

Distorted Human Decision-Making as a Critical Aspect of Pandemic Planning and Preparedness

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The United States continues to experience lower than expected vaccination rates against COVID-19 due to a variety of barriers such as lack of trust, lack of planning, cultural perspectives and issues, suboptimal communication, and political/economic conflicts of interest. In this paper issues of human behavior and decision-making are highlighted as integral to understanding the generally poor US response to the SARS-CoV-2 pandemic. In particular, the US pandemic response was significantly distorted through a combination of cultural and human behavior issues related to conflicting leadership, cultural individualism, the prevalent idea of the democratization of expertise, and a false epistemological lens for decision-making. Including experts from multiple disciplines reveals how to address the human behavioral side of pandemic planning and operations to increase vaccine coverage rates. Including content experts from psychology and the social sciences allows the explicit recognition and preparation for distorted human behavior in planning for future pandemic response.

INTRODUCTION

Since the first awareness of COVID-19 in December 2019, the novel coronavirus SARS-CoV-2 has claimed more than a recorded 6 million lives, threatened the physical and mental health of the global population, and led to a drastically transformed reality for all [1]. Loss of loved ones, dramatic changes to lifestyles, limited socialization, altered working environments, disruptions to education and economies, a striking rise in unemployment, strained health systems, constant uncertainty, medical complications and disabilities, and consequent mental health challenges have become inseparable parts of the “new

normal” brought about by the pandemic [2-9]. As various countries implemented different measures to contain the spread of the virus, ranging from mandatory to voluntary non-pharmaceutical interventions to field hospitals and mass vaccination campaigns, it has been demonstrated with unmatched clarity that the success of COVID-19 mitigation efforts and, ultimately, the conditions under which resolving this pandemic will rely, are conditional on individual and collective human decision-making and behavior. From denial and simple ignorance regarding pandemic risks to almost ideologized reluctance to comply with evidence-based preventive measures, we have

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witnessed extremely variable attitudes and responses to our shared pandemic reality [10-23]. These observations have also demonstrated the critical necessity of incorporating issues surrounding human decision-making, behavior, and response into national plans for pandemic and contingency planning and effective response.

The human behavioral side of the pandemic, especially the impact of distorted individual and collective decision-making on pandemic control, has been dramatically illustrated in the context of vaccination. Widespread immunization against COVID-19 and widespread population immunity remains the only realistic prospect for ending the pandemic phase and regaining some sense of normalcy [24-26].

Unprecedented in scale and speed, global vaccine development efforts led to the rapid development, authorization, and deployment of a number of COVID-19 vaccines. To date, numerous studies and real-life data have repeatedly demonstrated the safety, efficacy/effectiveness, and overall risk:benefit ratio compared to the consequences of COVID-19 infection, of the approved COVID-19 vaccines in Western countries [27-37]. With more than 4.2 billion people worldwide having received at least one dose of a COVID-19 vaccine in less than a year once it became available, these vaccination efforts are likely comparable only to the polio and smallpox eradication campaigns [38-40]. However, despite irrefutable benefits of COVID-19 vaccines, significant obstacles have been encountered as countries attempt to reach high vaccination coverage targets and herd immunity.

While vaccine supply and logistics remain important barriers in the process of COVID-19 vaccination in underdeveloped and some developing countries, all the US population age 5 years and older now has free and unrestricted access to highly effective vaccines. Despite this, amid the deadliest pandemic in the history of the country, US vaccination rates are lower than those of many developed countries, with only 70.5% of the population ≥ 5 years of age being fully vaccinated against COVID-19 and 82.7% having received at least one dose as of May 10, 2022 [41]. The net result is that the US has had the largest number of COVID-19-related deaths per capita compared to 21 peer countries [42]. Life expectancy from 2019-2020 in the US dropped a mean of 1.87 years, while the mean in 21 different peer countries dropped a mean of only 0.58 years [42]. As a result, in the US, COVID-19 was the 3rd most common cause of death during 2021 [43].

VACCINE HESITANCY: A MAJOR CHALLENGE

While other possible contributors to suboptimal uptake should also be acknowledged, the vast majority

of currently unvaccinated individuals in highly developed countries are, at this point in the pandemic, simply unwilling to get immunized. If we exclude medical contraindications, the major reasons behind this include widespread fear, ignorance, lack of trust, and misinformation and disinformation drivers resulting in hesitancy or rejection towards vaccines [44-47]. The World Health Organization (WHO) defines vaccine hesitancy as “a delay in acceptance or refusal of vaccination despite availability of vaccination services” and named it among the top 10 threats to global health in 2019 [48]. Indeed, large surveys conducted both before COVID-19 vaccine rollout and over time following authorization and full availability of COVID-19 vaccines demonstrate that even though the number of hesitant individuals and vaccine opposition has declined, those numbers are now stagnant, and a significant percent of those in the US not yet fully vaccinated do not intend to get vaccinated in the near future [49,50]. While 1 in every 321 Americans has now died due to COVID-19, and with data clearly demonstrating that unvaccinated individuals have a significantly higher risk of hospitalization and death upon infection, vaccine uptake trends over the last months signify that the proportion of the hesitant or resistant population have remained static, further decreasing the chances of reaching herd immunity and resolving this pandemic [51,52].

As a result, vaccine hesitancy and rejection have been critical factors in the inability to increase immunization coverage and prevent morbidity and mortality. COVID-19 vaccine disinformation and misinformation have been rampant across the world and have significantly increased vaccine hesitancy. In many ways, vaccine misinformation and disinformation are as dangerous a “pathogen” as many other pathogens in terms of leading to human morbidity and mortality. Van der Linden et al. discuss the importance of creating “cognitive antibodies” in individuals to help protect from misinformation [53-55]. The topic of vaccine misinformation is extensively reviewed elsewhere [54-57], however it should be noted here that, indeed, the ability to identify and protect against misinformation is a critical part of addressing vaccine hesitancy and its implications for pandemic response planning are further discussed below in the proposed research agenda.

Generally, attitudes towards vaccination are far from dichotomous and in fact lie along a diverse spectrum spanning from confident acceptance of recommended vaccines to undebatable refusal of all immunizations. Many vaccine hesitant individuals are not at the extreme negative end of this continuum. Rather, declination of offered vaccines is generally motivated more by fear of vaccine side effects to denial of the seriousness of the pandemic, mistrust in science, health authorities and governments, and to beliefs in conspiracy theories instilled

by vocal disinformation and political propagandists, better known as “anti-vaxxers” [58]. While uncertainty in decision-making about immunization is as old as the practice of immunization itself [59], the factors influencing these opinions and subsequent vaccination behavior appear to be expanding and diversifying. Thus, the issue of vaccine hesitancy has become increasingly complex and magnified even further during the COVID-19 pandemic [58,60-69].

The process of human decision-making and behavior, especially in times of crisis and uncertainty, is subject to numerous biases and is vulnerable to a multitude of cultural, political, economic, and social influences even when data and statistics point to the obvious benefits of a particular behavior, such as receiving a vaccine. Efforts to address vaccine hesitancy have mainly focused on conveying uniformly framed *data-based* messages by public health authorities and healthcare providers (HCP) employing a universalized, “one size fits all” highly analytical information approach or cognitive style. Such an approach ignores consideration of the diversity of the target audience. While the importance and impact of appropriate communication cannot be overstated [70,71], current efforts that continue to use the same communication and education framework are unlikely to have additional beneficial effects on COVID-19 vaccine acceptance. Therefore, as knowledge about the multifactorial dimensions of vaccination attitudes and behavior expands, creative and proactive approaches that recognize the reality of distortions of human decision-making during pandemics are urgently needed in order to: 1) design interventions and improve population-level vaccine coverage, and 2) add such considerations into the entire cycle of pandemic planning and operations at the local, state, and national levels.

A MULTIDISCIPLINARY APPROACH TO PANDEMIC PREPAREDNESS

We believe that the road to improving vaccine acceptance lies in a *multidisciplinary* approach to the human behavioral side of vaccine acceptance, seeking to identify and account for the diversity of composite drivers of attitudes towards vaccination and the actual decision-making process about vaccine acceptance. As an example, the tools developed by the WHO’s Strategic Advisory Group of Experts on Immunization (SAGE) working group to identify and diagnose vaccine hesitancy and its major drivers in communities and nations, as well as the WHO adaptation of the Increasing Vaccination Model, can be useful beginnings for this purpose [58,72]. By acknowledging the diversity of the problem and of the target groups, multiple experts have underscored the importance of utilizing *multi-component*

rather than unidirectional approaches that incorporate insights from multiple disciplines. An example of such an approach is the Guide to Tailoring Immunization Programme (TIP) developed by WHO EUR [73]. The topic of vaccine hesitancy and ways to address it efficiently are further discussed in a more recent report by the Sabin-Aspen Vaccine Science & Policy Group [74]. In addition to recommendations for further research into dynamic drivers and dimensions of vaccine hesitancy, and a multipronged and targeted approach to counter it, the specific importance of social media platforms in vaccine discussion and therefore in the formation of vaccine attitudes and behaviors, was particularly highlighted in this report. This comprehensive data-based work also points to the need to develop and employ a targeted media strategy to overcome current barriers and challenges such that results in an improvement in pro-vaccination social media presence. In line with the findings of these and other expert groups, we believe that to address the multifaceted issue of vaccine hesitancy, collaborations involving experts across medical and non-medical fields are urgently needed to devise strategies tailored to the various and specific strata of vaccine hesitant individuals and in individualizing communication and educational approaches as warranted. In particular, by addressing the whole person through the intersection of multiple disciplines, a clearer understanding and set of strategies can be developed beyond that of the current limiting paradigms under which public health-level immunization programs are implemented. Insights from professionals in medical sciences, epidemiology, and public health must be interdigitated with those gained from experts across such disciplines as mental health, cognitive psychology, education, strategic communication, social media studies, fact-checking, linguistics, cultural anthropology, and behavioral economics to customize and maximize efforts directed at decreasing vaccine hesitancy [75]. Development of such a multidisciplinary approach is crucial not only for increasing vaccination uptake and compliance with non-pharmaceutical interventions to ameliorate the COVID-19 pandemic, but for public health emergency preparedness in general. To our knowledge, no such deliberate gathering of such content expert individuals has taken place to directly inform pandemic planning efforts at the national level. One of us (GAP) has participated in multiple national and state-level table top and planning exercises over the last 25 years and this has been a readily observed deficiency in planning efforts. We believe this can be an important corrective to the current ineffective pandemic planning doctrine.

PSYCHOLOGICAL IMPACTS ON THINKING AND DECISION-MAKING

One of the many professions that has much to offer in human thinking and decision-making is the field of psychology and mental health. By exploring concepts such as ways of thinking and influences on decision-making, the neurobiology of fear and uncertainty, how experiences of trauma impact individuals, and preferred cognitive styles; a wider conceptualization can be developed in understanding vaccine hesitancy and rejection. This wider conceptualization can inform innovative and more robust solutions that can lead to improved vaccine acceptance and coverage at the individual, community, and national levels. This understanding can also productively inform the creation of successful strategies for pandemic preparedness.

Currently we are living in a world under conditions of physical and emotional uncertainty and threat because of the continuing global COVID-19 pandemic. As a result of this world-wide trauma, coupled with significant emotional, physical, economic, and other stressors, real physiological and neurobiological changes have occurred that impact pandemic responses. It is critical that HCPs are mindful of these changes while engaging patients in conversations surrounding vaccines. When making decisions about health, it is imperative to interdigitate data and human behavior together. It is not enough to simply communicate fact-based data and expect that others will be swayed by (or live flexibly within) the data alone. Human behavior, decision-making, cognitive biases and heuristics, and cognitive styles and thought patterns need to be considered [76]. By understanding and interlinking these areas, public health policy can be better developed and implemented. Taking all of this into account, how does the health care profession respond to someone who is not persuaded by data, facts, or science? How best to engage in an evidence-based but sincere manner given our cultural context?

Initial considerations include the reality that a very prominent feature of this pandemic is the nearly constant attendant anxiety and threat perception that many individuals are experiencing, and hence are likely to operate out of a sympathetic nervous system (fight-or-flight) dominance. When sympathetic nervous system dominance occurs, the brain is activated differently, such that this changes the perception of risks and benefits from an intervention (mask-wearing, vaccination, etc.), as well as impacting thinking patterns and engagement in conversation.¹ When the sympathetic nervous system (fight-or-flight) is activated following a threat or a perception of a potential threat, the amygdala is engaged and there is loss of some level of access to executive function and

decision-making, moving instead to fight-or-flight-based survival responses. This is critical for the healthcare provider to understand because a patient's decision making (both when living in a pandemic world, as well as post-pandemic) will be impacted by their perception of threat and safety. This also highlights the need for clear guidelines in pandemic preparedness which can be created and delivered to individuals, allowing decision-making from the prefrontal cortex instead of through conversations based on fight-or-flight survival strategies that occur "in the moment" of the pandemic. For example, if an individual perceives that receiving the COVID-19 vaccine or going to a healthcare provider's office increases their exposure to threats (the SARS-CoV-2 virus), or other potential threats to their safety, they may choose to reject vaccination, in some cases for reasons that have nothing to do with the vaccine itself. For example, if the patient fears the possibility of contracting COVID-19 when getting a vaccine, this may lead some individuals into fight-or-flight behavior (ie, gaining distance from the HCP's office by refusing vaccine).²

With repeated exposure to trauma, which can be conceptualized as any event that impacts an individual's felt sense of safety, the individual's nervous system and reactions are impacted and reinforced. This leads to increasingly "living out of" the amygdala instead of the prefrontal cortex. This briefly demonstrates why it is critical to not only address an individual's lived experiences of trauma, but also for trauma-informed principles to be incorporated into individual health care provider visits and within pandemic planning and preparedness. Considering individual and collective trauma (and common trauma-based reactions and responses) as we navigate health and other decision-making is likely to increase higher executive decision-making.

To this end, it is also helpful for the healthcare provider to understand what a patient considers to be a threat to their individual safety, as well as what safety means not only to the individual, but also for the individual's family, community, or group, as this might present an opportunity pathway for helpful communication strategy and conversation at the larger community level, with the goal of increasing vaccine acceptance rates. Perhaps an example of this latter idea has been the success of beauty shop and barbershop venues for increasing vaccine acceptance among some communities of color by utilizing community-level education by trusted messenger members of the community [77].

¹This neurobiological change, and the impact on conversation and decision-making for the patient, will be described in further detail.

²To clarify, it is important to note here that an individual may also be emotionally regulated within the parasympathetic nervous system and still choose to not accept vaccination for other reasons.

Table 1. System 1 and System 2

System 1	System 2
<ul style="list-style-type: none"> • Unconscious • Associative • Operates under intuition, heuristics, and biases • Utilizes habitual thinking • “What you see is all there is” 	<ul style="list-style-type: none"> • Conscious and takes effort • Lazy • Slow and inefficient • Can override thinking errors • Self-awareness and self-control • Follows rules • Makes deliberate choice and decisions

Adapted from Kahneman, D., *Thinking, Fast and Slow*. 2011: Farrar, Straus and Giroux [78].

THINKING AND DECISION-MAKING UNDER CONDITIONS OF UNCERTAINTY

Another important issue is that humans tend to be overly confident in the quality of their decision-making ability, especially under conditions of uncertainty (some of which was explored above). However, as demonstrated in many studies spanning several decades, humans regularly fall prey to a variety of heuristics and cognitive biases, impacting their ability to navigate health decision-making. Daniel Kahneman, a Professor of Psychology and winner of the 2002 Nobel Prize in Economic Sciences, has spent decades researching decision-making and judgment. Kahneman’s work has revolved around two ways of thinking, which he labeled “System 1” and “System 2” thinking. “System 1 operates automatically and quickly, with little or no effort and no sense of voluntary control. System 2 allocates attention to the effortful mental activities that demand it, including complex computations. The operations of System 2 are often associated with the subjective experience of agency, choice, and concentration [78].” In Table 1, a brief description of System 1 and System 2 thinking is outlined.

This concept both clarifies how and why individuals make poor decisions and offers insights in how to counter such cognitive biases as applied to vaccine decision-making. Individuals tend to be overly confident in their decision-making abilities, believing that “what I see is all there is,” and miss obvious data due to their “lazy System 2” which does not activate. How, then, can the HCP help to support the patient in decision-making, taking System 1 and System 2 into account? Might the HCP help to slow down thinking, understand that individual patient’s preferred cognitive style [76], and thereby assist the patient in making better informed decisions in a more conscious and effortful manner, such that thinking errors might be reduced? Examples of some of the more common cognitive biases include the availability bias (whereby individuals assume that things are more or less likely to occur based on the ease of recall) [79] and the confirmation bias (whereby individuals hold onto infor-

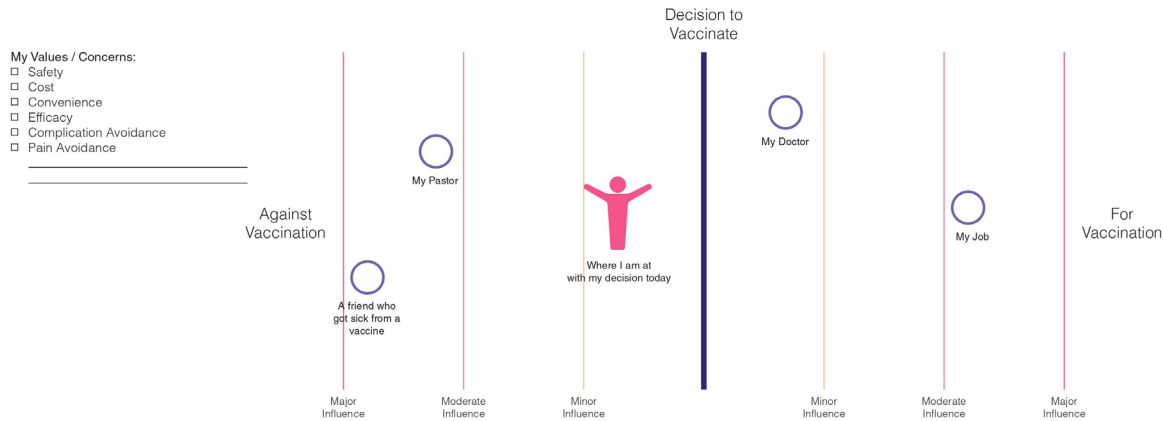
mation that aligns with their initial or preferred belief) [80]. These biases can be overridden by an individual’s effortful System 2 thinking, but are easily missed in the decision-making that is done out of the quick and effortless System 1 thinking.

In addition to the more common biases and heuristics already discussed, errors of omission versus commission also impact health decision-making. Individuals tend to fear acts of commission (active action-taking) over acts of omission (passive, inaction), meaning that individuals prefer a potential for a negative effect that occurs because they did not take a given action, rather than a potential negative effect occurring because they deliberately took an action. As an example, a person may fear a potential side effect of the COVID-19 vaccine, and would thus rather risk not getting the vaccine and potentially dealing with a side effect of the virus than to get the vaccine and have a significant side effect of the vaccine occur. By falling into the error of omission, an individual falls into the habitual thinking of System 1, failing to activate their effort-requiring System 2 that would override the thinking error. It is important that HCPs be aware of these heuristics and biases within the decision-making processes of their patients as they navigate balancing risks and benefits. It’s important to remember while engaging in this awareness that all humans fall into these erroneous thinking patterns, and it can be helpful to normalize this in conversation as well.

HUMAN CENTERED DESIGN IN PANDEMIC PREPAREDNESS AND VACCINE HESITANCY

Another solution that should be innovatively applied to individual-level discussions of vaccines among the hesitant (as well as pandemic preparedness in general), and arising from outside traditional medical methodology, is human-centered design (HCD). Human-Centered Design offers much wisdom in designing creative solutions for vaccine hesitancy. HCD is an approach that “seeks to develop user-oriented solutions to complex

VACCINATION DECISION MAKING EMPATHY TOOL



In order to understand individuals and their choices, it is critical to understand both their values relating to the choice, the hierarchy of information and influences they are encountering, and how they make sense of the diversity of perspectives.

Begin by inquiring about the patients' values and concerns, what are the factors that are influencing this decision? Mark this on the left of the tool.

As the patients about the influences on their decision, ask, *does this influence suggest that you do or do not get the vaccine? and how impactful is this influence on your decision?* plot it together on

the tool as a major, moderate, or minor influence. Those against vaccination go to the left, while those for vaccination go to the right.

Move on to openly and non-judgmentally ask the patients the questions: *How do these influences make you feel?* and, *How does these influence your choices?* It is critical at this point to avoid attempting to change the patients' minds.

Finally ask the patients to articulate where they are on the continuum of for or against vaccination and mark that on the tool.

With a clearer understanding of the influences patients wrestle with and the way they are processing this information, providers can begin a conversation that embraces their thought process rather than dismissing it.

Importantly, like the constant flow of information from nearly every other source, this must be an ongoing discussion, not a one-time encounter to change patient behavior. Referring to previous versions of the tool created in a collaborative manner allows both the patient and provider to understand the nuances of how perceptions change over time.

Figure 1. The Empathy Tool. Adapted from Poland et al. [81]; with permission from *Vaccine*.

problems, especially those that are rapidly changing and emotionally laden—such as novel vaccinations for a global pandemic. The method seeks to empathize with and understand peoples' unspoken and often unrealized motivations and develop novel solutions [81].” A deeper understanding of human needs (especially by engaging multiple professions and seeking to understand the individual) is a critical part of creatively designing solutions and tailoring health communication. HCD also provides a systems-level approach to individual decision-making, taking the context in which the individual engages into account. Characteristics of HCD include its “holistic, systems approach towards human needs, ensuring the solutions fit the dynamics of the (complex) sociotechnical system the user is part of [82].” Individuals making health decisions exist in complex systems and they bring all this to their decision-making. By understanding this milieu, and considering the systems that they exist within, we are better able to articulate and understand the influences on their decision-making.

To that end, HCP may find it useful to utilize the Empathy Tool [81] with vaccine-hesitant patients when

engaging in conversations about vaccine decision-making (Figure 1). The empathy tool, rooted in HCD principles, is meant to be utilized as a trust-building process between HCP and patient. In utilizing this tool, HCPs are better able to understand a patient's values, concerns, and influences on their decision-making. The empathy tool utilizes a process where the HCP listens to understand the patient and the systems and contexts within which they make decisions, and explores the strength of those influences (ie, HCP, job, church, friends, family) in their decision-making (and how the patient feels about the influence). This empathy tool can be utilized one time or as an ongoing trust-building process for a variety of health decisions, including vaccination.

We also note that medical providers' recommendations play among the most significant role in determining the decision a patient makes in receiving a vaccine [45,74]. Therefore, one of the principal target audiences for the insights and knowledge gained from the multi-disciplinary approach discussed above are healthcare professionals themselves. Through appropriate training medical personnel will be able to ultimately apply novel

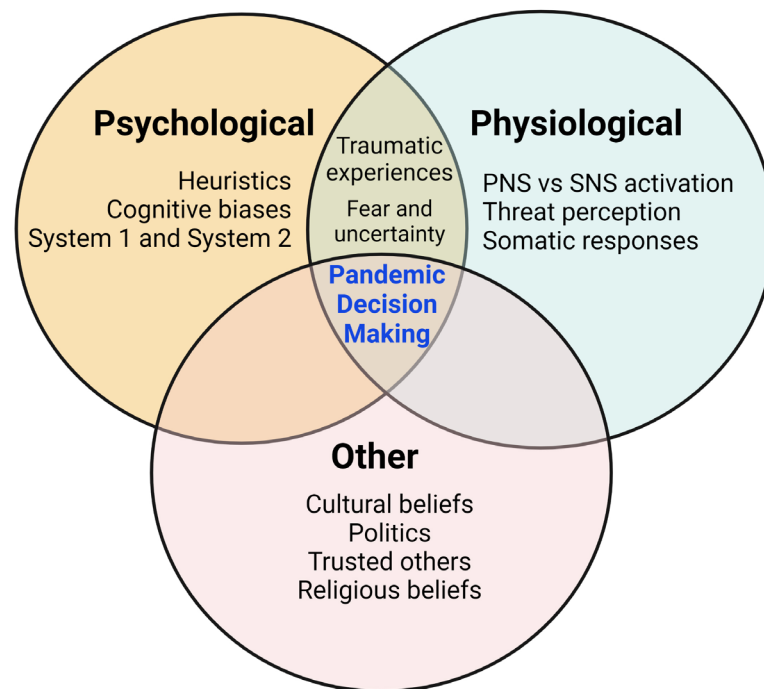


Figure 2. Physiologic and Psychological Influences on Pandemic Decision-Making

methodical frameworks to their practice and patient communication efforts.

It may also be useful to conceptualize pandemic decision-making as a Venn diagram between physiologic impacts and psychological impacts (Figure 2). There perhaps could also be a third circle to this Venn diagram, which includes other micro- and macro-impacts across the systems of which the individual is a part. This includes the beliefs of family and friends (and trusted others), politics, religious beliefs, the workplace, cultural values, economic conditions, and community-wide experiences. Furthermore, this circle might also include other historic and system conditions. For example, rates of vaccine hesitancy are higher among racial/ethnic minorities [49,83-86]. It is widely acknowledged that one of the core reasons for this is historic mistrust towards government and health authorities based on past abuses [87,88]. Important factors should be considered while addressing vaccine hesitancy in these groups by, for example, partnering with trusted influential leaders and messengers in these communities.

A PROPOSED RESEARCH AGENDA

Among the issues clearly seen during the COVID-19 pandemic has been the necessity of planning for and recognizing the profound distortion of pandemic response by human behavior and decision-making. In addition to

the already reviewed and discussed areas for improving vaccine coverage rates, the authors suggest several research areas to “move the needle forward”:

1. Research on innovative strategies for moving from System 1 to System 2 thinking within vaccine decision-making.
2. Research on utilizing preferred cognitive styles within multiple population groups in communication and educational efforts.
3. The utilization of human centered design and the empathy tool (individually and layered together with the PCSDM (Preferred Cognitive Styles and Decision Making) model) on vaccine decision-making.
4. Given that a fair amount of vaccine hesitancy is fear based, innovative strategies and interventions to counter and address fear are warranted.
5. As van der Linden et al. suggest [53], research should be done on the novel concept of cultivating “cognitive antibodies” to protect against misinformation.
6. Research into the utility of an approach combining our proposed tools (preferred cognitive styles and empathy tool) with existing effective strategies such as behavioral change methods [89] to counter vaccine hesitancy.
7. Taking all the above into account, research on how best to build resiliency against the demonstrated dangers of misinformation and disinformation in regard to vaccines is critical.

CONCLUSIONS

A stunning finding in the US pandemic response is that an examination of the top 10 states in terms of COVID-19 cases, hospitalizations, and deaths are all Republican-dominated politically [41], while the bottom 10 states in terms of those same metrics are all Democrat-dominated politically. Why should an infectious disease and the necessary mitigation measures needed to prevent cases, hospitalizations, and deaths have anything to do with one's political leanings? And yet the data are clear – where mitigation measures were used and manipulated in service of political rather than public health interests, tremendous differences in health outcomes becomes obvious – this is anathema. Those entrusted with safe-guarding the public health must be monitored, evaluated, and held accountable for their decisions. Where that trust is violated, there must be real sanctions and legal remedies available to correct the system. Political agendas and economic conflicts of interest must never be allowed to pre-determine public health responses.

In the final analysis, a comprehensive grid of strategies and interventions must be created from an evidence-based approach that communities, states, and nations can utilize to best prepare for the next pandemic, or epidemic. To do so, first, a comprehensive data-driven evaluation needs to be performed in order to determine the actual issues and problems involved in our current faulty pandemic response. This is best done at the local, regional, state, and national levels given the varying dynamics at play. These failed and faulty responses need to be identified and evaluated in order to discover root issues, biases, and other problems. Second, a new method and organizational matrix must be developed that addresses the identified issues in a manner that shields the agreed upon response organization from political and other perverse pressures and influences. Attendant to this is what has been outlined above – include experts from cross-disciplinary fields who can add valuable perspective, tools, and skills to the design and implementation of creative and transformative programs intentionally designed to improve vaccine-decision making and vaccine coverage. Third, an appropriate step is to convene an independent national expert council or roundtable whose goal is to discern, integrate, and synthesize the cross-disciplinary information available, and deliver a detailed national action plan. Such a Council should be populated by relevant inter-disciplinary content experts in fields such as vaccinology, epidemiology, mental health, trauma-informed interventions, social and cultural anthropology, psychology, human-centered design, innovation and transformation experts, public health, infectious diseases, logistics, and others. Fourth, a plan should be devised targeting specific relevant areas and should not make the

usual fatal mistakes of meeting political, economic, and other conflicts of interest and agendas. The latter was a serious mistake of the pandemic response in the US and how it was mishandled nationally, regionally, and locally. This Council must transcend such foibles in service of the national interest. Perspectives must be gathered from outside medical science alone and bridges built across at-risk communities and interest groups in order to prepare for the next pandemic. Fifth, to inform the above, research dollars must be made available such that innovative strategies and interventions can be devised and tested across relevant target groups. Sixth, there must be accountability at local, state, and national levels for relevant outcomes. An individual ultimately must be accountable, and given appropriate authority reinforced by enlightened public health and legal authority, for outcomes. Seventh, outcomes must be measured and transparently reported. It is a truism that what gets measured becomes a priority for what gets done. Eighth, communication and educational efforts must be seen as preparatory – and not “just in time” when a pandemic or epidemic is already upon us. Such efforts start with scientific and health literacy beginning in the earliest years of education. Lastly, utilizing the principled pluralism may be an appropriate way for dialogue in the public square in determining a community's values and perceptions [90].

Real world examples of how to do this well exist. One example is the recent publication by the European Observatory on Health Systems and Policy entitled “Health Systems Resilience During the COVID-19 Pandemic” [91]. Another example of learning lessons in order to serve the purpose of greater preparedness is the US Marine Corps Center for Lessons Learned [92]. After every major military action, a top to bottom review with in-depth interviews are conducted and lessons collated and used to inform revised doctrine for conducting successful operations. In this manner, real-world highly kinetic data are gathered, analyzed, synthesized, and distributed in a timely manner to rapidly change doctrine in real-time. Another adjunct model might be the US General Accounting Office's reviews which seek to clearly and precisely discern facts from fiction, in service of making recommendations that benefit the nation, and without regard to political agendas. Such starting points are clearly needed in order to accurately and precisely define what decremented the US pandemic response, such that appropriate interventions can be designed, tested, and deployed. The point is that first problems must be imagined, acknowledged, and defined, and then interventions developed that counter the problems encountered, followed by real-world testing with validated metrics. Most importantly, there must be accountability at the highest levels for organizing and implementing a national pandemic plan. The public deserves no less, and the trust

of a people towards its government rests on such a paradigm of trust, as exemplified during this pandemic by the citizens of Denmark who closely adhered to governmental and public health recommendations [93]. By contrast, abuse of trust and political agendas which seek to divide and polarize must not be tolerated. An ideal approach might be the example of “Truth and Reconciliation” committees designed to build national trust by transparently identifying what went wrong and who is responsible in a manner designed to lead to improvement. All sides of the political spectrum should, for the good of the country who elects them to serve, assist with these efforts in an apolitical manner. Much is at stake. Three times in the last 18 years novel coronaviruses have jumped the species barrier to infect humans. It will happen again and next time we had best be better prepared, or yet again suffer hundreds of thousands, or even millions, of deaths, economic consequences, and quantifiably intolerable adverse medical outcomes.

In 1954 Marcel Sendrail, the French physician-philosopher said: “Each civilization, by its customs, its laws, its principles of thought, creates for itself a pathology appropriate to itself... a society chooses its diseases, and shapes its pathological destiny... [94].” Such appears to be the case. We must address our cultural “principles of thought” or lose our way.

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