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Viewpoint

Risk assessment and heuristics: How cognitive shortcuts can fuel the spread of COVID-19[☆]Annelise A. Madison^{a,b,*}, Baldwin M. Way^{a,b}, Theodore P. Beauchaine^b,
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We have four lines of defense against pathogens: behavior (Schaller and Park, 2011); skin and mucosal barriers; the rapid, general innate response; and the slow, targeted adaptive immune response. SARS-CoV-2 is novel and transmissible even without symptoms (Bai et al., 2020), and therefore avoidance behaviors, such as wearing masks and social distancing, are especially critical. Given rampant spread of SARS-CoV-2 in the U.S., inconsistent adherence to evidence-based public health guidelines is at first glance puzzling. A 10-wave survey of almost 140,000 U.S. adults in all 50 states between April and November 2020 revealed that adherence to public health guidelines, except for mask wearing, dramatically declined from Spring to Winter (Lazer et al., 2020). For example, in April 74% of respondents denied being in a room with a non-household member in the past 24 h, compared to 55% in October (Lazer et al., 2020). Demographics and partisanship play important roles, with women, Asian Americans, Black Americans, the elderly, the highly educated, and Democrats showing the highest adherence, and with an ever-widening partisan gap (Lazer et al., 2020). Yet even the most adherent have lapses. Indeed, everyone can fall prey to common *heuristics and biases* (cognitive shortcuts) that undermine individuals' risk assessments and help explain risky behaviors.

Still widely cited today, Tversky and Kahneman's incisive *Science* article specifies common heuristics that everyone—even physicians and mental health professionals—routinely use to conserve cognitive resources (Tversky and Kahneman, 1974). Although often harmless, these cognitive shortcuts can be deadly during a pandemic. Below we outline three primary heuristics that can bias risk assessment and promote unsafe behaviors during the COVID-19 pandemic: availability, representativeness, and anchoring.

The *availability heuristic* occurs when we judge the frequency or

probability of an event based on how easily instances come to mind. Often, we readily recall experiences of family members, friends, and acquaintances. Thus, we may judge COVID-19 severity or vaccine safety based primarily on experiences of those around us, and discount countervailing information—even aggregated data—especially when such data conflict with personal experience. For example, if an acquaintance had a mild case of COVID-19 or had severe side effects after receiving the SARS-CoV-2 vaccine, we are more likely to judge COVID-19 as a mild disease or the vaccine as unsafe. Importantly, recent and severe cases are readily retrieved from memory and therefore especially salient.

Humans use the *representativeness heuristic* to deduce whether individuals are more likely to belong to one group or another, irrespective of base rates. Based on how closely others *represent* our internal, schematic conception of who is at risk, we may ignore or fail to account for basic facts about SARS-CoV-2 and decide to engage with people who we believe are unlikely to be infected, even though we are all at risk of exposure and infection with this novel pathogen. The emergence of new, more infectious variants from England and South Africa will almost surely exacerbate this problem because they will not be seen as altering “local” risk.

A specific subtype of representativeness is *insensitivity to predictability*. Here, we make predictions about the future based on their alignment with an individual's current characteristics. For instance, if someone has COVID-19 but is largely asymptomatic, we may accurately evaluate their case as “mild” but make inaccurate predictions about transmissibility and lasting effects based on this information (Davidoff et al., 2020), even though (a) it is well-established that asymptomatic individuals transmit the virus (Bai et al., 2020), and (b) long-term, debilitating symptoms resembling myalgic encephalomyelitis occur

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even among those who initially had mild COVID-19 cases (Marshall, 2020).

A second subtype of representativeness is *insensitivity to sample size*. Here, we believe that small samples represent population parameters as well as a large samples do. During the COVID-19 pandemic, we may assume that infection rates among small gatherings (<10 people) match the population infection rate, resulting in low risk. However, small groups can readily stray from the population infection rate (in either direction). In the context of infectious disease, small groups may deviate exponentially from the population infection rate given that members of small groups are non-random, often sharing social contacts and high-risk occupations.

Finally, the *anchoring heuristic* refers to our tendency to hold tightly onto initial information and fail to adjust when updated information emerges. Thus, initial, inaccurate information may continue to influence our behavior into the future. For example, the U.S. Surgeon General's incorrect assertion in March 2020 that masks are ineffective, along with top government officials' slow uptake of masks, may continue to affect behavior a year later, despite compelling evidence that masks reduce transmission (Eikenberry et al., 2020).

Unfortunately, we have great confidence in the validity of our mistaken beliefs and are unlikely to discover their flaws because we systematically ignore countervailing evidence (Tversky and Kahneman, 1974). Heuristics are so powerful that they can operate even when participants understand them conceptually and are rewarded for overriding them to make more accurate judgements (Tversky and

Kahneman, 1974). Moreover, based on data showing that elderly individuals succumb to the same heuristics and resulting biased judgments, Tversky and Kahneman asserted that lifetimes of experience do not override—and may instead accentuate—use of heuristics and biases in judgment. Education, awareness, and further research on the role of heuristics in the spread of infectious disease should help to improve decision-making and reduce risky behavior during a pandemic. To make accurate risk assessments, engage in safe behaviors, and stop the spread of COVID-19, we must account for heuristics and their influence on our perceptions and behaviors.

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