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The role of education in complex health decisions: Evidence from cancer screening

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ABSTRACT

This paper uses data on real and perceived cancer risks and cancer screening behavior to test the allocative efficiency theory. Specifically, it explores whether the educated make better-informed health decisions. I propose that (1) when educated individuals are better informed, they are more likely to incorporate variation in risk factors when they report their personal cancer risk, and (2) as risk varies, the better educated will react more strongly by adopting preventive behaviors such as cancer screening. The results support for both predictions. Further, using data on attitudes toward breast health, I explore a possible mechanism: educated women are more receptive to scientific evidence and hold fewer nonscientific beliefs.

1. Introduction

In his famous 1972 article, Michael Grossman hypothesized that educated individuals produce health more efficiently, thus providing one explanation for the observed gaps in health by education level.[1] One purported reason for this efficiency is that more educated individuals may be better at processing information related to health, a conjecture known as the *allocative efficiency hypothesis*. A few studies offer indirect evidence of this hypothesis. For example, HIV and diabetes patients with more education are more likely to adhere to complex treatment regimes that those with less education (Goldman and Smith, 2002).[2] The educated also tend to be the first to adopt new treatments (Lichtenberg and Lleras-Muney, 2006). In the United States, those with more education were the first to respond to information on the health risks of smoking (De Walque, 2010), and in Uganda, those with more education were the first to adapt their sexual behavior in the face of the emerging HIV epidemic (De Walque, 2007). More direct tests of the allocative efficiency hypothesis are rare because they require data on both health knowledge and health behaviors. To my knowledge, only Kenkel (1991a,b) has simultaneously examined how health behaviors and knowledge vary with education. He showed that the educated know more about health risks from smoking, drinking, and lack of exercise and that this knowledge correlates with healthier lifestyle choices.

This paper provides new evidence on the allocative efficiency hypothesis using data on how the more educated and the less educated respond (1) in their beliefs about their subjective cancer risk and (2) by adopting preventative behaviors as their actual cancer risk varies.[3] Using a simple model, I show that the allocative efficiency hypothesis implies that the educated respond more to objective cancer risks when they decide to get screened and also when they form beliefs about their individual cancer risk. These

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[1] Alternative explanations for the correlation between health and education are plentiful (for surveys of the literature see Grossman and Kaestner, 1997; Grossman, 2000).

[2] See also Goldman and Lakdawalla (2005).

[3] A number of researchers have directly examined the role of education in preventive care. In particular, Fletcher and Frisvold (2009) as well as Cutler and Lleras-Muney (2007a,b, 2008) show that education is associated with an increase in the probability of preventive care, including various cancer screens. Kenkel (1994) argues that preventive care has primarily a investment character as opposed to the consumptive character of many other health inputs.

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predictions are not implied by simple differences in the willingness to pay for health. Using data from the National Health Interview Survey (NHIS) on cancer screening behavior and subjective statements about cancer risks related to various cancers, I find support for the allocative efficiency hypothesis: educated individuals are more likely to be screened for cancer if they are objectively (based on current medical evidence) at higher risk for developing cancer. Similarly, educated individuals are more likely to incorporate the presence of objective risk factors when assessing their personal cancer risk.[4]

The study also briefly considers survey evidence from an alternative data source that sheds some light on why the less-educated seem to be less aware of the risks they are facing. This evidence suggests that they are generally more skeptical about science-based medicine and more likely to believe in nonscientific explanations for cancer. It is plausible that skepticism towards science based medicine contributes to less efficient health care decision making among the less educated.

The findings of this study should help U.S. policymakers respond more efficiently to one of the largest challenges in public health: the increasing gap in health inequality observed in the US over the last 50 years. Over this time period, the US population has become significantly healthier, but those with little schooling have benefited little (Meara et al., 2008). Modern medical care requires patients to adhere to complex treatment schedules and confronts patients with a bewildering array of health care options. If, as this study suggests, education provides individuals with the skills they need to choose among these options, then lack of education will prevent many from fully participating in the gains from medical progress. The evidence provided in this paper suggests that raising education levels might be important for narrowing health gaps in the population.

2. A model of cancer screening and subjective risk

This section presents a simple stylized model of how the quality of information affects how individuals assess their personal risk of developing cancer and how it affects their demand for cancer screening. The model implies that informed agents react more strongly in both their subjective appraisal of risk and in their screening decisions when objective risk factors are present. The prediction on screening is the basis of the first test of the allocative efficiency hypothesis, and this prediction is indeed borne out in the data. However, simple demand differences across education can (but need not) generate the same prediction for screening behavior. It is for this reason that the data on subjective risk are important. The data on subjective risk allows me to derive and test an implication of allocative efficiency using the subjective risk data that is not implied by variation in the willingness-to-pay across education.

Individuals are either of low or high risk for developing cancer ($d_i \in \{L, H\}$), such that the probability of developing cancer is μ_{d_i} and $\mu_H > \mu_L$. Empirically, I associate these risk classes with the objective risk factors identified in the medical literature, the most important of which is whether cancer is present in the family. The information problem that agents face is to predict whether they belong to the high-risk or low-risk group.

Let $cr_i \in \{0, 1\}$ indicate the presence of cancer and let θ_i indicate screening.[5] Cancer screening generates survival gains g among those with cancer because of early diagnosis.

$$g = Pr(survival|cr_i = 1, \theta_i = 1) - Pr(survival|cr_i = 1, \theta_i = 0)$$

Denoting the costs of screening by c_i with distribution function $F(.)$, I represent the screening decision as:

$$E[\mu|\rho_i]gVSL_i - c_i \geq 0 \tag{1}$$

VSL_i denotes the marginal rate of substitution of consumption for survival, known as the *Value of a Statistical Life*. The signal ρ_i introduces the idea that information about individual cancer risks might differ across individuals. Individuals receive a signal $\rho_i \in \{0, 1\}$ that reveals information about their risk class. Assume that receiving $\rho_i = 1$ perfectly reveals that $d_i = H$:

$$\begin{aligned} &Pr(\rho_i = 1|d_i = L) = 0 \\ &Pr(\rho_1 = 1|d_i = H) = \pi_\rho \in (0, 1) \end{aligned} \tag{2}$$

The parameter π_ρ determines how informed individuals are. If π_ρ increases, then individuals are more likely to learn that they are of high risk if they indeed belong to the high-risk group. This simple model has implications about how subjective cancer risk, screening θ_i and objective risk d_i are related to the quality of information π_ρ as well as the willingness-to-pay for survival gains VSL_i. I summarize these implications in Propositions 1 and 2.

Proposition 1. *Screening*

(1a) *Holding VSL constant, an increase in π_ρ increases the gap in screening rates across risk groups*: $(\partial E[\theta_i | d_i = H] - E[\theta_i | d_i = L]/\partial \pi_\rho) > 0$.

(1b) *Depending on the distribution of c_i, an increase in VSL_i can increase or decrease the gap in screening rates across risk groups* $(\partial E[\theta_i | d_i = H] - E[\theta_i | d_i = L]/\partial VSL) >< 0$.

Proposition 2. *Subjective risk*

(2a) *Holding VSL constant, an increase in π_ρ increases the gap in subjective risk across risk groups*: $(\partial E[E[\mu_i | \rho] | d_i = H] - E[E[\mu_i | \rho] | d_i = L]/\partial \pi_\rho) > 0$.

(2b) *Holding π_ρ constant, an increase in VSL_i does not affect the gap in subjective risk across risk groups*: $(\partial E[E[\mu_i | \rho] | d_i = H] - E[E[\mu_i | \rho] | d_i = L]/\partial VSL) = 0$.

The proof of these propositions is straightforward and provided in Appendix A. These propositions are useful, because they generate testable implications about screening behavior and subjective risk assessments that allow one to investigate whether the quality of information about cancer risks differs across a population. In this model, the hypothesis that educated individuals are better informed is equivalent to assuming that π_ρ increases with education. According to Proposition 1, I can test this hypothesis using screening rates. According to (1a), those with better information respond more in their screening behavior as objective risks vary.[6]

Proposition 1b illustrates the limits of testing for differences in information using screening rates only. Even without an information advantage, the educated might respond more to differences in risk, simply because they are willing to expend more resources on health. This possibility matters, because differences in the demand

[4] It is important to understand that I do not and cannot test whether the overall level of screening or subjective risk is adequate. The implications of the allocative efficiency hypothesis tested do not refer to the overall levels of screening demand or anxiety about cancer risks. The implications tested in this paper refer to the interaction between risk factors and screening behavior as well as subjective risk.

[5] *Note*: $Pr(cr_i | I) = E[\mu | I]$ where I is an arbitrary information set.

[6] Note that Propositions 1 and 2 are referring to interactions in screening behavior and subjective risk assessments to the presence of cancer risk. The implications tested in this paper are about these interactions, not about the levels of screening and subjective risk. Consequently, the question of whether the overall level of screening is adequate, whether individuals over- or underscreen is not relevant for the tests of the allocative efficiency implemented in this paper.