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Differential epidemiology: IQ, neuroticism, and chronic disease by the 50 U.S. states

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ABSTRACT

Current research shows that geo-political units (e.g., the 50 U.S. states) vary meaningfully on psychological dimensions like intelligence (IQ) and neuroticism (N). A new scientific discipline has also emerged, differential epidemiology, focused on how psychological variables affect health. We integrate these areas by reporting large correlations between aggregate-level IQ and N (measured for the 50 U.S. states) and state differences in rates of chronic disease (e.g., stroke, heart disease). Controlling for health-related behaviors (e.g., smoking, exercise) reduced but did not eliminate these effects. Strong relationships also existed between IQ, N, disease, and a host of other state-level variables (e.g., income, crime, education). The nexus of inter-correlated state variables could reflect a general fitness factor hypothesized by cognitive epidemiologists, although valid inferences about causality will require more research.

1. Introduction

The study of individual differences — differential psychology — has recently expanded to include the study of differences across groups of people categorized by shared geography (e.g., states or nations). Aggregate-level measures now exist for both intelligence (IQ) and the *Big Five* personality traits (Lynn & Vanhanen, 2002; McDaniel, 2006; Rentfrow, Gosling, & Potter, 2008). These aggregate-level measures seem to consistently predict important geo-political outcomes, as reviewed below. The goal of the present study is to illustrate the unique capacity aggregate-level psychological variables possess in predicting disease rates across populations (here, the 50 U.S. states). These relationships persist even after controlling for state income levels, and for various health-related behaviors (smoking and exercising) that epidemiologists typically study as disease antecedents. Because we consider both dispositional and cognitive traits, we term this area *differential epidemiology* (as opposed to either *dispositional* or *cognitive epidemiology* — for the latter, see, e.g., Deary, 2010). We begin by reviewing the predictive value of both IQ and the personality trait, neuroticism (N), measured for individuals and for geo-political units.

1.1. Individual and aggregate-level intelligence

Intelligence tests presumably measure individual differences in the brain's ability to efficiently process information (Jensen, 1998). Though controversial as a construct outside psychology, a massive literature shows that individual IQ scores predict real-world outcomes, from income levels and socioeconomic status (Strenze, 2007), to job and school performance (Kuncel, Ones, & Sackett, 2010; Schmidt & Hunter, 1998), to health and mortality (Batty, Deary, & Gottfredson, 2007; Deary, 2008; Deary, 2010; Gottfredson & Deary, 2004). For many outcome variables, IQ scores emerge as the single best (but not the only) predictor (see, e.g., Jensen, 1998).

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In explaining links between IQ and epidemiology, Gottfredson (2004) argued that healthcare is a type of intelligence test (see also Gottfredson, 1997). Namely, health maintenance involves active participation in a series of tasks (e.g., learning health-related information), duties (e.g., dealing with health emergencies) and responsibilities (e.g., adhering to treatment). These behaviors require cognitive resources to manage effectively. Individuals (or groups of people) with high IQ would likely be in the best position to handle the complex spectrum of knowledge and behavior needed for good health.

Whether geographical units (versus individuals) differ in IQ has drawn increased attention from psychologists. In the aggregate, IQ scores have now been calculated for nations across the world (Lynn & Meisenberg, 2010; Lynn & Vanhanen, 2002), and for the 50 U.S. states (McDaniel, 2006). Both national and U.S. state IQs predict many of the things that individual IQ scores do, including socio-economic status (Pesta, McDaniel, & Bertsch, 2010), education (Lynn & Meisenberg, 2010), and crime (Pesta et al., 2010). Particularly relevant are recent studies showing links between aggregate IQ and epidemiologic outcomes (e.g., global state health: Pesta et al., 2010; life expectancy, mortality and fertility rates: Reeve, 2009; positive and negative health indicators: Reeve & Basalik, 2010).

1.2. Individual and aggregate-level neuroticism

Personality is the set of psychological traits or constructs that create consistency in how people think, act and feel (John, Robins, & Pervin, 2008). A highly regarded theoretical perspective on personality is the "Big Five" model (Costa & McCrae, 1992). The model assumes that five factors explain most of the variance in one's personality: neuroticism, extraversion, openness, agreeableness and conscientiousness. We focus here on just neuroticism, as it emerged as the only consistent *Big Five* predictor of epidemiologic outcomes (e.g., rates of heart disease or high blood pressure) and health-related behaviors (e.g., rates of smoking or exercise). Individuals scoring high on N tend to be anxious, stressed, and worry-prone, while those scoring low tend to be the opposite (Costa & McCrae, 1992).

Among individuals, N correlates with many health-related variables, including depression and anxiety disorders (Jyhla & Isometsa, 2006), mortality (Deary et al., 2008; Wiebe, Drew, & Croom, 2010), coping skill (John et al., 2008), death from cardiovascular disease (Shipley, Weiss, Der, Taylor, & Deary, 2007), and whether one smokes tobacco (Munaf, Zetteler, & Clark, 2007). Recent research also shows a strong relationship between N and *metabolic syndrome;* a chronic complex of health symptoms associated with increased heart disease and mortality (Phillips et al., 2010). To explain this relationship, Phillips et al. (2010) suggest that N "may be a marker of central nervous system (CNS) excitation, with higher levels leading to biological senescence, thus, increasing susceptibility to disease"(p. 193).

As with aggregate-level IQ, psychologists have recently focused on how personality traits vary across geographical units. Estimates now exist of the *Big Five* personality traits for each of the 50 U.S. states (Rentfrow, 2010; Rentfrow et al., 2008). State personality predicts many interesting aspects of American culture, including political preference and voting patterns (Rentfrow, Jost, Gosling, & Potter, 2009). Consistent with research on individuals, N seems to be the best predictor (among the Big Five traits) of health outcomes for the 50 U.S. states (as reviewed by Rentfrow et al., 2008).

Why do geo-political units differ meaningfully on psychological dimensions? One possibility is the attraction/similarity paradigm, where people are drawn to others who closely resemble them in characteristics like cultural background, personality, or shared demographics (Lydon, Jamieson, & Zanna, 1988). Both social (e.g., religious beliefs and customs) and genetic (e.g., IQ and personality, in part) factors characterize the settlers of a particular geographic area. Settler characteristics then become the basis for local beliefs and behaviors, which either attract or repel future residents from assimilating a community's culture. These specific characteristics likely still remain represented genetically and culturally in local populations in a non-random fashion (Rentfrow et al., 2008).

1.3. Explaining links between aggregate IQ/N and health

Arden, Gottfredson, and Miller (2009) proposed four possible explanations for links between individual-level IQ and health. We generalize their discussion here to include relationships between aggregate-level IQ, N and the health of populations:

(1) IQ/N and health could be influenced by common genetic factors.
(2) IQ/N and health could be influenced by common environmental factors.
(3) Health could influence IQ/N.
(4) IQ/N could influence health (Arden et al., 2009, p. 581).

Explanations (1) and (2) contrast genetic and environmental factors. In explanation (1), genes and genetic mutations affect health, IQ and N. This explanation is preferred by Arden et al. (2009), who argued for the existence of a general fitness factor, determined by genetics. The fitness factor subsumes IQ, N and health outcomes. Links between IQ/N and health are mediated by differences in lifestyle behaviors (e.g., smoking, exercising), which then lead to differences in disease rates across individuals or populations. In explanation (2), the relationship between IQ/N and health is caused by environmental variables. Examples include prenatal care, social stress, and pathogen loads.

The last two explanations differ on the direction of presumed causality. In explanation (3), health influences IQ/N, while the reverse holds in explanation (4). For the former, perhaps good health increases brain efficiency (as measured by IQ) and reduces stress (as measured by N); whereas disease decreases brain efficiency and increases stress. For explanation (4), high IQ/low N individuals might be more likely to engage in behaviors (e.g., exercise, eating healthy) conducive to good health. Though similar to explanation (1) in terms of what it predicts, explanation (4) does not necessarily implicate genetics. For example, high IQ might indirectly affect health by improving educational and career opportunities (Arden et al., 2009).

All four explanations probably contribute to the relationship between IQ/N and health (Arden et al., 2009). Consistent with this conclusion, most important socio-political variables (including health outcomes) are strongly inter-correlated at the aggregate level. For example, Pesta et al. (2010) identified