. Scientists are not neutral characters; nor are they rarified entities with only academics and geniuses. They are human beings with their own political beliefs, commitments, and motives which they bring into their respective field, just like politicians and anyone else in the general public.

Public health decision making is guided by science and evidence. Scientists' decisions and success are valued through indicators such as prevention of premature death and morbidity and quantitative improvements in health status.[4] However, when championing these causes, they can find themselves at fault for not acknowledging or understanding how these initiatives affect the broader economic and social order. And with this narrow mindset, they contribute to the tension between science and politics.

In the context of public health crises, we should appreciate the similarities and differences in politicians and scientists and the political processes of decision-making versus the public health methods of decision-making. Especially during crises, governance reflects not just the individual successes of leaders, but also the

coordination among them. If the events surrounding the COVID-19 pandemic have illustrated anything to us it is the consequences of the role of intersectorality between leadership and science, good or bad. While it is simple to acknowledge there exists a bridge between political and public health systems, societies struggle to effectively use this collaboration for good; instead, the strain between them is revealed. Scientific specialists and political specialists are recognized separately, and often for different reasons, but we often fail to acknowledge the reality that both work within an interconnected network. Public health often does not recognize and appreciate the insights and ingenuity of political leadership, while policy often neglects the complexity and heterogeneity of public health.[5]

Navigating public health crises properly depends on the actions and behavior of the public. Policies and systems can be proposed (e.g., handwashing, wearing masks, physical distancing), but their effectiveness is determined by the practices of the people. And the manner in which people respond can be the reflection of the cohesiveness, cooperation, and messaging of leadership. This can be illustrated on a global scale by examining the management by the World Health Organization (WHO) and the International Health Regulations (IHR).

WHO and the IHR (2005)

The WHO and the IHR (2005) provide an example of the relationship between science and political leadership as it manifests in the real world. With a global lens the WHO and the IHR (2005) are at the center of public health governance. Since its establishment in 1948, the world has recognized WHO as the leader in international health collaboration and global health leadership. Its role has continuously evolved over time to attend to a

diverse set of global development and security matters.[6] Among the various tasks put under the agency's authority, WHO has assumed the responsibility to guide the world in its response to public health emergencies. In these situations, WHO proclaims that it, "*prepare[s] for emergencies by identifying, mitigating and managing risks, prevent[s] emergencies and support[s] development of tools necessary during outbreaks, detect[s] and respond[s] to acute health emergencies, and support[s] delivery of essential health services in fragile settings*."[7] And in efforts to do so, it oversees and supports implantation of the IHR (2005).

The background behind the IHR (2005) and the WHO demonstrates how the relationship between science and politics is not new but instead has had influence throughout history. The IHR was first conceptualized in the mid-19th century when Europe was overwhelmed by the burden of cholera and it became a set of guidelines and regulations for the affected nations to abide by in the common interest of global health and trade.[6] By 1969, this international health agreement was adopted, revised, and renamed, the International Health Regulations, by the WHO.[6, 8] In the face of rising international trade and travel, and the emergence and reemergence of infectious diseases and other public health threats, the World Health Assembly (the governing body of the WHO that is comprised of leaders from all Member States) urged for another revision of the IHR to address the changing environment.[8] Though the proposal for amendment was presented in 1995, it was not until the 2003 SARS outbreak that officials began to recognize and appreciate the importance, and present need, of reframing the international organization for infectious disease control and definition of global health security.[6]

The new IHR was adopted in 2005 and contributed to significant changes in global health governance. Notably, it emphasized global solidarity over national sovereignty and situated the common global threat at the core of its framework; it not only broadened the WHO's influence in global health security, but also expanded its own scope of interest to include any events that would constitute a Public Health Emergency of International Concern (PHEIC) – not just specific diseases; it required that participating countries develop the capacity to respond to public health emergencies; and it developed a communication and notification process that countries must adhere to with the WHO at the center of the international communication and coordination.[6]

The IHR and its updates truly transformed the relationship between international diplomacy and public health; its foundation was built upon rigorous scientific evidence and paved the way for a whole new outlook on global cooperation and collaboration. However, after the SARS outbreak, the reality that science and politics are inextricably connected became abundantly clear and the promise that the IHR (2005) revisions showed were met head on with political involvement and disruption that has since made implementation extremely difficult.[9] Infectious disease crises effectively expose what, when, and how leaders decide to use public health science. Weaknesses in WHO guidance, as well as limitations in the IHR (2005) framework, contribute to the tensions between science and politics and ultimately place the global community at an increased risk of the burden of infectious diseases.

Constrained by politics, WHO has been criticized for inconsistent and unfounded methods of declaring PHEICs. It has been criticized for lack of transparency and acting on a political agendas rather than global well-being.[8] Agency leaders in the face of

H1N1, Ebola, and MERS pandemics provided little evidence and scientific reasoning for the decisions made.[8] The WHO describes its role as a global leader, but is rarely held accountable for actions through methodological planning and assessments.

The IHR (2005), whose decision algorithm is founded on rational action based on science, medical evidence, and global public health insight, does not address the need for skills and expertise required to navigate the increasingly political dimensions of outbreaks.[6] Furthermore, the IHR (2005) is implemented by the hands and funds of global donors and stakeholders who all have their own political agendas.[9] Between the WHO and the IHR (2005) the overlap and the collaboration between science and politics is either absent or siloed.

When science and politics remain separate and even contend, effective leadership is difficult. As of 2014, 64/194 Member States (MS) of the WHO have met the core capacities of the IHR (2005).[8] Leadership has either failed at instilling the sense of urgency and significance of public health preparedness or not provided the necessary support to those more vulnerable. There is hesitancy among countries to even report outbreaks in fear of the economic and political consequences.[8] And there is a lack of public confidence and acceptance of the WHO role in pandemic response. The WHO appears to value political correctness over scientific evidence to justify decisions.[8] Overall, WHO and the IHR fall short to foster global cooperation and diplomacy to maintain a safe and healthy world.

Science and politics must work in harmony. The WHO should champion trust, transparency, and reasoning to ensure MS understand both science and evidence as well as politics.[6] The IHR (2005) should be updated to address more than medical

threats. It should support MS to develop the skills and competency to handle and manage political environments, address public fear and opinion, and translate that all into effective leadership.[6] Global governance as a whole must adopt an inclusive multidisciplinary approach welcoming (even requiring) allegiance between health experts and politicians.

The actions by MS demonstrate that – at the heart of effective public health action and leadership – is constituent receptivity. When those being led are not given the proper communication, and in an appropriate manner, the myriad of health difficulties that arise, nonadherence and trivialization, rule.

Leadership During the COVID-19 Pandemic

Another example of how the relationship between science and politics can be viewed in context is by examining outcomes of the COVID-19 pandemic. The COVID-19 pandemic highlighted that success in response is not the outcome of simply being prepared; it showed that success involves leadership. The Global Health Security (GHS) Index is a report created by the Nuclear Threat Initiative (NTI), the Johns Hopkins Center for Health Security (JHU), and the Economist Intelligence Unit (EIU). It includes a comprehensive assessment of 195 countries under the IHR (2005) about their capability to prevent and mitigate public health crises.[10] Rankings represented the synthesis of scores from six categories (prevention, detection and reporting, rapid response, health system, compliance with international norms, and risk environment), 34 indicators, and 85 subindicators.[10]

The distinction between preparedness and leadership can be illustration when comparing outcomes in the United States and those in New Zealand. The United States was ranked #1 (score: 83.5/100) overall, across the 195 countries and deemed most prepared for an infectious disease outbreak.[10] In contrast, New Zealand was ranked #35 with a score of 54/100.[10]

In theory, the United States should have managed the COVID-19 outbreak best of all measured countries based on resources, economic position, development, and capacity building. But this was far from the case. As of April 2021, the United States reported over 31 million COVID-19 cases (this accounts for 10% of its population and 25% of the world's reported cases despite the United States representing only 4% of the global population) and over 560,000 deaths.[11, 12] Prior to the COVID-19 outbreak, the United States had been undermining the bridge between science and politics by decreasing the number of health and science staff at U.S. embassies around the world; keeping the White House Office of Science and Technology Policy without leadership; reducing funding for the National Institute of Health, USAID, and their own pandemic preparedness taskforce; eliminating the national Security Council's global health security team that was supposed to advise pandemic strategy; and disengaging with the WHO.[12]

Once COVID-19 was at the forefront of national and global news, the U.S. administration (at the time) established a federal Coronavirus taskforce yet proceeded to negate its effectiveness by continuously belittling the significance of the pandemic and trivializing the severity of disease.[12] The country's performance during the COVID-19 pandemic has been characterized by government politicization of public health; the

widespread dissemination of misinformation and support for unbased and harmful practices by officials; and the removal of and disregard of lead public health staff and experts from various federal and state agencies.[12, 13]

Conspiracy theories, confusion, and distrust was fueled by the Trump administration's antiscience platform and communication throughout the crisis. President Trump himself – with no scientific background or intention of listening to any expert advice – at times actively undercut the credibility of his scientific advisors and acted on personal relationships and agreements that he believed would best improve his public image. The United States reflects the epitome of poor coordination of science and politics and has paid the price.

New Zealand presented a completely different narrative. Since the beginning of the pandemic, the country reported around 2,50 COVID-19 cases (that is less than 1% of its population) and 26 deaths overall.[11] In stark contrast to President Trump's response to the pandemic, Prime Minister Jacinda Ardern has faced the crisis with precaution, scientific advisement, and transparency since the WHO announced that it was a pandemic.

In March 2020, several public health experts provided evidence-based guidance and urged Ardern to approach the pandemic with more ferocity. In just a few days, New Zealand went into full nationwide lockdown.[14] In partnership with Health Minister David Clarke and other health experts, New Zealand's government committed to acting on science and evidence and even going further than the WHO advised.[14] The country's leadership was unmatched in their efforts to inform and educate. It maintained openness regarding the risks and reasons why certain measures were taken; both the

national government and the Ministry of Health provided complementary updates daily; and leadership communicated with its constituents using a language that could be understood by everyone all the while still conveying crucial scientific evidence.[14]

The disparate manner in which the United States and New Zealand each dealt with the COVID-19 pandemic offer examples of how leadership manifests during public health crises, specifically what roles science and politics play.

The importance of intersectorality between science and politics should be evident, and we must understand the relationship. There are neither metrics nor studies that establish direct, quantifiable causes and effects of science in politics and politics in science during pandemics. As this issue continues to be apparent, the research community should begin to address these gaps. By examining the relationship between science and public health indirectly through the perspectives of the public, we can generate evidence of their overall interactions and provide recommendations that may initiate further analysis on the issue.

CHAPTER 3: METHODS

This systematic literature review utilized the Preferred Reporting Items for Systematic Reviews and Meta-Analysis extension for Scoping Reviews (PRISMA-ScR) framework as a guide for search methods and analyses.[15] There was not a need to establish an intervention or comparison group for this project; a meta-analysis was not conducted.

Search Methods

The aim of the review was to discover, combine, analyze, and reflect on current publications that explicitly refer to concepts of public perceptions, science, and political leadership during a pandemic or infectious disease outbreaks.

To review relevant literature on this topic, the study searched three electronic databases: PubMed, Embase, and Global Health. Each search included key words or phrases that addressed the concepts of politics and leadership; public response; pandemic; and science. (c.f., Appendix A). Considering nuances within each database, the entries varied to maintain continuity of ideas and terms across sites. For PubMed, the search applied a ‘text word’ field tab to focus results and eliminate irrelevant content. Depending on the database’s filter options, the final searches were refined to include only journal articles, journal issues, articles in press, and reviews. To ensure accessibility and relevance, results were limited to English and those published in 2000 or later.

Searches using a combination of key words and filters were also conducted on the WHO IRIS database as well as the CDC database to find relevant gray literature. These searches were unsuccessful; no documents were added for review.

Once searches were completed and the initial limitations set, a total of one thousand two-hundred sixty-six (1,266) records were imported into the web-based application, Covidence, for data management, deduplication, and screening.

Screening

One person conducted the initial title and abstract screening as well as subsequent full-text screening against inclusion and exclusion criteria for this project.

Inclusion criteria included …

- articles published during or after 2000.
- articles published in English.
- articles whose full text was available through the Emory library.
- population of interest was the general population.
- research projects with the purpose of exploring the general public's response during pandemics or outbreaks by collecting primary data (quantitative or qualitative), coming directly from study participants (in the form of surveys or interviews/focus groups).
- studies whose variables of interest illustrated the relationship between the public's views on political leadership and governance and their understanding and acceptance of science and public health guidelines.

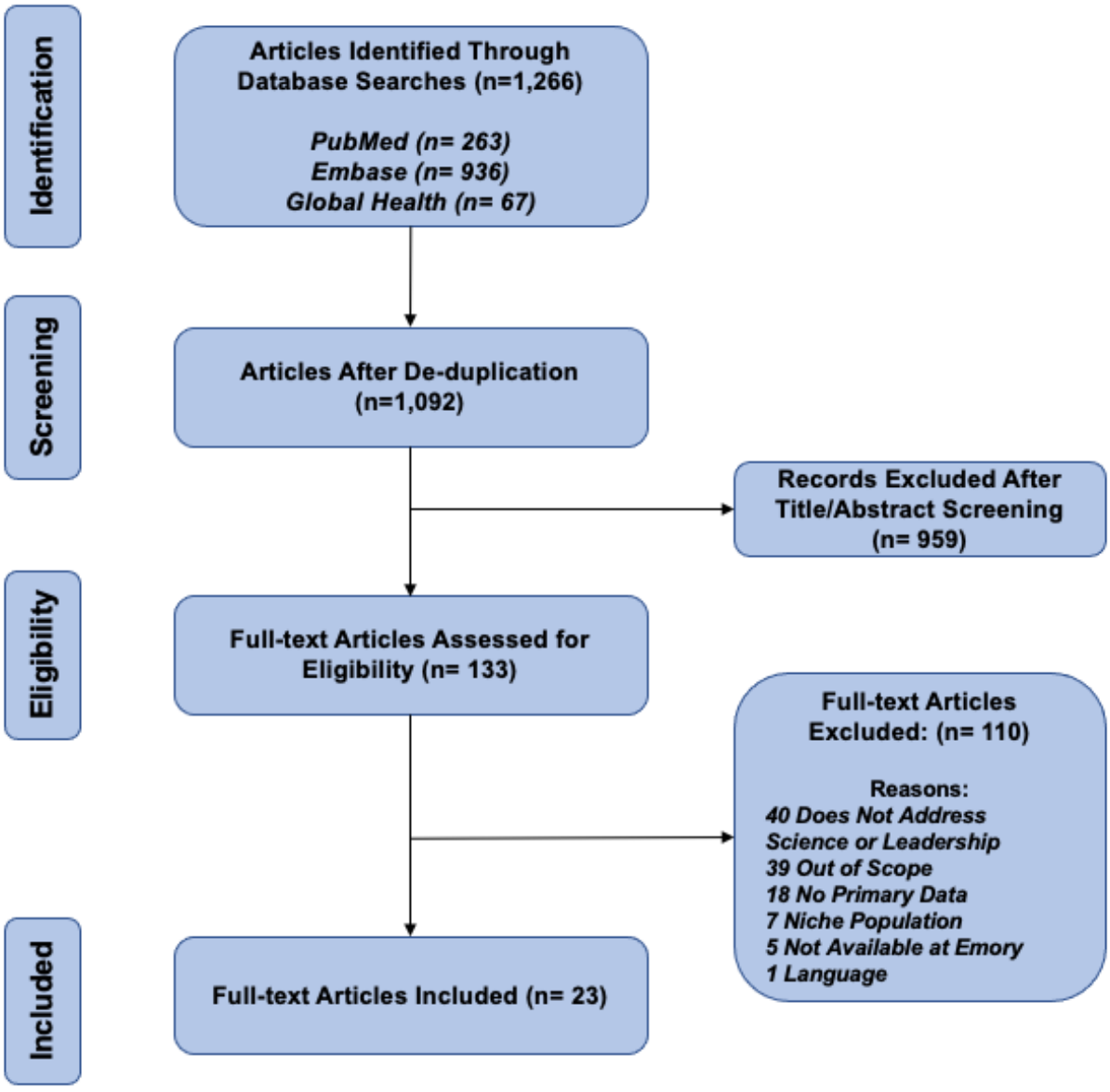
Exclusion criteria for this review included …

- articles published before 2000.

- articles published in a language other than English.
- articles unavailable through the Emory library.
- population of interest was narrowed to look at a specific occupation, race, gender, or organization.
- studies that did not focus on the effects of a pandemic or outbreak crisis or explore attitudes about the role of government and public health guidance.
- studies that did not collect data directly from study participants.
- studies that analyzed public responses to pandemics in relationship to aspects outside the scope of this project, including but not limited to specific demographics, mental health, resource allocation, and virology.

The number of articles that went through screening and full-text review are illustrated in the PRISMA flowchart (Figure 1). Twenty-three articles were used for final review and data extraction.

Figure 1. Science and Political Leadership Article Review Screening Process and Outcomes Using PRISMA-ScR Framework, 2021



Data Extraction

For the final, full-text review, 23 studies were imported into EndNote for organization and the following elements were extracted from each article and managed using Excel™: (i) country/countries of interest; (ii) specific public health crisis; (iii) participants; (iv) study design and data collection methods; (v) variables of interest; and (vi) relevant findings.

Submission to IRB was not required because human subjects research was not conducted.

CHAPTER 4: RESULTS

Overview

Of the 23, full-text articles included for final review, three studies reported on multiple countries and provided comparisons (i.e., Margraf, *et* al. surveyed participants in France, Germany, Poland, Russia, Spain, the United Kingdom, and the United States; Determann, *et* al. conducted their research in the Netherlands, Sweden, and Poland; and Sabat, *et* al. analyzed data from Denmark, France, Germany, Italy, Portugal, Netherlands, and the United Kingdom). The remaining articles provided data from the United States (n=4), China (n=2), Singapore (n=2), Thailand (n=2), the Democratic Republic of Congo (n=1), Germany (n=1), Israel (n=1), Japan (n=1), Liberia (n=1), New Zealand (n=1), Nigeria (n=1), South Africa (n=1), Uganda (n=1), and the United Kingdom (n=1). All studies collected data from their country or countries of interest through a sample that reflected the general population. (Table 1)

The COVID-19 pandemic was the most commonly discussed public health crisis (n=15) followed by Ebola (n=3), SARS (n=2), and H1N1 (n=1). Two articles addressed pandemics in general and did not identify a specific event. Sixteen studies used only cross-sectional surveys and questionnaires as their data collection method; three conducted focus groups or key informant interviews; two were random control trials; one conducted a longitudinal survey; and one study used a mixture of quantitative and qualitative methods.

Table 1. Data Extracted from 23 Full-Text Articles Reviewed for Science and Political Leadership Systematic Review, 2021

Author(s)	Title	Year	Country/Countries	Crisis	Population	Data Collection Methods	Interests
Ali, S.H., *et* al.	Trends and Predictors of COVID-19 Information Sources and Their Relationship with Knowledge and Beliefs Related to the Pandemic: Nationwide Cross-Sectional Study	2020	United States	COVID-19	U.S. General Public n= 11,242	Cross-sectional survey	Sources of information; trust, beliefs, and knowledge
Berman, A., *et* al.	Use of SMS-Based Surveys in the Rapid Response to the Ebola Outbreak in Liberia: Opening Community Dialogue	2017	Liberia	Ebola	Liberian General Public n=1,000	Cross-sectional survey	Trusted sources of information, knowledge, perceived risks
Determann, D., *et* al.	Future pandemics and vaccination: Public opinion and attitudes across three European countries	2016	Netherlands, Sweden, and Poland	Pandemics	General Public n=41	Focus groups	Public opinion and attitudes regarding preventive measures
Deurenberg-Yap, M., *et* al.	The Singaporean response to the SARS outbreak: knowledge sufficiency versus public trust	2005	Singapore	SARS	Singapore General Public n=863	Cross-sectional survey	Knowledge, public trust, satisfaction with state control measures
Duan, T., *et* al.	Government Intervention, Risk Perception, and the Adoption of Protective Action Recommendations: Evidence from the COVID-19 Prevention and Control Experience of China	2020	China	COVID-19	Chinese General Public n=3,837	Cross-sectional survey	Risk perception, adoption of PARs, and government intervention
Ezeibe, C.C., *et* al.	Political distrust and the spread of COVID-19 in Nigeria	2020	Nigeria	COVID-19	Nigerian General Public n=120	Mixed methods	Impact of political distrust
Gesser-Edelsburg, A., *et* al.	Analysis of Public Perception of the Israeli Government's Early Emergency Instructions Regarding COVID-19: Online Survey Study	2020	Israel	COVID-19	Israeli General Public n=1056	Cross-sectional survey	Risk perception, crisis management, compliance with directives imposed on public, and information sources
Goodwin, R., *et* al.	Anxiety and public responses to COVID-19: Early data from Thailand	2020	Thailand	COVID-19	Bangkok General Public n=203	Cross-sectional survey	Knowledge, anxiety, spread of information, and associations between anxiety, trust, and preventive behaviors
Kreps, S.E., *et* al.	Model uncertainty, political contestation, and public trust in science: Evidence from the COVID-19 pandemic	2020	United States	COVID-19	U.S. General Public n=2,038; 1,008; 1,771; 1,001; 999 *	Randomized control trial	Public support for science-based policy responses to pandemic
Margraf, J., *et* al.	Behavioral measures to fight COVID-19: An 8-country study of perceived usefulness, adherence and their predictors	2020	France, Germany, Poland, Russia, Spain, Sweden, United Kingdom, and United States	COVID-19	General Public n=7,658	Cross-sectional survey	Usefulness of prevention measures; adherence
Min, C., *et* al.	The relationship between government trust and preventive behaviors during the COVID-19 pandemic in China: Exploring the roles of knowledge and negative emotion	2020	China	COVID-19	Chinese General Public n=3,000	Cross-sectional survey	Relationship between government trust and recommended preventive behaviors, role of knowledge and negative emotion
Ophir, Y.	The Effects of News Coverage of Epidemics on Public Support for and Compliance with the CDC- An Experimental Study	2019	United States	Pandemics	U.S. General Public n=321	Randomized control trial	Exposure to social, scientific, and pandemic themes on public perception
Quah, S.R., *et* al.	Crisis prevention and management during SARS outbreak, Singapore	2004	Singapore	SARS	Singapore General Public n=1,202	Cross-sectional survey	Prevention practices, knowledge of SARS, and appraisal of SARS crisis management

Quinn, S.C., *et* al.	Exploring communication, trust in government, and vaccination intention later in the 2009 H1N1 pandemic: results of a national survey	2013	United States	H1N1	U.S. General Public n= 2,079	Cross-sectional survey	Perceptions about pandemic communication; trust in government actions and spokespersons
Reddy, S.P., *et* al.	South Africans' understanding of and response to the COVID-19 outbreak: An online survey	2020	South Africa	COVID-19	South African General Public n=55,823	Cross-sectional survey	Knowledge, attitudes, and behaviors
Sabat, I., *et* al.	United but divided: Policy responses and people's perceptions in the EU during the COVID-19 outbreak	2020	Denmark, France, Germany, Italy, Portugal, Netherlands, and United Kingdom	COVID-19	European General Public n=7,000	Cross-sectional survey	Perceptions of COVID-19 containment measures
Saechang, O., *et* al.	Public Trust and Policy Compliance during the COVID-19 Pandemic: The Role of Professional Trust	2021	Thailand	COVID-19	Thai General Public n=809	Cross-sectional survey	Public trust; compliance to policy control measures
Schmelz, K.	Enforcement may crowd out voluntary support for COVID-19 policies, especially where trust in government is weak and in a liberal society	2021	Germany	COVID-19	German General Public n=4,799	Cross-sectional survey	Effects of enforcement on motivation to comply with COVID-19 measures
Schmidt-Sane, M.M., *et* al.	Challenges to Ebola preparedness during an ongoing outbreak: An analysis of borderland livelihoods and trust in Uganda	2020	Uganda	Ebola	Ugandan General Public n=287	Focus groups and key informant interviews	Livelihood strategies, (mis)trust in epidemic response, Ebola prevention, transmission, and preparedness
Sibley, C.G., *et* al.	Effects of the COVID-19 pandemic and nationwide lockdown on trust, attitudes toward government, and well-being	2020	New Zealand	COVID-19	New Zealand General Public n=1,003	Longitudinal survey	Institutional trust, attitudes towards nation and government., health, and well-being
Uddin, S., *et* al.	How did socio-demographic status and personal attributes influence compliance to COVID-19 preventive behaviors during the early outbreak in Japan? Lessons for pandemic management	2021	Japan	COVID-19	Japanese General Public n=11,342	Cross-sectional survey	Government compliance
Vinck, P., *et* al.	Institutional trust and misinformation in the response to the 2018-19 Ebola outbreak in North Kivu, DR Congo: a population-based survey	2019	Democratic Republic of Congo	Ebola	Beni and Butembo General Public n=961	Cross-sectional survey	Institutional trust, adherence to guidelines, misinformation
Williams, S.N., *et* al.	Public perceptions and experiences of social distancing and social isolation during the COVID-19 pandemic: a UK-based focus group study	2020	United Kingdom	COVID-19	U.K. General Public n=27	Focus groups	Social and psychological impacts, views on government communication, adherence

**Study consisted of multiple individual experiments*

Demographic Patterns

Several studies conducted simple analyses illustrating how demographic variables (e.g., age, education, income levels) could significantly influence a population's response during a public health crisis.[16-21] Studies in Thailand, the United States, and Singapore found significant correlations between age and different responses.[16-18, 20, 21] In Thailand, younger respondents (< 40 years old) identified online doctors and overseas governments as the most trusted sources of information during the COVID-19 pandemic.[18] Those in the United States study showed that the odds of participants at least 40 years of age using government websites was significantly less compared to those aged 38 years old or younger.[16]

Age was also seen to influence other aspects of pandemic response. Another study conducted in Thailand during the COVID-19 pandemic showed that elderly respondents were 17 percentage points less likely to wear a mask when going out in public compared to their younger counterparts.[21] In contrast, in a cross-sectional survey asking the general Singaporean population about their prevention practices during the SARS outbreak, participants ≥ 35 years old were more inclined to take preventive measures than younger counterparts (OR= 1.365; 95% CI = 1.123 – 1.658).[20] Interestingly, a different study based in Singapore, conducted by Deurenberg-Yap *et* al. (2005), revealed younger respondents in Singapore answered SARS knowledge questions more correctly on average than older subjects.

Age was not the only demographic variable that produced significant correlations with public responses during pandemics. Participants in a United States-based study (with a bachelor's degree or higher) had statistically significant greater odds of using all

sources of information regarding COVID-19 (e.g., government, doctors, social media, religious leaders) except traditional media (i.e., television, radio, newspapers, and podcasts) compared to those with less formal education.[16] Similarly, those surveyed in Singapore who had tertiary education had significantly higher knowledge scores compared with those with primary or no formal education.[17] Finally, data from respondents in China showed those well-educated tend to undertake recommended preventive behaviors more frequently as well as those that reported higher income levels.[19]

Risk Perception

Of the many factors that influence and build a population's relationship with leaders during public health crises, personal perceptions of risk played a significant role.[22-24] Several studies found correlations between *risk perceptions* (i.e., fear that people have of contracting the infectious agent; fear of their close contacts and loved ones contracting the virus; and perceived severity of disease) and outlook towards authorities. A study in Israel found a significant positive correlation (Pearson) between risk perception and the public's evaluation of crisis management ($r=0.19$, $P<0.001$).[23] As risk perceptions of COVID-19 increased, the evaluation of how state leadership managed the crisis (i.e., perceived effectiveness of preventive measures and communication tactics) also increased.

Positive outlook on government and health system responses and management were also apparent in China.[22] Their data illustrated a positive association between participant perceived risk during the COVID-19 pandemic and their perceptions of how

the government was communicating in efforts to promote public understanding and awareness.[22]

In South Africa, significantly fewer participants with a moderate self-perceived risk of COVID-19 infection agreed that the national and local health systems and governments were capable of managing the outbreak ($p<0.001$) compared to those with low perceived risk.[24] Inconsistent with the other two studies – in South Africa – the more at risk the participants felt, the less likely they were to appraise the institutions and leadership for their outbreak management.[24]

Impression of Leadership

One recurring theme from this review centered on the public's impression of leadership during infectious disease outbreaks. Evidence showed that the public's confidence and respect for leaders – politicians, scientists, or infectious disease experts – was linked to the amount and type of public knowledge regarding the threat at hand; the evaluation of authorities' performance and management; and adherence to public health guidelines. Taken together, these data paint a complex relationship between leadership and its population during public health crises.

Public health knowledge and misinformation

The general population should be aware of public health science and knowledge surrounding the present crisis. One should have the capacity to behave and process information to promote overall well-being and health. Simply knowing how a virus can spread or what measures can be taken can save millions of lives. However, the

relationship between leader and constituent can influence or hinder accurate public health information.

Data showed that exposure to different information sources and the public's trust in those sources were significantly associated with different levels of knowledge and beliefs regarding the relevant crisis.[16, 17, 25] Citizens in the Democratic Republic of Congo (DRC) and Liberia showed the simple relationship between trust in leaders and information. In the Ebola outbreak, the majority of participants in both studies identified health professionals as the most trustworthy, authoritative figures and therefore their main source of Ebola information.[25, 26] At the same time, participants reported low trust in government authorities as well as low use in national government for information.[25, 26] Individuals' trust in leaders play a large part in determining what type of information they are exposed to, but other studies have taken it one step further to demonstrate how trust in sources influence the perceived accuracy of information.

As technology and social media become ingrained in societies, the spread of misinformation (i.e., infodemics) continues to be a central issue during public health crises. In many cases, when there was relatively low trust in leadership among the public, people were less likely to have the appropriate public health knowledge and more likely to agree with detrimental misinformation.[16, 17, 25] For example, a study in the United States found the odds of believing COVID-19 conspiracy theories were significantly less among those that used and *trusted* government websites than those who did not.[16] Results from a New Zealand study showed a significant negative correlation between trust in science and beliefs in conspiracies.[27] During the 2002-2003

SARS outbreak in Singapore, study participants showed higher levels of accurate knowledge of the virus when they reported higher levels of trust in government.[17]

One study found that among the Chinese general population knowledge of COVID-19 was a significant moderator of the relationship between government trust and excessive preventive measures taken by the public; higher levels of trust in government was positively related to excessive preventive behaviors only among those with low levels of COVID-19 knowledge.[19]

Trust in individual leaders showed to be an important factor in public knowledge, but data also demonstrated that simply the number of sources that people trusted could influence public health knowledge as well. In a United States-based study conducted on COVID-19, participant data illustrated that the increase in total number of information sources that the respondents used (e.g., government, TV, social media, newspapers, doctors) for pandemic information was associated with only improved awareness of the benefits of face masks, but not any other disease questions regarding treatments, origin, complications, or other protective measures.[16] However, on the other side of the coin, those in the study based in the Democratic Republic of Congo who were exposed to relatively fewer sources for information on Ebola were more vulnerable to misinformation compared to those who were exposed to more sources.[25]

Crisis management

Evaluating management of pandemics was also impacted by public impression of different figures of influence. Data from Israeli participants illustrated a significant difference between participants' attitudes toward crisis management based on who they

viewed as the most credible spokesperson ($F_{5,981}$=43.16; P=<0.001) and what they identified as the most credible source of information ($F_{5,1036}$=18.15; P=<0.001).[23] On average, participants who identified the Israeli Prime Minister as the most credible spokesperson during the COVID-19 pandemic had a better outlook on the state's performance during the crisis compared to participants who had identified other representatives such as the Director General of the Ministry of Health, Head of Public Health Services, Israeli Minister of Health, infectious disease specialists, and journalists as most credible.[23] Notably, if participants viewed infectious disease specialists as the most credible spokesperson during the pandemic or believed that scientific articles were the most credible sources of information, their evaluations of the state's response were significantly lower in comparison to those that favored other spokespersons and information sources.[23]

This relationship between public evaluation of crisis management and impression of leaders was highlighted in other articles and contributed to the narrative that when overall impressions of leadership are favorable, constituents are more likely to be satisfied with the relevant crisis management. Participants in Thailand who had poor trust and faith in central and local government institutions were also associated with poor perceptions of their political leaders' ability to manage the COVID-19 pandemic and provide appropriate healthcare services.[21] Among the sample population studied in South Africa during the COVID-19 pandemic, 72% of the participants acknowledged their support and confidence in government sources and when asked about the measures that authorities had taken to curb the burden of disease, 90% of respondents

agreed that such initiatives (e.g., closing schools and restricting public gatherings) were appropriate.[24]

A study conducted in Singapore and the United States provided a detailed account about what specific leadership traits led to positive evaluations of crisis management. In Singapore, the population showed a high opinion of authorities' crisis management and this sentiment correlated to many respondents agreeing that leadership was accurate (82.2%), clear (86.3%), sufficient (84.5%), timely (84.4%), and trustworthy (87.8%).[20]

Participant data from the United States cross-sectional survey conducted by Quinn *et* al. (2013) on the H1N1 outbreak further added to the understanding of this relationship. From the sample, appreciation of government officials sharing their evolving understanding of pandemic as well as agreement with the statement, "I understand that information about swine flu will change as scientists learn more about the virus" both were positively correlated with the public's high acceptance of government recommendations.[28]

In a multinational study, individuals from France, Germany, Poland, Russia, Spain, Sweden, the United Kingdom, and the United States were asked about current COVID-19 prevention measures and overall impressions of their governments. The German respondents reported most positively on both their state's COVID-19 communication and position (agreeing that it was clear and understandable, credible and honest, and guided by people's interests) as well as on the perceived usefulness of the preventive measures set by authorities.[29] Comparatively, out of the sampled countries, the French population showed the worst opinions towards their government and the lowest feelings of being well informed which tests showed to be a significant predictor of perceived

usefulness of policy.[29] Evidence from this research supports the idea that an effective way for leadership to gain the public's support is to ensure that they are seen as open, understandable, credible, and honest figures.

Data from a from another multinational survey illustrated a different pattern in this relationship. Populations from Denmark and the Netherlands had two of the highest reported levels of trust in their national government with more than 70% of respondents in each country praising their leadership.[30] However, despite favorable impressions of authorities, Denmark and Netherlands also had the greatest number of residents that explicitly opposed the measures that their governments were taking to contain COVID-19.[30] Participants who came from a nation with relatively less demanding public health policies (i.e., those from Denmark, Netherlands, and the United Kingdom) reported significantly lower rates of government approval than those coming from MS with stricter containment measures (i.e., Italy, France, and Portugal).[30]

A randomized control trial of a New Zealand sample (n=2,006) identified a pattern of trust in both scientists and politicians; and overall the public was satisfied with government performance.[27] Participant responses were randomly chosen from data collected pre-lockdown (control group) and post-lockdown (treatment group).[27] And after controlling for treatment, analysis showed that, overall, there was a stronger correlation between the public's satisfaction with government performance and their trust in politicians than government performance and their trust in science.[27]

Finally, an unexpected pattern arose from multiple studies; strong, positive opinions towards health professionals and their trustworthiness yet when it came to questions about who should manage the pandemics, this sentiment was not reflected. Among the

group studied in Thailand, researchers found 70 – 80% of participants expressed high trust in professional healthcare workers, but only about half of the respondents actually believed that they and the general health system could effectively deal with COVID-19.[21] Similarly in South Africa, the majority of respondents expressed high trust towards the health and scientific community but when asked about the capabilities of different management sectors, participants rated government bodies significantly better than health system representatives.[24]

There could be many reasons for this outcome. A randomized control trial conducted by Kreps, *et* al. in the United States offered evidence of one potential explanation. The study showed that most of public lacked basic factual knowledge about science and an understanding of the scientific method; it demonstrated how scientific reversals in public health models and predictions undermined the public's trust in science and science-based leadership.[31] The presentation of scientific uncertainty in media and the politicization of facts was seen to negatively affect both support for using COVID-19 models to guide policy making as well as attitudes toward science generally.[31]

Adherence to public health guidelines

Lastly, a relationship that was commonly identified was the influence of impressions of leadership on the public's acceptance and willingness to adhere to guidelines and measures set by them. Evidence focused on the relationships between personal contexts, perceptions, and beliefs. What these data showed is how internalized feelings can manifest in active participation or disengagement.

When people believe leaders are responding appropriately to public health threats, and that they are acting in the best interests of their constituents, the population is more likely and willing to practice recommended health guidelines. This was illustrated in the data from the multinational study conducted by Margraf *et* al. (2020) where the overwhelming majority of participants (coming from France, Germany, Poland, Russia, Spain, Sweden, the United Kingdom, or the United States) agreed that their country's established COVID-19 preventive measures were useful and appropriate for the circumstances, 77.4%; most of them also reported adherence to rules, 91.7%.[29] The mediating factors between these statistics were feeling as if government communication was being guided by the interests of people and feeling well informed about the current crisis; these showed to be positive predictors of adherence to and perceived usefulness of policy measures among the public in all the surveyed countries.[29] It was not surprising to see that the United States' participants reported below average on all variables related to government communication and consequently average or below average levels of adherence compared to other countries.[29]

Data from the Israeli population found a statistically significant positive correlation between the public's opinion of leadership practices and their adherence to public health guidelines (such as physical distancing and wearing masks) ($r=0.15$, $P<0.001$).[23] A sampled population in Singapore provided evidence that the odds that someone practiced at least six of the eight SARS preventive measures (i.e., hand washing, masks, and covering mouths) was higher among persons who viewed authorities as open, effective, and approachable than those that did not view authorities that way (OR 0.909; 95% CI 0.855 to 0.966).[20]

Similarly, both studies that focused on the general population in China during the COVID-19 pandemic found significant correlations between respondents' attitudes on government prevention, control, and aid approaches and their reported adherence to state public health measures.[19, 22] Min *et* al. (2020) specifically presented data showing that government trust not only was associated with compliance with the recommended measures, but that it also correlated to people taking additional measures that were not suggested or recommended.[19]

A more positive impression of leadership in terms of trust, timeliness, transparency, and effectiveness results in better abiding of public health guidelines and preventive strategies. This pattern continues to appear in studies based in Thailand, Germany, United States, Nigeria, Japan, and the Democratic Republic of Congo.[18, 21, 25, 32-35] In Thailand, data found significant associations between public trust in government and public trust in health professionals, as well as a strong and significant relationship between professional trust and practicing precautions.[21] In fact, data highlighted that the relationship between trust in government and following guidelines was 88.6% indirectly affected by trust in health professionals.[21]

Among the German public, researchers also contributed insightful evidence to suggest that promoting voluntary anti-COVID-19 measures may lead to more people responding positively towards guidelines because it could suggest that the government believes people are responsible.[33] Whereas, if institutions enforced laws, people would see that as the government does not trust the public and therefore there is animosity and a decrease in practice measures.[33]

Finally, results from the United States-based study provided additional evidence on a unique dimension to the relationship between impressions of leadership and adherence to guidelines. In a randomized control trial, the researcher identified four themes in public health communication that are needed during a pandemic: medical/health disruption, individual response, organizational response, and social/economic disruption information.[35] The experiment went to show how being exposed to all, some, or none of that information could affect participants' levels of self-efficacy, certainty, trust, and intention to comply to guidelines.[35] As expected, those in the group that was exposed to all four themes showed the highest levels of all the variables, however, those that were only exposed to the scientific theme (reporting on medical/health issues) were seen to have, on average, the worse outcomes unless supplemented with information that included information on social risks and organizational/institutional response.[35]

Personal Testimonies

The reported evidence is mostly quantitative. However, several reviewed articles used focus groups and/or key informant interviews as their methods of data collection. These results offer special insight into perspectives and behaviors of a population in relation to leadership, public health, and crises.

One common topic brought up was the influence of communication by government and scientific experts. Focus group participants from the United Kingdom, the Netherlands, Sweden, and Poland all spoke about the overwhelming burden of being exposed to mixed and vague messages regarding pandemic response, the need for tact and thoughtfulness when it comes to pandemic communication, and the benefit and perceived reliability of one, consistent message.[36, 37] Participants in the Netherlands,

Poland, and Sweden specifically complained about how even doctors, those with the objective scientific knowledge and background, did not always agree on the use of preventive measures during pandemics and this had caused skepticism and reluctancy towards their doctors' insight and guidance.[37]

Discussion among participants in the United Kingdom study went on to describe the severe lack of trust in national government; these opinions stemmed from the politicization of the pandemic.[36] Focus group respondents in Uganda, when asked about the Ebola virus disease, also reflected this sentiment and stressed the way politics had deterred the population from trusting authorities, and even health workers, and weakened the nation's response to the public health outbreak as a whole.[38] Furthermore, these respondents mentioned that they would be receptive to information and guidance from NGO workers because of their perceived impartiality and apolitical nature in the Ebola response.[38]

For leaders to gain the trust of their constituents, testimonies show they must be engaged, transparent, and collaborative. Among the people interviewed in Uganda, local leaders who were significantly engaged in the community were said to have earned the highest levels trust compared to government health workers who were not trusted at all.[38] Dutch informants, in conversations regarding pandemics in general, explained that to prevent widespread panic during such crises something must hold governments accountable to convey complete, trustworthy, and timely information regarding the crisis.[37] They added that to be most effective, public health representatives and institutions must also have an active role and oversee the distribution of information.[37] The Poles and Swedes from the same study agreed that a

representative expert from National Public Health Institutes should step forward with the truth regarding the disease and vaccination.[37]

When it came to practicing public health safety measures, respondents explained that nonadherence to guidelines was attributable to extreme circumstances such as socioeconomic needs that outweigh safe practices[38] and a general lack of understanding and lack of enforcement.[36]

Finally, an interesting result from both of the qualitative studies based in Europe was that, despite the lack of clarity during public health crises, uncertainty from leadership and within the population, and people's overall disproval of and trust in authorities, and even experts at times, the majority of the participants assured that they were still adherent to government instructions.[36, 37]

CHAPTER 5: DISCUSSION and RECOMMENDATIONS

This project adopted the PRISM-ScR framework to review published literature and explore the breadth, diversity, and nature of the evidence on this topic.[15] Specifically, it summarized the current, relevant body of knowledge about the relationship between scientific knowledge and political leadership through the perspective of the public facing a pandemic. The results illustrated how effective public health action is mediated by the complex and intricate interactions between personal and interpersonal factors that govern how people approach public health crises.

According to several studies, individual demographics and risk perceptions had significant association with the way in which people responded to their leaders and accepted information during an infectious disease outbreak. Further, there was a large body of evidence showing the relationships between the public's perception of leadership and the manner in which they accepted and retained public health knowledge, evaluated the management of the crisis, and ultimately how they adhered to the preventive guidelines put in place to protect society.

This review provided unique and novel insight into the overall role of science and politics during public health crises. Through the perspective of the public, we identified relationships and patterns across various nations that help guide recommendations for the future and highlight what more there is to learn.

Recommendations for Political Figures

Engage health professionals in decision-making and communication

Taken together, these data created a narrative around the relationships among the receptiveness to science, impressions of politicians, trust in government approaches, and public action. The effectiveness of leadership and policies during critical infectious disease outbreaks is ultimately bound by the practices and values of the population it serves.

Though it seems obvious, where people put their trust has a substantial impact on the information in which they are exposed. But, acknowledging this does not create significant impact in pandemic response; instead, leaders must go as far as to take advantage of these trends and establish cohesion between sources. To do this, they must engage with the scientific community to ensure that populations choosing to follow government risk communication versus those that rely on public health sources receive parallel and complementary insight on how to stay safe during the crisis.

Information and misinformation in the digital age is a real threat to successful management of infectious disease outbreaks. Results from two of the studies highlighted the potential balance that must be struck when presenting information to the public.[16, 25] Having too much exposure to different sources of information as well as having too little exposure could both impair individual's ability to obtain sufficient and accurate information. Therefore, politicians engaging with the health realm means guaranteeing continuity and cooperation between their communication as well as working collaboratively to condense and appropriately manage the available sources.

If the political sphere can genuinely incorporate the scientific sector, studies show positive correlations between trust in scientists and trust in politicians; negative correlations between trust in politicians and vulnerability to misinformation; and negative correlations between trust in scientists and acceptance of conspiracy theories.[16, 17, 21, 25, 27] These variables show a range of effects on the public's receptiveness to government measures and their intentions to follow guidelines. By building off of the politician's diplomatic tact and the scientist's public health knowledge, politics and science can and should work together to communicate and instill an appropriate sense of caution in the population. As one of the studies shows, the relationship between trust in government and following guidelines was 88.6% indirectly affected by trust in health professionals. Experts are an integral part of leadership during crises.[21]

There are data indicating strong relationships between the public's perception of risk and various responses to the outbreak.[22-24] Leaders should not aim to incite public panic and fear; they still must provide constituents with the realities of the severity of disease so that the population understands what is at stake and appreciate the measures taken. One study based in Israel showed that those who primarily used infectious disease experts and read scientific articles highly disproved of the government's response.[23] While there are no data that explains the reason for this correlation, it can be hypothesized that perhaps it was due to the lack of coordination between the two spheres. Those with the scientific background and knowledge could have been more aware of the characteristics of disease and potential risks for which they did not see appropriately managed or communicated by government.

More research should be conducted to directly explore the different relationships found in this review. The identification of the relationships in general provides starting points to what can be done to better promote intersectoral partnership.

Be open about the non-scientific influences in decisions

When communicating to the public about preventive measures or guidelines, politicians should explicitly separate evidence-based, decision-making and decisions influenced by non-scientific findings. Though this might seem counteractive to bridging the relationship between science and politics, it may actually serve to bolster it. It acts as the product of respect toward science and respect toward the art of politics. There are many situations in which politicians have to make difficult decisions and depending on the context of the situation, matters outside of health and science may influence policy recommendations. This is the reality of leadership in general, sacrifices have to be made. We recommend politicians make clear what guides them. The responsiveness of the public to leadership is related to perceived clarity, sufficiency, timeliness, and accuracy of what authorities communicate.[20, 28, 29, 37] Politicians should resist conflating science-based reasoning and value-based reasoning and divulge when and where they are using each. When these two approaches are muddled together, it risks the politicization of scientific matters.

To gain the respect and the adherence of the public, the politicization of science and public health during pandemics had only been reported to hurt this effort.[36, 38] Participants from one focus group explained how it muddles the truth and that they never know what is genuinely true or valid.[36] Politicization undermines the public's support for epidemiologic COVID-19 models that guide policy decisions as well as

overall attitudes towards science and the scientific community. When the public cannot appreciate the input and direction from public health leaders and scientists, effective public health action during an infectious disease outbreak seems paradoxical.

Politicization of a pandemic was also correlated to decreased trust in government among a population and trust had a significant influence on several variables regarding the public's response.[31] More research should investigate the effects of specific messaging and the nature behind the decision. However, the hypothesis that when politicians adopt a certain level of transparency when communicating to their public, that is, specifically identifying which decisions are science-based and which are not, the public's trust in the institution will improve as well as the overall relationship between science, politics, and the public during a public health crisis.

Recommendations for Health Professionals

Present evidence fairly and with transparency

In the midst of an infectious disease outbreak, politicians are not the only leadership figures that have the responsibility to present information in a fair and transparent manner. They are not the only players "at fault" for this either. Public health professionals and scientists must acknowledge the reality that not everyone, and especially not all politicians, are equipped with the same scientific background or terminology.

As expressed in one of the reviewed articles, the majority of the public (at least those in the United States) demonstrated the lack of simple, foundational awareness and familiarity about science and the scientific method.[31] While those in the academic field

are more likely to understand concepts such as probability, power, confidence, validity, or generalizability, many laypersons take scientific results and statistics with blind embrace. On the surface this may not appear to be a harmful result, however, data showed that reversals in science-based public health recommendations and predictions severely compromises the public's trust in science.[31] Therefore, health professionals should not only strive to present data in a straightforward manner but as the experts in their fields, they must also help educate the public about the true significance of their results. In fact, another study found a positive correlation between the public's understanding that public health information is bound to evolve as a pandemic progresses and their acceptance of the government recommendations and guidance.[28]

Another aspect is the pattern of distrust among health professionals. Though very few studies show a significant proportion of their populations expressing negative attitudes towards these representatives, among those that did, the feelings related to the clarity in recommendations, low faith in the health care system as a whole, or the disagreements between health professionals regarding appropriate preventive measures.[37, 38]

The robustness and legitimacy of health professionals and the healthcare system are also critical aspects of pandemic response. In the effort to promote their capabilities to inform and guide, they must work together within their own sphere, as well as the greater network they are a part of, to ensure that there is unity and coherence among them. Trust in health professionals has significantly affected the public's response during infectious disease outbreaks and therefore we must solidify their role.

Learn the art of politics

An interesting pattern was, despite high regard for health professionals' insight and guidance, some populations demonstrated significantly poor evaluations on whether the health sector had the ability to manage the outbreak.[21, 24] Health scientists should be, and are needed, at the forefront of pandemic response and leadership with just as equal and significant voice as politicians. Sentiments expressing concern or doubt in the health sector's capacity to lead the management of a public health crisis should not be overwhelmingly widespread.

Just as politicians are bound by their lack of scientific knowledge, scientists are constricted by their lack of proficiency in navigating the political field. To be taken seriously in the eyes of the public, they must learn the art of politics. Data has shown that the majority of populations have put full faith and trust in these institutions and experts,[21, 23-27] but now these leaders must use this support to their advantage to create meaningful change during a crisis.

Becoming familiar with political processes and having skills to lead an entire nation can make scientists strong advocates for health policy and more influential leaders. Representatives of the health system should be given the chance to impart their knowledge and background as it revolves around the current public health crisis. However, this is not just important for times of crises, but it is crucial in building the relationship between science and politics in general and long-term. Scientists far too often choose to stay away from politics, but they instead must embrace the tact and skill that is required to lead populations and begin to understand how to appropriately and

most effectively communicate with the leaders who sign legislation regarding public health policies.

Recommendations for the Community

The relationship between science and politics during public health outbreaks is of primary concern for the participating leaders in the relevant spheres, but some of the evidence highlights areas where outside forces, such as media and academic institutions, can have a role in mediating or supporting the bridge and collaboration between the two sectors.

Improvements in technology and the increasing breadth and influence of media posed a significant challenge in public health communication. In some cases, during the COVID-19 pandemic social media has crippled the coordination and efforts to integrate science and politics. Social media leaders should recognize the power their platforms have and consequently take action to promote science and diplomacy. They have the responsibility and power to do more.

Almost everyone is exposed to some form of media; media can find its way and influence in all corners of the globe. With enough support and administrative will, media (whether that be television, radio, papers, or social media) can use its reach to ensure that populations are presented with as much accurate and appropriate information as possible. This also means that the spread and amplification of misinformation can be controlled and managed more thoroughly.

One of the reviewed studies showed how being exposed to different combinations of information regarding medical/health disruption, individual response, organizational

response, and social/economic impact could significantly influence people's levels of self-efficacy, certainty, trust, and intention to comply to guidelines.[35] Participants showed the highest levels of all studied variables when they were presented with communication that had all four types of information within it.[35] Media should capitalize on this insight and in its effort to better manage the information floating around the world, make sure that populations are receiving a holistic overview of the public health crisis and equipped with the right amount and appropriate knowledge. Media has the platform and the technical ability to present information on key public health policy decisions and the factors (scientific and political) that influence them, and they should take advantage of that.

Results demonstrate that demographic characteristics (e.g., age, education, and income level) have significant influence on population receptiveness to important information and guidelines during pandemics.[16-21] In addition to media, academic institutions (at all levels) should assume responsibility in fostering a better relationship between science and politics during global health crises. These institutions can improve curricula so that future generations have a more robust knowledge and awareness of science, statistics, and analytics. They can also augment the manner in which civics courses are taught so that they address the importance of public health policy and thereby rearing more educated and aware voters. The influence that academic institutions have should not be directed solely for times of crisis, but they should be implementing these changes continuously and rigorously to support the relationship between science and politics at all levels and in all contexts. Including health topics into government courses should also be supplemented with introducing practical considerations regarding nutrition or the

environment in science courses to explain to people how scientific knowledge can impact public policy.

Limitations

After considering the results and reflection of this review, there are several sources of limitation in this project that need to be addressed. First, this was a descriptive review and while patterns and commonalities between studies were identified, any statistically founded results that regard a generalized relationship between science and politics across nations cannot be concluded.

Though there were strict inclusion and exclusion criteria for the studies reviewed, we note that only one person participated in the search methods, initial title and abstract screening, full-text review, and data extraction. Twenty-three articles were reviewed in the final analysis. This demonstrates the novel nature of the topic and provides a call for the expansion of literature about the relationship among science, politics, and public responses during public health crises. This outcome may also be due to the specific databases that were used for searches; in the future, perhaps utilizing different databases with focuses in psychology, sociology, or business may generate more results. Furthermore, though there were no exclusion criteria restricting specific countries, the presented studies only reflect populations from 23 different nations.

Another source of limitation in this thesis project is the fact that 17 (73.9%) of the reviewed articles were cross-sectional studies. The benefit of this research method is that it typically collects representative, population-level data and insight; however, cross-sectional designs are also known to have bias in responses, high levels of

nonresponse, and can only provide a snapshot of data making it difficult to analyze relationships and trends over time.[39]

CHAPTER 6: CONCLUSION

The relationship between science and politics is complex, involves myriad factors, and is continuously changing. Simple demographics; population risk perceptions; and impression of government and leadership as it relates to public health knowledge, crisis management evaluation, or adherence to guidelines are all part of an interconnected web of influence. And while there is a breadth of information that provides examples of and conceptual foundations on the relationship between science and politics, this review presented and summarized the results of studies that highlighted specific, quantifiable correlations.

While the tension between science and politics is not new, the COVID-19 pandemic has put a spotlight on the relationship. Infectious disease crises effectively reveal the true nature and importance of the interaction within and between public health professionals and political leaders. But we cannot wait for the next pandemic or outbreak to strike before we take the steps to address intersectorality in leadership. Building and supporting the collaboration, cohesion, and partnership between science and politics must be a continuous effort in the global community as well as in individual nations.

It is apparent that health experts and politicians have different backgrounds and leadership approaches, but these differences should be seen as points where the two spheres can complement each other, providing and sharing insight and knowledge from their own domains. There are many perspectives and approaches that could be taken to analyze this relationship and this current review described it from the voice of the people because it is the public who is the actor of change during public health crises.

By exploring their views and behaviors as they revolve around science and political leadership it has allowed for the identification of several significant trends and patterns that contribute to the overall understanding of the complexities of the relationship between science and politics. With this insight, suggestions for public health representatives, political figures, and communities in general were made so that we can begin to enhance the productivity of this relationship and provide new avenues and targets for future research that may conduct more direct analysis. But until then, the role of science and politics must be at the forefront of our minds as any aspect of success in our nations and in our world is dependent on proper leadership and promotion of overall health and well-being.

REFERENCES

1. Morens, D. M., Daszak, P., Markel, H., & Taubenberger, J. K. (2020). Pandemic COVID-19 Joins History's Pandemic Legion. *mBio, 11*(3), e00812-00820. doi:10.1128/mBio.00812-20
2. Lee, K., & Brumme, Z. L. (2012). Operationalizing the One Health approach: the global governance challenges. *Health Policy and Planning, 28*(7), 778-785. doi:10.1093/heapol/czs127
3. N. Howe (Producer). (2020). *Stick to the Science* [Podcast]
4. Hunter, E. L. (2016). Politics and Public Health-Engaging the Third Rail. *Journal of public health management and practice : JPHMP, 22*(5), 436-441. doi:10.1097/PHH.0000000000000446
5. Fafard, P., & Cassola, A. (2020). Public health and political science: challenges and opportunities for a productive partnership. *Public Health, 186*, 107-109.
6. Kickbusch, I. (2016). *Governing the Global Health Security Domain*. Retrieved from Geneva, Switzerland:
7. World Health Organization. (2021). What we do. Retrieved from https://www.who.int/about/what-we-do
8. Gostin, L. O., & Katz, R. (2016). The International Health Regulations: The Governing Framework for Global Health Security. *The Milbank quarterly, 94*(2), 264-313. doi:10.1111/1468-0009.12186
9. Burkle, F. M., Jr. (2015). Global Health Security Demands a Strong International Health Regulations Treaty and Leadership From a Highly Resourced World Health Organization. *Disaster Med Public Health Prep, 9*(5), 568-580. doi:10.1017/dmp.2015.26
10. Cameron, E. E., Nuzzo, J. B., Bell, J. A., Nalabandian, M., O'Brien, J., League, A., . . . Warmbrod, L. (2019). *Global Health Security Index: Building Collective Action and Accountability*. Retrieved from https://www.ghsindex.org/wp-content/uploads/2020/04/2019-Global-Health-Security-Index.pdf
11. Worldometers.info. (2021). Covid-19 Coronavirus Pandemic. Retrieved from https://www.worldometers.info/coronavirus/. from Worldometer https://www.worldometers.info/coronavirus/
12. Daszak, P., Keusch, G. T., Phelan, A. L., Johnson, C. K., & Osterholm, M. T. (2021). Infectious Disease Threats: A Rebound To Resilience. *Health Affairs, 40*(2), 204-211. doi:10.1377/hlthaff.2020.01544
13. Ziegler, J. N. (2020). Science, Politics, and the Pandemic. *Current History, 119*(820), 303-309. doi:10.1525/curh.2020.119.820.303
14. Wilson, S. (2020). Pandemic leadership: Lessons from New Zealand's approach to COVID-19. *Leadership, 16*(3), 279-293. doi:10.1177/1742715020929151
15. Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., . . . Straus, S. E. (2018). PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med, 169*(7), 467-473. doi:10.7326/m18-0850
16. Ali, S. H., Foreman, J., Tozan, Y., Capasso, A., Jones, A. M., & DiClemente, R. J. (2020). Trends and Predictors of COVID-19 Information Sources and Their Relationship With Knowledge and Beliefs Related to the Pandemic: Nationwide

Cross-Sectional Study. *JMIR public health and surveillance, 6*(4), e21071-e21071. doi:10.2196/21071
17. Deurenberg-Yap, M., Foo, L. L., Low, Y. Y., Chan, S. P., Vijaya, K., & Lee, M. (2005). The Singaporean response to the SARS outbreak: knowledge sufficiency versus public trust. *Health promotion international, 20*(4), 320-326. doi:10.1093/heapro/dai010
18. Goodwin, R., Wiwattanapantuwong, J., Tuicomepee, A., Suttiwan, P., & Watakakosol, R. (2020). Anxiety and public responses to covid-19: Early data from Thailand. *Journal of psychiatric research, 129*, 118-121. doi:10.1016/j.jpsychires.2020.06.026
19. Min, C., Shen, F., Yu, W., & Chu, Y. (2020). The relationship between government trust and preventive behaviors during the COVID-19 pandemic in China: Exploring the roles of knowledge and negative emotion. *Preventive Medicine, 141*, 106288-106288. doi:10.1016/j.ypmed.2020.106288
20. Quah, S. R., & Hin-Peng, L. (2004). Crisis prevention and management during SARS outbreak, Singapore. *Emerging infectious diseases, 10*(2), 364-368. doi:10.3201/eid1002.030418
21. Saechang, O., Yu, J., & Li, Y. (2021). Public Trust and Policy Compliance during the COVID-19 Pandemic: The Role of Professional Trust. *Healthcare (Basel, Switzerland), 9*(2), 151. doi:10.3390/healthcare9020151
22. Duan, T., Jiang, H., Deng, X., Zhang, Q., & Wang, F. (2020). Government Intervention, Risk Perception, and the Adoption of Protective Action Recommendations: Evidence from the COVID-19 Prevention and Control Experience of China. *International Journal of Environmental Research and Public Health, 17*(10), 3387. doi:10.3390/ijerph17103387
23. Gesser-Edelsburg, A., Cohen, R., Hijazi, R., & Abed Elhadi Shahbari, N. (2020). Analysis of Public Perception of the Israeli Government's Early Emergency Instructions Regarding COVID-19: Online Survey Study. *Journal of Medical Internet Research, 22*(5), e19370-e19370. doi:10.2196/19370
24. Reddy, S. P., Sewpaul, R., Mabaso, M., Parker, S., Naidoo, I., Jooste, S., . . . Zuma, K. (2020). South Africans' understanding of and response to the COVID-19 outbreak: An online survey. *S Afr Med J, 110*(9), 894-902. Retrieved from http://www.samj.org.za/index.php/samj/article/download/13049/9486
25. Vinck, P., Pham, P. N., Bindu, K. K., Bedford, J., & Nilles, E. J. (2019). Institutional trust and misinformation in the response to the 2018-19 Ebola outbreak in North Kivu, DR Congo: a population-based survey. *Lancet Infect Dis, 19*(5), 529-536. doi:10.1016/s1473-3099(19)30063-5
26. Berman, A., Figueroa, M. E., & Storey, J. D. (2017). Use of SMS-Based Surveys in the Rapid Response to the Ebola Outbreak in Liberia: Opening Community Dialogue. *J Health Commun, 22*(sup1), 15-23. doi:10.1080/10810730.2016.1224279
27. Sibley, C. G., Greaves, L. M., Satherley, N., Wilson, M. S., Overall, N. C., Lee, C. H. J., . . . Barlow, F. K. (2020). Effects of the COVID-19 pandemic and nationwide lockdown on trust, attitudes toward government, and well-being. *Am Psychol, 75*(5), 618-630. doi:10.1037/amp0000662

28. Quinn, S. C., Parmer, J., Freimuth, V. S., Hilyard, K. M., Musa, D., & Kim, K. H. (2013). Exploring communication, trust in government, and vaccination intention later in the 2009 H1N1 pandemic: results of a national survey. *Biosecurity and bioterrorism : biodefense strategy, practice, and science, 11*(2), 96-106. doi:10.1089/bsp.2012.0048
29. Margraf, J., Brailovskaia, J., & Schneider, S. (2020). Behavioral measures to fight COVID-19: An 8-country study of perceived usefulness, adherence and their predictors. *PLoS One, 15*(12), e0243523-e0243523. doi:10.1371/journal.pone.0243523
30. Sabat, I., Neuman-Böhme, S., Varghese, N. E., Barros, P. P., Brouwer, W., van Exel, J., . . . Stargardt, T. (2020). United but divided: Policy responses and people's perceptions in the EU during the COVID-19 outbreak. *Health policy (Amsterdam, Netherlands), 124*(9), 909-918. doi:10.1016/j.healthpol.2020.06.009
31. Kreps, S. E., & Kriner, D. L. (2020). Model uncertainty, political contestation, and public trust in science: Evidence from the COVID-19 pandemic. *Science advances, 6*(43), eabd4563. doi:10.1126/sciadv.abd4563
32. Ezeibe, C. C., Ilo, C., Ezeibe, E. N., Oguonu, C. N., Nwankwo, N. A., Ajaero, C. K., & Osadebe, N. (2020). Political distrust and the spread of COVID-19 in Nigeria. *Glob Public Health, 15*(12), 1753-1766. doi:10.1080/17441692.2020.1828987
33. Schmelz, K. (2021). Enforcement may crowd out voluntary support for COVID-19 policies, especially where trust in government is weak and in a liberal society. *Proceedings of the National Academy of Sciences of the United States of America, 118*(1), e2016385118. doi:10.1073/pnas.2016385118
34. Uddin, S., Imam, T., Khushi, M., Khan, A., & Ali, M. (2021). How did socio-demographic status and personal attributes influence compliance to COVID-19 preventive behaviours during the early outbreak in Japan? Lessons for pandemic management. *Personality and individual differences, 175*, 110692-110692. doi:10.1016/j.paid.2021.110692
35. Ophir, Y. (2019). The Effects of News Coverage of Epidemics on Public Support for and Compliance with the CDC- An Experimental Study. *J Health Commun, 24*(5), 547-558. doi:10.1080/10810730.2019.1632990
36. Williams, S. N., Armitage, C. J., Tampe, T., & Dienes, K. (2020). Public perceptions and experiences of social distancing and social isolation during the COVID-19 pandemic: a UK-based focus group study. *BMJ Open, 10*(7), e039334-e039334. doi:10.1136/bmjopen-2020-039334
37. Determann, D., de Bekker-Grob, E. W., French, J., Voeten, H. A., Richardus, J. H., Das, E., & Korfage, I. J. (2016). Future pandemics and vaccination: Public opinion and attitudes across three European countries. *Vaccine, 34*(6), 803-808. doi:10.1016/j.vaccine.2015.12.035
38. Schmidt-Sane, M. M., Nielsen, J. O., Chikombero, M., Lubowa, D., Lwanga, M., Gamusi, J., . . . Kaawa-Mafigiri, D. (2020). Challenges to Ebola preparedness during an ongoing outbreak: An analysis of borderland livelihoods and trust in Uganda. *PLoS One, 15*(3), e0230683-e0230683. doi:10.1371/journal.pone.0230683
39. Levin, K. A. (2006). Study design III: Cross-sectional studies. *Evidence-Based Dentistry, 7*(1), 24-25. doi:10.1038/sj.ebd.6400375

APPENDIX A

Search Criteria

Table A1. *PubMed Database Search Criteria for Science and Political Leadership Systematic Review, 2021*

#1	Policy[tw] OR political leadership[tw] OR politics[tw] OR transparency[tw] OR communication[tw]	658,908
#2	Science[tw] OR research[tw] OR evidence-based[tw]	10,678,674
#3	Public adherence[tw] OR public perception[tw] OR attitude[tw] OR trust[tw]	314,401
#4	Pandemic[tw] OR outbreak[tw]	117,327
#5	#1 AND #2 AND #3 AND #4 (Filters: Journal Article, Review, from 2000-2021)	263

Table A2. *Embase Database Search Criteria for Science and Political Leadership Systematic Review, 2021*

#1	Policy OR (political AND leadership) OR politics OR transparency OR communication	1,262,850
#2	Science OR research OR (evidence AND based)	11,963,223
#3	Public AND adherence OR (public AND perception) OR attitude OR trust	903,853
#4	Pandemic OR outbreak	155,373
#5	#1 AND #2 AND #3 AND #4 (Filters: Article, Article in Press, Review, from 2000-2021)	936

Table A3. *Global Health Database Search Criteria for Science and Political Leadership Systematic Review, 2021*

#1	(policy OR political leadership OR politics OR transparency OR communication) AND (public adherence OR public perception OR attitude OR trust) AND (pandemic OR outbreak) AND ((science or research OR evidence-based)) (Filters: Journal Article, Journal Issue, Case studies, from 2000-2021)	67