Is Fundamental Causality a Network Phenomenon?: Network Education and Individuals' Health[†]

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Abstract

Education is a fundamental cause of health because it structures access to valuable economic and social resources that directly and indirectly influence health. The mechanisms that underlie this relationship have been primarily examined from an individualistic perspective to demonstrate how highly educated persons mobilize various resources to garner health advantages. Education is often conceptualized as an individual-level health resource, but it may also be inter-individual health resource within social relationships. Education, conceptualized as a network good, may have a positive influence on health over and above what we would anticipate based on our individual education alone. We will test this hypothesis with ego-centric network data from the U.S. General Social Survey by estimating a series of nested regression models predicting individuals' self-rated health as a function of educational resources available within their social network. The proposed analyses will advance our understanding of education's role as a fundamental cause of health.

Is Fundamental Causality a Network Phenomenon?:
Network Education and Individuals' Health

Introduction

Educational attainment is considered a "fundamental cause of disease" (Phelan et al. 2004; Phelan, Link and Tehranifar 2010) because it provides individuals with material and non-material resources that directly and indirectly promote health (Mirowsky and Ross 2003). Educational attainment is positively associated with a broad array of mental, physical, and behavioral health outcomes and these associations have been documented in multiple social and historical contexts. Social relationships also influence health because they are a conduit for the exchange of health-related material and non-material resources (Smith and Christakis 2008; Umberson and Montez 2010). Education likely plays an important role in this process because it fundamentally shapes resource availability and the inter-personal dynamics that govern the resource exchange process. Thus, education likely is both an intra-individual and inter-individual health resource within social relationships.

Consistent with the notion that education is an inter-individual health resource with social relationships, prior research strongly suggests that education spillovers occur within families. Most extant studies focus on education spillovers within parent-child and spousal dyads. A longstanding research tradition in demography positively associates parental education, particularly maternal education, with infant and child health (Caldwell 1994; Elo 2009). Prior research also demonstrates that the positive correlation between parental education and offspring health/mortality risk continues into adulthood (Elo 2009; Hayward and Gorman 2004). Emerging evidence also suggests that education spillovers within parent-child dyads also flow in the opposite direction. Adult children's education is positively associated with more favorable health outcomes among parents (Friedman and Mare 2014; Yahirun, Sheehan and Hayward 2017). Research positively correlating spousal education with more favorable individual-level health outcomes among married adults provides evidence that inter-familial education spillovers also matter for individual-level health outcomes within generations (Brown, Hummer and Hayward 2014; Huijts, Monden and Kraaykamp 2010; Kravdal 2008; Monden et al. 2003).

Research Questions

The existence of education health spillovers among parent-child and spousal dyads imply that education is both an intra-individual and inter-individual health resource within social relationships. Thus, the proposed paper expands prior work on education health spillovers within families by examining whether education has spillover effects on health within the broader context of individuals' social connections. The proposed analyses address the following unresolved research questions: Do individuals reap health benefits from the educational attainment of others within

their social network? Is fundamental causality a network phenomenon?[1] We address these research questions with a nationally representative U.S. dataset that contains high quality ego-centric network data. Answering these questions will advance our understanding of fundamental causality, network processes, and population health disparities more generally. We outline our analysis plan and expected results below.

Methods

Data

Data are from the 1985 General Social Survey (GSS) Network Module (N = 1,531 respondents) which contains high quality personal (or ego-centric) network data collected via a social network generator focusing on respondents' "core discussion networks."[2] Respondents (egos) were asked to identify up to five people (alters) "with whom [they] discussed matters important to [them]" within the last six months (Burt 1984; Marsden 1987). Interviewers were instructed to probe for additional names when respondents mentioned less than five names. Interviewers were also instructed to record only the first five names given when respondents mentioned more than five names. The sample contains relatively few social isolates (n = 136, 8.9%) with most respondents listing one to five names (n = 1,311, 85.6%) and few even listing more than five names (n = 84, 5.5%). Information provided by respondents (egos) for up to five alters includes race, education, age, gender, tie strength (ego-alter) contact frequency (ego-alter), relationship type (ego-alter), relationship duration (ego-alter), and relationship closeness (ego-alter and alter-alter). These attributes will allow us to construct various network measures. The items on the 1985 GSS Network Module have very low missing rates.

Measures

The dependent variable will be respondent (ego) self-rated health measured on a four-point ordinal scale (1 = Excellent, 2 = Good, 3 = Fair, 4 = Poor).[3] Following Song and Chang (2012), our primary independent variables will include average alter education and the proportion of alters with a high school or college education. Once we establish basic relationships with these specifications of alter education, we will introduce more nuanced measures that capture educational diversity within networks and/or differences in ego-alter educational attainment (measures of structural

[1] Link and Phelan (1995) imply that fundamental causality has a network component because they explicitly note that "beneficial social connections" are a key mechanism through which fundamental causes influence health. Moreover, other research has established that educational attainment, at least among individuals, is a fundamental cause of disease (Phelan et al. 2004).

[2] The GSS is a nationally representative cross-sectional survey of U.S. adults (recent years also have a longitudinal component). Although the 1985 and 2004 GSS have similar network measures, we currently do not plan to use 2004 GSS Network Module. Comparisons of network composition, size, and alter attributes between 1985 and 2004 are not possible due to well-documented problems with the 2004 GSS network generator. Nonetheless, other published studies use the 2004 GSS Network Module to establish relationships between network composition/structure and health-related outcomes (Song and Chang 2012). Therefore, we will explore the possibility of using the 2004 GSS prior to PAA because it has additional health measures and other covariates that may provide insights into selection processes that shape discussion network composition.

[3] We plan to measure self-rated health ordinally, but we will conduct sensitivity analyses that measure self-rated health dichotomously (0 = Excellent/Good, 1 = Fair/Poor).

equivalence, etc.). We will recode alter education into a series of ordinal variables representing the highest attained educational credential: No high school education (1-12 years, but no diploma), high school education (high school graduate), some college education (some college but no Bachelor's degree), or college education (Bachelor's degree and higher). We will measure respondent education on the same four-category ordinal scale using a question asking respondents to note their highest educational credential.

Control variables will include respondent sociodemographic attributes (race/ethnicity, nativity status, age, marital status, gender) and socioeconomic attributes (education, employment status, occupational prestige, and income to poverty ratio). We will also control for structural properties of discussion networks including social integration and tie strength. Following Song and Chang (2012), we will measure social integration via network size (the total number of alters mentioned, range: 0-6). Although network researchers measure tie strength in ego-networks in various ways (Borgatti, Everett and Johnson 2018; Burt 1980; Marsden 1990; Marsden and Campbell 1984; Wasserman and Faust 1994), we follow Song and Chang (2012) and measure tie strength in terms of the frequency of ego-alter contact (averaged across alters) under the presumption that education spillovers are more likely to occur among actors who have strong social ties and interact frequently. We will also explore using relationship duration (averaged across alters) and other common network measures of tie strength prior to PAA.

The variable list/specifications above are not definitive. We may also elect to include additional controls of network composition that take into account alter age, race, religious preferences, and/or the type of relationship between egos and alters (i.e., parent, child, other relative, work colleague, etc.). Our ultimate goal is to develop parsimonious models that include measures consistent with our analytic goals and key concepts drawn from social capital and social network theory.

Analysis

We will estimate a series of nested ordinal logistic regression models predicting respondents' self-rated health as a function of personal characteristics and network attributes[4] Model 1 will regress self-rated health on own education, sociodemographic controls, and socioeconomic controls. This model mimics the standard approach taken in the education-health literature. It will allow us to establish the baseline association between own education and self-rated health. Model 2 will regress self-rated health on network education, own education, own sociodemographic characteristics, and own socioeconomic characteristics. Model 3 will regress self-rated health on network education, network structure, own education, own sociodemographic characteristics, and own socioeconomic characteristics. Models will not control for both network education measures simultaneously (average alter education, proportion of alters with a high school education or more) due to collinearity. All analyses will be weighted and adjust for design effects using the survey data analysis commands available in Stata 14. At minimum, these models will allow us to

[4] We will also include tables with descriptive statistics. Prior to estimating the ordinal regression models, we will conduct robustness checks/perform model diagnostics (test proportionality/parallel lines assumption, etc.). We will also estimate a series of binary logit models to that regress fair/poor vs. good/excellent self-rated health on the independent and control variables.

establish whether a basic relationship exists between network education levels and self-rated health. We will explore alternative model specifications prior to PAA.

Expected Results

We expect to uncover a positive correlation between network education and individual-level self-rated health. The association will exist independently of on respondents' own level of education, socio-economic attributes, sociodemographic characteristics, and network structure/attributes. We also expect to find that the association between network education and self-rated health will vary among individuals embedded educationally homogamous and heterogamous discussion networks. Highly educated persons in highly educated networks will report the best health. Conversely, persons with low educational attainment in networks that have similarly low levels of educational attainment will report worst health. We also expect that persons in educationally heterogamous networks, as a result of either educationally hypergamy or hypogamy, will fall somewhere between these two extremes in terms of self-rated health.

Conclusion

These results, if they are consistent with our expectations, would provide additional evidence that access to social and economic structural resources influence health. The results would also substantially advance our understanding of fundamental causality and imply that fundamental causality is, at least in part, a network phenomenon. Fundamental causality is a complex phenomenon that occurs at multiple levels (institutional, cultural, social, political, and individual). As others have noted (Freese and Lutfey 2011), core tenants of the theory imply that network processes are at play. Social networks provide a conduit for resource flows at various levels via diffusion effects, interpersonal exchanges, and/or inter-individual spillover effects. Prior research, with few exceptions (Freese and Lutfey 2011), inadequately incorporates network processes/concepts into the conceptual framework of fundamental causality. The dynamics that give rise to fundamental causality can and often do manifest themselves in many forms, but fundamental causality presumably is, at least in part, a network phenomenon. Most prior research overlooks this basic fact and direct attempts to integrate network principles into fundamental causality are very limited. The proposed analyses address these gaps in extant research.

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