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Limited common origins of multiple adult health-related behaviors: Evidence from U.S. twins☆

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ABSTRACT

Health-related behaviors are significant contributors to morbidity and mortality in the United States, yet evidence on the underlying causes of the vast within-population variation in behaviors is mixed. While many potential causes of health-related behaviors have been identified—such as schooling, genetics, and environments—little is known on how much of the variation across multiple behaviors is due to a common set of causes. We use three separate datasets on U.S. twins to investigate the degree to which multiple health-related behaviors correlate and can be explained by a common set of factors. We find that aside from smoking and drinking, most behaviors are not strongly correlated among individuals. Based on the results of both within-identical-twins regressions and multivariate behavioral genetics models, we find some evidence that schooling may be related to smoking but not to the covariation between multiple behaviors. Similarly, we find that a large fraction of the variance in each of the behaviors is consistent with genetic factors; however, we do not find strong evidence that a single common set of genes explains variation in multiple behaviors. We find, however, that a large portion of the correlation between smoking and heavy drinking is consistent with common, mostly childhood, environments. This suggests that the initiation and patterns of these two behaviors might arise from a common childhood origin. Research and policy to identify and modify this source may provide a strong way to reduce the population health burden of smoking and heavy drinking.

1. Introduction

Health-related behaviors, such as smoking and heavy drinking, are responsible for a large portion of global morbidity and mortality. For example, smoking, heavy drinking, and obesity were associated with 38% of United States mortality in 1993 and almost 50% in 2000 (McGinnis and Foege, 1993; Mokdad et al., 2004). Health-related behaviors have also been implicated as reasons for international differences in life expectancy: smoking and obesity may explain why the United States has lower life expectancy compared to other Western countries and why life expectancy in the former Soviet Union countries has stagnated relative to other European countries (Preston et al., 2011; Rehm et al., 2007).

An important question for understanding trends and variation in health outcomes is whether multiple health-related behaviors are determined by a common cause or if behaviors each have unique underlying determinants. In many studies, socioeconomic status, usually measured as either schooling or household income, is posited as a cause of health-related behaviors. On first glance, the evidence is compelling: higher levels of schooling are overwhelmingly associated with healthier behaviors across many domains and may potentially explain why more-schooled people tend to be in better health (Cawley and Ruhm, 2011). Despite these associations, a more recent literature using data on identical twins has tried to determine if these associations are causal, or if schooling is determined by unobserved characteristics that also determine health-related behaviors. The findings from these

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studies suggest that while schooling is associated with better health-related behaviors, schooling may not be a cause of these behaviors (Amin et al., 2015; Behrman et al., 2011; Behrman et al., 2015).

Genetics are also commonly cited as causes for health-related behaviors. Studies have found that a substantial part of the variation in smoking, physical exercise, and body mass index (BMI) can be attributed to genetic differences within populations (Bauman et al., 2012; Kaprio et al., 1982; Vink et al., 2005; Walters, 2002). Also, many aspects of the childhood environment have been associated with physical activity patterns (Bauman et al., 2012), smoking behavior (Gilman et al., 2003), and obesity across a wide range of adult ages (Parsons et al., 1999). While these studies have provided substantial evidence to suggest that genetics and childhood environments play an important role in the development of health-related behaviors in adulthood, the relationship between a common set of genetic endowments, childhood environments, and variation across multiple behaviors remains unclear.

In this paper we use data on U.S. twins to investigate the degree to which multiple health-related behaviors can be explained by a single set of characteristics. Our paper combines approaches from economics and behavioral genetics to determine the contribution of schooling, genetic endowments, and environments to unhealthy behaviors – or the outcomes of such behaviors such as BMI – among U.S. adults. As the health and mortality profile of high- and increasingly also low-to middle-income countries shifts further towards chronic, behavior-related, conditions, understanding the origins of health-related behaviors can help to formulate effective policies and interventions to improve population health.

1.1. Background

Given the substantial associations between health-related behaviors, morbidity, and mortality, a large literature has focused on why people engage in behaviors that are widely known to negatively affect health. Underlying much of this literature is the belief that specific factors, such as genetics, personality, or schooling, are common underlying determinants of a broad range of individual health-related behaviors. In the following sections, we briefly review evidence from health, economics, and behavioral genetic studies on the causes of health-related behaviors.

Economic studies of the underlying behavioral causes of health are heavily influenced by Grossman's model of health capital. In this model, more-educated people are more likely to make better choices regarding health inputs, including health-related behaviors, given available resources (allocative efficiency), and are better at producing health from a given set of inputs (productive efficiency) (Grossman, 1972). Similar theories suggest that more educated people may also have more available resources to invest in health (Link and Phelan, 1995). Descriptive studies of health behaviors are very consistent with these theories, since higher levels of schooling are strongly associated with healthier behaviors across many domains. For example, college graduates are less likely to smoke, less likely to be obese, less likely to drink heavily, and less likely to be physically inactive compared to high school dropouts. They are also more likely to receive mammograms, colorectal screenings, and use sunscreen (Cawley and Ruhm, 2011). Cutler and Lleras-Muney attempt to unpack these strong associations by examining the potential mechanisms behind the large education gradient in health-related behaviors. They find that around 30% of the educational gradient in health-related behaviors is explained by income, health insurance, and family background, and around 30% from knowledge and cognitive ability (Cutler and Lleras-Muney, 2010). While this study made a substantial contribution towards understanding the sources of educational differences in health-related behaviors, the study design was limited by an inability to identify whether the education health relationship is causal. In a recent paper, Heckman, Humphries, and Veramendi use a dynamic structural model of educational choice and find evidence that education may have a causal effect on health (Heckman et al., 2016). An emerging literature using data on identical twins has also tried to determine if these associations are causal, or if schooling is determined by unobserved characteristics that also determine health-related behaviors. These studies essentially assume that identical twins share the unobserved characteristics (such as parental background, genetic dispositions, the shared mostly childhood environment) that simultaneously influence schooling and health outcomes and bias estimates of the education health relationship in conventional analyses (Kohler et al., 2011). By using within-MZ-twins estimates, the cross-sectional associations between schooling and health are purged of bias from these unobserved factors. The findings from these studies suggest that while schooling is associated with better health-related behaviors, schooling may not be a cause of health-related behaviors (Amin et al., 2015; Behrman et al., 2011, 2015). Similarly, Cutler and Glaeser try to confirm empirically Grossman's model by arguing that if health-related behaviors are determined by individual investments in future health, different health-related behaviors should be correlated within individuals. Using data from the Behavioral Risk Factor Surveillance System, they find weak correlations between the health-related behaviors of individuals—such as obesity and smoking, and smoking and receiving mammograms for women—implying that the factors that determine health-related behaviors vary across behavioral domains (e.g. the factors that lead individuals to smoke do not necessarily lead individuals to be physically inactive) (Cutler and Glaeser, 2005).

Variation in health-related behaviors has also been examined from a behavioral genetics perspective. Under this paradigm, health-related behaviors are additively determined by genetic endowments, common (shared by sibling) environments, and individual idiosyncratic environments. Many behavioral genetic studies of health find that a large fraction of the within-population variance in health-related behaviors is consistent with variation in genetic factors. For example, a study using Dutch twins pairs reports that smoking initiation has a heritability of 44%–implying that, subject to the assumptions of the behavioral genetics model, 44% of the variation in smoking initiation is associated with genetic differences within the population (Vink et al., 2005). This same study finds that 51% of the variation in the initiation of smoking is associated with the shared, mostly childhood, environment between twins. This approach has been applied to a range of behaviors: in a meta-analysis of the heritability of alcohol abuse and dependence, Walters reports that around 12% of the variation in alcohol abuse is associated with genetic variation in the population (Walters, 2002). Genetics are also thought to play an important role in unhealthy weight–a literature review of many behavioral genetic studies finds that genetic factors are associated with between 50% and 90% of the variation in BMI (Min et al., 2013). These studies thus suggest that genetic and childhood environmental heterogeneity is an important correlate of health-related behaviors. Importantly, the size of the association between genetic factors and health-related behaviors may also interact with other behaviors. For example, Mustelin et al. find that higher levels of physical activity reduce the association between genetic factors and BMI (Mustelin et al., 2009). Boardman et al., find that the composition of the smoker population in the United States became increasingly genetically “vulnerable” to smoking as the overall population of smokers decreased (Boardman et al., 2011). The results from these studies suggest that genetics may become more correlated with health-related behaviors as the populations of individuals that engage in those