Investigating the causes of health inequity with biometrical models

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My research can be broadly described as the *evaluation of biometrically-informed designs for psychology* and *their application to understanding health inequity*. My substantive work focuses on how individual differences influence the broader relationship between health and socioeconomic status (SES). My methodological work focuses on developing and improving biometrically-informed designs, such as behavior genetic models and discordant kin models. I have published 8 peer-reviewed articles, in both substantive journals (e.g., *Journal of Personality and Social Psychology*, *Intelligence*, *Psychological Science*) and methods journals (e.g., *Structural Equation Modeling*, *Advances in Methods and Practices in Psychological Science*). In this research statement, I describe the major branches of my research program.

Biometrically-informed designs

Biometrically-informed designs leverage genetic and environmental relationships between subjects. They can be used to describe genetic and environmental influences, as is the case with behavior genetic models. They can also be used to facilitate causal inference with kin comparison designs.

Kin comparisons facilitate Causal Inference

Although randomized experiments are the gold standard for inferring causation, many psychological questions cannot be answered with experiments. Instead, psychologists invoke quasi-experimental designs, and often use covariates to control for potential confounds. Regardless of the covariates used, some processes cannot be logically controlled, such as systematically-confounded genetic and environmental influences (e.g., familial; Lahey & D'Onofrio, 2010; Garrison & Rodgers, 2016). When those influences are present, the covariate approach is hopelessly confounded, and can mislead researchers into misclassifying causes as confounds and confounds as causes. For example, in Garrison and Rodgers (2016), we tested the popular claim that intelligent individuals delay having sex, using a novel sibling comparison design. Although intelligence was associated with delaying intercourse, intelligence is not the cause of that delay; its association was due to familial confounding.

Unfortunately, these familial effects are present in many psychological constructs, including individual differences, SES, and health. Although biometrically-informed designs are particularly effective at incorporating those familial effects, such models are underused in psychology (Lahey & D'Onofrio, 2010). We developed a more accessible design, adapted from a standard dyad model

(Garrison & Rodgers, 2016). The discordant kinship design controls for familial influences within a simple regression framework, by taking the difference between the two siblings. For twins and full siblings, this method has high power (>.80) and low type I error rates (α=.05), even in the presence of familial confounds. In a paper under revision at the European Journal of Personality, we have expounded upon the model and provided a broader series of empirical illustrations (Garrison & Rodgers, working paper). The accompanying R software package has already been published on CRAN (Garrison & Ream, 2017).

The cutoff criteria for behavior genetic models are wrong

In all areas of psychology, researchers use cutoff criteria to decide whether their models adequately explain their data – to see whether their models fit. Reviewers use them; editors use them; journal readers use them. We all use them. Well-fitting models are compelling, whereas poorly-fitting models are not. Unsurprisingly, papers providing such criteria are among the most highly cited. For example, Hu and Bentler (1999) has been cited over 54,000 times. However, recent work by Kang, McNeish, and Hancock (2016) reveals that cutoff criteria are model-specific and heavily influenced by the measurement model. The cutoff criteria presented by Hu and Bentler cannot be generalized beyond the single-factor model. For example, if these criteria were applied to five-factor data, the best fitting model will have four or fewer factors. Cutoff criteria need to be generated for the specific model of interest. Fortunately, behavior genetics employs relatively few models. Thus, unlike many areas, model-specific cutoff criteria can be feasibly created. My dissertation will determine whether the traditional criteria are effective cutoffs for the classic ACE model and identify what the optimal criteria are. Thus far, I have confirmed that most of the criteria in current practice are too liberal; I am finalizing the design of the simulation. Further, because nearly all behavior genetics research is conducted in R (Garrison, 2018), I plan to release a supplemental R package. I expect to continue this work with additional behavior genetic models, and eventually release user-friendly software to generate custom cutoff criteria based on a user-specified model.

How do we untilt the Health Gradient?

The relationship between socioeconomic status (SES) and health is remarkably consistent across place and time. The wealthiest 1% of Americans live an average of ten years longer that the poorest 1% (Bor, Cohen, & Galea, 2017). Explanations for this difference usually emphasize that material disadvantage causes these gaps. Such situational explanations account for differences between those who have and who have not. Those situational explanations, however, do not account for the finely stratified health differences that exist across the entire range of SES. Recent theories have helped address such limitations, but implicate multiple different explanatory pathways.

In Garrison and Rodgers (in press), we argued that the three major theories for the SES-health gradient align with interpretations associated with biometrical models. Specifically, Social Causation models, where an individual's social standing affects their health, ought to act through environmental pathways; Social Selection, where health affects people's abilities to climb the social ladder, should act through environmental pathways; whereas Social Confounding argues that third variables (e.g., personality, intelligence) influence both social standing and health through genetic pathways. In our analysis of the National Longitudinal Surveys of Youth (NLSY), we found a primarily-genetic etiology for the link between SES and physical health, and a primarily shared-environmental etiology for the link between SES and mental health. We integrated classic theory with behavior genetics to conclude that the physical health gradient has genetic precursors, that potentially are explained by third variables, such as intelligence and personality, whereas the mental health gradient has shared-environmental sources, which is suggestive of a social causation model.

Accordingly, both indivdual differences and the environment influence the health gradient. Individual differences influence longevity (Jackson, Connolly, Garrison, Leveille, & Connolly, 2015), but are also influenced by employment (Schultz, Connolly, Garrison, Leveille, & Jackson, 2017). They're associated with health differences (Garrison & Rodgers, under revision), but are not always causal (Garrison & Rodgers, 2016). Nevertheless, stressful events influence both physical and mental health (Garrison, Doane, & Elliot, 2018). Doubtlessly, both individual characteristics and situational events influence this relationship.

Future Directions

I plan to continue untangling this complex relationship with explicitly incorporating traits. Specifically, I aim to examine how intelligence and conscientiousness mediate the relationship between SES and physical health. Because the NLSY has multiple generations, I anticipate incorporating intergenerational effects into later studies. In addition, I intend to continue collaborations with Joshua Jackson on the Kelly/Connolly Longitudinal Study.

Although I anticipate continued work with the NLSY, I have identified other family and household datasets to extend this work, including:

- the National Longitudinal Study of Adolescent to Adult Health (Add Health);
- the Midlife in the United States (MIDUS) national survey; and
- the Household, Income and Labour Dynamics in Australia survey (HILDA).

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