Health beliefs and decision making

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Introduction

We make decisions that affect our short-term and long-term health several times every day. We all have beliefs about what is good for us and what is bad for us (and we at least sometimes act in accordance in those beliefs). How we form these beliefs, and how these beliefs do or do not affect our future behavior is a domain ripe for cognitive science research. Given the importance of topics such as causal reasoning, reinforcement learning, and decision-making to our field, one might expect direct applications to health to be at the forefront. However for the sake of experimental and formal control, researchers typically conduct experiments with materials disconnected from real world beliefs and design experimental tasks that may not reflect the true structure of the domain.

The goal of this symposium is to show how the domain of health is perfect for a more tightly coupled exchange between investigating real-world beliefs and behavior with controlled experimental tasks ready for formal explanation. The research we will present both advances our basic cognitive science theories and are key pieces of applied health interventions. The work uses a variety of empirical methods, sampling populations from across the globe.

Speakers: Zachary Horne is an assistant professor at Arizona State University who studies belief updating and explanatory reasoning. His presentation connects big data analysis of real-world health beliefs and behaviors with experimental methods. Amy Perfors is an Associate Professor at the University of Melbourne whose research focuses on quantitative approaches to higher-order cognition, and cultural evolution. She presents work on reasoning about extremely low-frequency "black swan" events with severe consequences. Micah Goldwater is a senior lecturer at the University of Sydney, who researches concept learning and causal reasoning. He presents experiments on the interaction of interpreting new information about medical treatments and people's prior beliefs. Cristine Legare is Associate Professor at the University of Texas at Austin. Her research examines cognition across ages, cultures, and species to answer questions about cognitive and cultural evolution. She presents research on perinatal risk and the cultural ecology of health. Our moderator and discussant is Ellen Markman, Professor at Stanford University and a leader in in the field of applying cognitive science to health. Her work focuses on how to leverage the structure of belief to improve health decision-making. Professor Markman will lead the integrative discussion after the four presentations.

We hope this symposium will help spread the practice of connecting cognitive science with health research.

Effects of headline images on vaccination attitudes

Zachary Horne

Between 2018 and 2019, an estimated 34,200 people died from the flu (Center for Disease Control, 2019). Around 37% of adults receive the flu vaccination, a decrease of 6% over the prior few years. There are numerous barriers to causing people to receive vaccinations, but one potentially overlooked barrier is common images displayed when news articles report the spread and consequences of the flu. Indeed, online newsfeeds seem to commonly present images of the *flu vaccine* when reporting the number of people who have died from the *flu*, in contrast to, for example, the images typically presented with news of outbreaks of salmonella in poultry or E. coli in produce.

Here, I describe an investigation of how these images impact perceptions of the dangers of vaccines when people scroll through their online newsfeeds. I discuss how people may associate the negative information about a disease (e.g., the deaths caused by the flu) with the vaccines—an association that may lead to increased hesitancy towards vaccination. I examined the effects these headlines may

have on vaccination attitudes by first experimentally measuring how different types of headline images (e.g., an image of a vaccine, the flu virus, a sick child) affects participants' vaccination attitudes. Second, I conducted a machine learning study that mined news feed data and popular sources for new article images (e.g., Getty images) to measure the rates at which different news sources use headline images of the flu vaccine in their reporting of deaths caused by the flu. This work identifies new barriers to increasing vaccination rates in the U.S. and abroad.

Decision-making about "black swan" events in health care and beyond
Amy Perfors

Formal models of decision-making struggle to account for reasoning in situations where the outcomes are extremely unlikely (e.g., 1 in a million) but the associated utilities are extreme as well (e.g., death). Many real-world situations, especially health decisions, have this character. In this talk I will discuss research comparing utility-based models of decision-making to people's reasoning in situations where they must gamble money on outcomes with this structure. People show a systematic bias that may emerge from a failure to appropriately ignore events with tiny probability. I will then discuss follow-up work involving translating these gamble-based decisions (which, being quantitative, are amenable to modelling) to real-world qualitative problems in domains including health (which are not amenable to modelling because it is impossible to assign numbers to the utilities and probabilities). This work suggests that decision-making in more real-world situations is highly influenced by specific domain knowledge and assumptions, and does not necessarily reflect the insights from quantitative models in a straightforward way.

Herbal medication and causal illusions
Micah B. Goldwater

In 2018, herbal medicine and supplements sales were $8.842 billion in the US, an increase of 9.4% from 2017, when sales grew 8.5% from 2016 (the *Nutrition Business Journal*'s annual report, see Smith et al., 2019). Despite this trend, there is minimal evidence that herbal medicine benefits your health. This trend is worrying because purchasing ineffective treatments is not just a waste of money- these supplements can be dangerous. For example, they appear to increase the risk of death in cancer patients (Johnson et al., 2018). This talk aims to better understand how people form beliefs that these medical treatments are effective, and asks what can help revise these beliefs.

Across a series of experiments, participants were surveyed about their prior beliefs in and experiences with herbal medication. They then completed a causal learning paradigm concerning the efficacy (or lack there of) of a novel herbal medication. Further, the experiments examined a short educational intervention about the logic of causal inference from randomized control trials. Across the experiments, there were strong effects of prior beliefs, the statistical relationships present in the learning paradigm, and the educational intervention. The question of whether people are "rationally" updating their prior beliefs about herbal medication, with or without the educational intervention will be evaluated.

Perinatal risk and the cultural ecology of health in Bihar, India
Cristine H. Legare

The perinatal period is associated with substantial health risks to mothers and infants. These risks vary in amount and kind based on environmental risk factors and access to high quality health care. Maternal and infant mortality rates have declined rapidly over the past several decades worldwide, but continue to vary substantially among populations. The objective of the current study was to examine the cultural ecology of health associated with mitigating perinatal risk in Bihar, India (Legare et al., in press). The occurrences, objectives, and explanations of health-related beliefs and behaviors during pregnancy and postpartum were examined using focus-group discussions with younger and older mothers. First, perceived physical and supernatural threats and the constellation of traditional and biomedical practices including taboos, superstitions, and rituals used to mitigate them were documented. Second, the extent to which these practices are explained as risk-preventing versus health-promoting behavior were described. Third, the extent to which these practices are consistent, inconsistent, or unrelated to biomedical health practices and the extent to which traditional and biomedical health practices compete, conflict, and co-exist are explained. Finally, the relations between traditional and biomedical practices in the context of the cultural ecology of health and reflect on how a comprehensive understanding of perinatal health practices can improve the efficacy of health interventions and improve outcomes will be discussed.

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