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Screening Tests, Information, and the Health-Education Gradient

Ciro Avitabile[♥], Tullio Jappelli[♦], Mario Padula[♠]

Abstract

The association between health outcomes and education – the health-education gradient - is widely documented but little is known about its source. Using microeconomic data on a sample of individuals aged 50+ in eight European countries, we find that education and cognitive skills (such as verbal fluency) are associated with a greater propensity for standard screening tests (mammography and colonoscopy). In order to study the role of information on the decision to screen, we test whether the health-education gradient varies with the quality of the information provided by the health care system, as proxied by the quality of the General Practitioner. Using an Instrumental Variable approach to control for the potential endogeneity of the GP quality score, we find evidence of a strong and significant complementarity between education and quality of primary care. We interpret this result as evidence that health-education gradient can be explained, at least in part, by the fact that better educated individuals are more able to process and internalize health related information as provided by GPs.

JEL Classification: I0, I1, I2.

Keywords: Health, education, information, general practitioners.

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1. Introduction

People with better education tend to have better health and to exhibit healthier behavior, even holding income, occupation and other socioeconomic variables constant. This well-established fact does not yet have a satisfactory explanation. Cutler and Lleras-Muney (2006), in reviewing the literature, note out that the correlation between education and health - the health-education gradient - might derive from health causing education in childhood, education causing health later in life, or by some hidden factor affecting both. Even in a sample of individuals whose education is already acquired, the mechanisms through which education and health are related are not well understood, as education is itself correlated with the ability to acquire and process information, household resources, and preferences.

In this paper we study whether the education differences in health-related behavior result from differences in knowledge. On the one hand, more educated individuals might acquire more information for example because they read more. On the other hand, as argued by Cutler and LLeras-Muney (2007), while most health related information is freely distributed, it might be believed more by the better educated. In order to test whether and how education can affect health related knowledge, we analyze the interaction between quality of general practitioners (GPs) and education in the decision to screen for breast and colon cancer. While education facilitates the acquisition of health-related information, health professionals could provide the same information. If access to information explains at least part of the correlation, the health-education gradient will be less important for those who receive better information from the health system. In this case education and outside sources of information would be substitutes, and the gradient flatter. On the other hand, people with better education might also benefit more from the information provided by the health care system because they can process and internalize it better. In this case education and outside sources of information would be complements and the gradient steeper. In both cases, failure to control for information received from the health care system biases the estimated effect of education on health.

We use internationally comparable data on eight countries (Austria, Belgium, Denmark, France, Germany, Italy, Spain, and Switzerland) covered by the Survey of Health, Ageing and Retirement in Europe (SHARE). Understanding how information provided by health professionals affects individuals' decision-making and how it interacts with other channels of information poses two problems. First, measures of medical advice are frequently not available in survey data. Second, the type of information and the quality of doctors might be correlated with unobserved characteristics of patients.

Our empirical strategy addresses both of these problems. We focus on two screening tests, mammography and colonoscopy, that are strongly recommended to asymptomatic individuals aged 50 or above, regardless of their health history. This should rule out the problems of selection bias that arise in samples of individuals already diagnosed for various diseases.

A further reason to concentrate on these two tests is that both screening procedures are either free or heavily subsidized for the individuals included in our sample. This minimizes the risk of education proxying for differing capacity to access health services.

Finally, we focus on a specific group of health professionals. In all the countries covered by our study GP coverage is free of charge and universal. The distinctive feature of the GP-patient relation is that it is usually long-term and likely to be characterized by repeated interactions. As Scott (2000) notes, the long-term relation facilitates information transmission between GP and patients. We exploit the unique SHARE data to construct a measure of GP quality based on the completion of standard geriatric assessments, and show that it is strongly correlated with the probability of patients being advised to undergo the standard universally recommended screening tests. To our knowledge, our work is the first attempt to construct an individual measure of primary care quality and to relate it to patients' decision.[1]

Nevertheless, the non-random assignment of GP quality and the potential recall bias of patients might drive a spurious correlation between the quality score and the decision to undertake preventive screening. In order to address this issue, we exploit a feature common to all the countries covered by our analysis: regional governments are largely autonomous in the decisions concerning the funding, the size and the allocation of public health care expenditure.[2] Therefore, we exploit regional variations in quality indicators of primary care and health promotion to control for the potential endogeneity of the GP quality score.

We then estimate whether the health-education gradient is affected by GP quality. Our econometric results suggest that education and cognitive abilities (as measured by verbal

[1] Morris and Gravelle (2006) investigate the relationship between GP supply and body mass index in UK using information at area level.

[2] The European Observatory on Health Systems and Policies provides detailed descriptions of the different health care systems (see www.euro.who.int/observatory).

fluency) increase the propensity for preventive screening. A better GP quality is also positively associated with screening. Our baseline estimates show a weak and not statistically significant substitutability between quality of general practitioners and education. When we control for the potential endogeneity of the GP quality score the results deliver a consistent pattern: the better the quality of the general practitioner, the higher the effect of education and cognitive ability on the probability of undertaking both mammography and colonoscopy. This result supports the hypothesis that more educated individuals can better process and internalize the information provided by GPs. It also has an important implication, namely that making more health related information freely available might not reduce health disparities, at least in a sample of elderly.

In Section 2 we review evidence on the health-education gradient and the different channels that can lead to an association between education, health outcomes and health risks. In Section 3 we describe the data and provide descriptive statistics on the percentage of people covered by GPs and their quality. The empirical results are presented in Section 4, and Section 5 concludes.

2. The health-education gradient

The positive association between education and health has been widely documented for the US (Grossman and Kaestner, 1997; Cutler and Lleras-Muney, 2006) and the UK (Marmot, 1991; Banks et al., 2007). Less is known for other countries, and particularly for continental Europe. Mackenback et al. (2003) rely on national survey data to study mortality differentials by educational level and occupational class among men and women in Finland, Sweden, Norway, Denmark, England, and Italy. Avendano et al. (2005), using SHARE data, find that men and women over 50 with less education are more likely to report poor health status, chronic conditions, and physical limitations due to health problems. Even less is known as to why health outcomes and education are positively correlated.

Education might improve health simply because it is associated with more resources, including access to health care. This is perhaps the most obvious explanation, but it is not the whole picture. Cutler and Lleras-Muney (2006) show that after controlling for income and health insurance, education is still a significant determinant of health status in the US. In addition to earning higher incomes, however the better educated might also work in healthier environments. However, Lahema et al. (2004) and Cutler and Lleras-Muney (2006) find that job characteristics do not fully explain the education gradient, at least in the US.

Education could also be correlated with individual preferences (such as impatience and risk aversion) that can ultimately affect investments in health. For instance, suppose that the more risk-averse are also more likely to go to school and achieve higher education. If risk-averse individuals are also more likely to do screening, as is found in Picone, Sloan and Taylor (2004), one would find a relation between education and health, but it would be driven entirely by failure to control for risk aversion.

Education is directly related to health information in several ways. An extensive literature shows how education increases awareness of unhealthy behaviors and health risks. Schooling reduces smoking, drinking and sedentary life (Kenkel, 1991a; Kenkel, 1991b), affects demand for early detection of breast and cervical cancer (Kenkel, 1994) and flu vaccination (Mullahy, 1999). Another strand of the literature points out that better educated people are quicker to exploit technological advances in medicine and more complex technologies - see Lleras-Muney and Glied (2003), and Cutler and Lleras-Muney (2006).

Previous research has tried to identify the role of information in the health-education gradient relying on event studies or direct survey questions. De Walque (2006) uses event studies to investigate how different education groups responded to an HIV information campaign in Uganda. Kenkel (1991a) uses direct questions available in cross-sectional data to analyze whether the effect of health information (as measured by answers to health-related questions) on risk factors varies with years of schooling.[3] In this paper we take a third approach, comparing the probability of undergoing the most common screening tests among individuals who interact with universally and freely available health professionals. After controlling for the potential endogeneity of the GP quality score, we test whether the health-education gradient is flatter or steeper for individuals who interact with better GPs.

[3] The risk factors are drinking, smoking and lack of physical exercise.

3. The data

We use the most recent data release of the Survey of Health, Aging and Retirement in Europe (SHARE), a survey of the population aged 50+ conducted in 2004.[4] The survey involved 19,286 households and 32,022 individuals, covering a wide range of topics, including physical health, behavior, socioeconomic status, income and intensity of social interaction. Some questions refer to the household (for instance, income), others to each eligible member within the household and to his or her partners; this is the case for the indicators of health status and behavior.[5] SHARE also includes a section on preferences, beliefs, attitudes and other items, including the demand for preventive care, and an individual level indicator of GP quality. The SHARE data are thus particularly useful for the issues we are investigating.

Of 11 countries covered by SHARE, we exclude Greece, the Netherlands and Sweden, because in these countries GPs play a less important role. In Greece primary care is just beginning to develop and only a small fraction of the population is registered with a GP. In the Netherlands there are two health insurance schemes; GP consultation is compulsory only under the sick fund system, which covers only 60 percent of the population.[6] The Swedish health system has traditionally been hospital-centered, as the very low ratio of GPs to specialists shows (Simoens and Hurst, 2006). Our final sample thus includes 12,405 men and 15,177 women aged 50-85 in Austria, Belgium, Denmark, France, Germany, Italy, Spain, and Switzerland.

3.1. Screening test compliance

We focus on two cancer screening tests: mammography and colonoscopy. Early detection of breast and colon cancer significantly reduces mortality. The American

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[4] The SHARE data collection has been primarily funded by the European Commission through the 5th framework program (project QLK6-CT-2001-00360 in the thematic program Quality of Life). Additional funding came from the US National Institute on Ageing (U01 AG09740-13S2, P01 AG005842, P01 AG08291, P30 AG12815, Y1-AG-4553-01 and OGHA 04-064). Data collection in Austria (through the Austrian Science Foundation, FWF), Belgium (through the Belgian Science Policy Administration) and Switzerland (through BBW/OFES/UFES) was nationally funded. The SHARE data set is presented in Börsch-Supan et al. (2005).

[5] The questionnaire and the sample design are patterned after the US Health and Retirement Survey (HRS) and the English Longitudinal Study of Ageing (ELSA). Börsch-Supan et al. (2005) report details on sampling, response rates and definitions of variables.

[6] Only low income employees and people aged 65 and above are eligible for this fund.

Association of Colon and Rectal Surgeons recommends regular screening after age 50.[7] According to the American Cancer Society, women aged 40 and above should have a mammogram performed every year and for as long as they are in good health.[8] In most European countries mammography is recommended every second year to women aged 50 and above, regardless of health history. Accordingly, even if education affects personal health histories, our use of tests recommended to the general population on the basis of age should avoid biasing the health-education gradient.

Field studies in the medical literature show that patient compliance is much higher for mammography than for colonoscopy, even among groups at risk.[9] Colonoscopy and mammography are interesting also because the costs and benefits vary with individuals and with tests themselves. If colonoscopy and mammography are provided free of charge by a National Health System, the cost consists mainly in perceived invasiveness. The benefit, early detection of a disease, depends on health and on time preference, as is pointed out by Picone, Sloan and Taylor (2004): better health and a lower time preference are associated with higher demand for preventive screening.

Table 1 shows the percentage of women aged 50-85 who had a mammography done in the two years before the survey and the percentage of men and women who had colonoscopies at least once in the previous ten years. In France the percentage of women doing breast screens is above 70 percent, while it is just 22 percent in Denmark. France, Germany and Austria show the highest rates for colonoscopy; in Spain only 8 percent of women and men had had that test done.

Institutional factors explain part of the international differences in screening rates and protocols. In Austria, Germany, France, Italy, and Spain women aged 50-69 are invited to take a mammography at least once every two years free of charge.[10] In Denmark only two out fourteen communities have established a breast cancer prevention program, which currently covers only 20 percent of the Danish female population.

The scenario for colorectal cancer screening is different. Only in a few countries special programs are in place (see Holland, 2006). In Austria all men and women 50+ are invited for

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[7] For details see www.fascrs.org/.

[8] See www.cancer.org/.

[9] Urban, Anderson and Peacock (1994) find a compliance rate of about 40 percent for mammography in a population of 50+ women. Cottet et al. (2006) find a compliance rate of 18 percent for colonoscopy among first-degree relatives of patients with large adenomas.

[10] In France the age group extends to women 74 years old; in some Autonomous Communities in Spain the limit is 64/65.

precautionary check-ups, informed about the risks of colorectal cancer and invited to take a colonoscopy. In Italy, since 2001, colonoscopy every five years has been free of charges (exempted from co-payment) for men and women age 45+ and for the population at risk as defined by the Ministry of Health. The testing protocols for this form of cancer vary. In France individuals at risk are advised to have the colonoscopy only if the fecal blood test is positive; in Italy and Germany it is recommended to all individuals at risk; and in the other countries there are no special provisions for colorectal cancer screening.[11]

3.2. The quality of general practitioners

Recently the OECD and the World Health Organization have constructed quality indicators for primary medical care, measuring obesity and diabetes prevalence, smoking rate, flu vaccination for high-risk groups, and colon cancer screening (OECD, 2004). Here, we are interested in measuring the quantity and quality of information that public health care systems give to people who must make health-related decisions. Because of universal and compulsory registration, the quality of general practitioners is crucial to this function.

In principle a variety of different health professionals can provide primary health care but in most countries GP is the most common point of first contact. With a few exceptions, GP care is provided free of charge and on a universal basis by National Health Systems.[12] According to a recent definition, "the GP engages with autonomous individuals across the field of prevention, diagnosis, cure, care and palliation" (Brotons et al., 2005). Although the organization and provision of GP care differ from country to country, everywhere one of the GP's most important tasks is to provide health-related information and explain options treatment to patients (see Scott, 2000). Moreover, high quality general practice might shorten decision times and track patients' behavior more closely (Cutler and Lleras-Muney, 2006), which could be particularly relevant for colonoscopy.[13]

Using the SHARE drop-off questionnaire, we construct a GP quality indicator at individual level, with six measures of geriatric assessment. These are straightforward aspects of medical consultation that should be easily recognized by the respondents, regardless of

[11] In France the introduction of a colon cancer screening program hinges on the result of trials in 22 Departments. More detailed information about the regulatory frameworks in the EU countries can be found in Screening in Europe, Policy Brief, European Observatory on Health Systems and Policies.
[12] In Germany, individuals pay small charges for some additional services.
[13] People who take the test must follow a special diet for up to three days beforehand the test and are given a laxative to clear their colon. Before the examination they are given a sedative by an injection into vein.

education. In particular, SHARE respondents report whether their GP asks about physical exercise, falls and drugs, suggests regular physical exercise or checks their weight. We convert these questions into dummy variables, so the GP quality index ranges from zero (the GP does none of the above) to six (all of the above).

Table 2 illustrates the international variability of GP coverage and the quality index. Consistent with the free and universal access, 94 percent of the individuals in our sample are registered with a general practitioner. The countries where the GP quality score is highest are France and Spain (above 3), while Denmark has the lowest (2.1). In Italy and Denmark, 25 percent of the sample receive no geriatric assessment, 20 percent in Austria and 16 percent in Spain reported they received all the assessments. These results basically accord with patients' evaluations and country-level indicators of the quality of health care. Grol et al. (2000), using the European Task Force on Patient Evaluations of General Practice Care (EUROPEP), find a generally negative opinion of the geriatric assessments of GPs in Denmark and the other Scandinavian countries. France, Austria and Germany are the countries with the highest GP density, Denmark the lowest (Simoens and Hurst, 2006).

We take the GP quality index as a proxy for the flow of information between doctors and their patients. Interestingly, this indicator is strongly correlated with the probability of having been advised to get a flu vaccination in the year before the survey, which is strongly recommended to people over 65. Figure 1 plots this probability against the GP score. We take the positive association between the two variables as an indication that the GP score does proxy for the amount of medical information transmitted by health professionals.

4. Empirical analysis

We test whether education and GP are complements or substitutes in explaining the demand for screening, by estimating the following probit model:

$$\Pr(y_i = 1) = \Phi(\beta_0 + \beta_1 E_i + \beta_2 GP_i + \beta_3 E_i \times GP_i + \gamma' X_i)$$

where y_i takes value 1 if individual i undertakes the screening test, E is years of education and GP is the general practitioners' quality score; X_i includes age, marital status, presence of children, disposable income, occupational status, a proxy for the quality of health supply and an indicator of social activities as explanatory variables for screening compliance. In order to control for variations in the supply of health care at the regional level we use the waiting time in months for outpatient surgery examination. This is defined the average at regional level of the individual responses on the number of months waited for their last outpatient examination.[14]

Recent work shows that social networks affect the incidence of health conditions and health care utilization, see Pescosolido and Levy (2002), Devillanova (2007), and Deri (2005). We therefore consider social activities as an additional channel through which people acquire information on health (by word-of-mouth or observational learning). We rely on a set of questions on seven kinds of activities engaged in the month prior to the interview.[15] We convert the seven variables into a score of 0 to 7. Country dummies are included in all specifications to account for institutional and cultural differences. Sample means for variables used in the estimation are reported in Table 3 separately for those who undertake mammography and colonoscopy tests and for those who don't.

The main parameter of interest is β_3.[16] A positive value would mean that education and GP quality are complements, a negative value would imply they are substitutes. However, there are at least three reasons to expect the estimate of β_3 to be biased. First, even though the access to GP is universal and free of charge, individuals are allowed to choose their GP and eventually change him without any monetary cost. Therefore, GP quality might be endogenously determined. Second, our index is based on self reported answers. The failure to recall whether the GP performed a certain assessment might be correlated with unobservable traits that are correlated with the level of education. Third, even though the assessments should be performed regardless of the patient health history, in practice GPs might decide to perform them only on individuals with a specific health history or particular symptoms. It is hard to determine the direction of the bias *a priori*. In the data we observe that the GP index is negatively correlated with years of education (Figure 2). This might be due to the fact that individuals with higher levels of education (and income) might bypass the GP and rely primarily on specialists. This is confirmed by the positive correlation between years of

[14] Our results are robust to alternative measures of the waiting time.

[15] Specifically: (1) voluntary or charity work; (2) care for a sick or disabled adult; (3) help for family, friends or neighbours; (4) attendance of an educational or training course; (5) participation in a sport, social or other kind of club; (6) taking part in a religious organization; (7) taking part in a political or community-related organization.

[16] In a probit model the marginal effects depend on the parameter as well as on the density function. For notational simplicity in the text we refer to the relevant parameter to denote the marginal effect.

education and the proportion of specialists visits, as defined by the ratio of contacts with specialists over the total number of contacts with doctors in the last 12 months (Figure 3).

To address these concerns we instrument GP quality using the flu vaccination coverage for high risk individuals and the smoking rate measured at the regional level. The first variable is the regional proportion of individuals aged 65 or above who answered yes to the question whether they got a flu shot in the year before the survey. The second variable is the ratio of the number of smokers over the total population in the region. According to the OECD (2004), the former is an indicator of quality of preventive care in the area, while the second measures the quality of health promotion. It is understood that the health system can affect the vaccination coverage in risk groups through medical education, awareness campaigns and establishing remind and recall systems. Both educational campaigns and cessation counseling have been assigned an important role in reducing smoking rates. The rationale behind our instruments is straightforward: on average, in regions with higher investments in preventive care and health promotion it is easier to find a better GP. Using the territorial units classification (NUTS) adopted by EUROSTAT, we are able to calculate our measures of investments in primary health care for 102 regions.

The identification assumption is that, conditional on the average waiting time in the region, flu vaccination coverage and smoking rate can affect the take up of colonoscopy and mammography only by affecting the average quality of general practitioners. A potential violation might rise if our instruments proxy for the quality of health care services other than the primary care ones. In order to bolster confidence in the identifying assumption, we test whether flu vaccination coverage and smoking rates are correlated with two indicators that are extensively used to measure the quality of secondary care: the number of hospital beds and the number of physicians in the region.[17] Reassuringly, we can never reject the null hypothesis of zero correlation.

4.1. Mammography

Table 4 reports the results for mammography. In order to test whether education and GP quality are complements or substitutes, we first allow for the interaction between years of education and the GP quality score. The results of the baseline probit estimates are reported in

[17] These two indicators are provided in the EUROSTAT REGIO database but they are not available for the full list of regions included in our sample.

column 1. Consistent with previous evidence, education has a positive and significant effect on the probability of undertaking the test. An extra year of education increases the probability by 0.9 percentage points. GP quality is positively and significantly correlated with the probability of taking the test. The marginal effect on the interaction between the GP score and years of education suggests a weak and non-significant substitutability between these two variables.

In our sample of elderly women we find that the probability of taking the test falls with age, by 1.2 percentage points per year. Since medical guidelines prescribe that women over 50 should take the test every two years, this result may seem surprising, but it is consistent with many studies in the medical literature - for instance Burack, Gurney, and McDaniel (1998).[18] The probability increases by almost 10 percent for married women indicating that prevention is more prevalent among couples. Interestingly, we also find that it is significantly higher for women with children (5.8 percentage points).

The income coefficient signals that households' resources are positively correlated with screening, even though the correlation is weak and significant only at the 10 percent confidence level. A plausible explanation is that women in the age group 50-69 are allowed to screen free of charge in all the countries examined. For older women the cost of the exam is largely subsidized.

The effect of social activities is positive and precisely estimated. The coefficient indicates that an additional social activity raises test compliance by just below 2 percentage points, suggesting that social interactions increase people's awareness of health risks and lower the cost of acquiring health-related information.

Our primary interest here is measuring the quality of the information provided by health professionals, but other aspects of health supply might also be relevant to the decision to screen. In particular, long waiting times might discourage women from undertaking the test. This is confirmed by the negative and significant effect of the average number of months individuals have to wait before receiving an outpatient treatment.

Since for the elderly educational attainments might not reflect current ability to process information, we also investigate the role of current cognitive skills. The cognitive psychology literature identifies four main domains of ability: orientation, memory, executive function and language. These abilities depend on genetic endowments and environmental factors, such as

[18] The results might be due also to a cohort effect, which cannot be distinguished from a genuine age effect in cross-sectional data.

childhood home environment and education, and change over time, see Richards et al. (2004). In particular we test whether planning and executive functions (verbal fluency) increase the propensity to screen for breast cancer and whether this effect is mediated by the quality of the general practitioner. Results are reported in column 2.[19]

Fluency has a strong a significant effect on the probability of taking a mammography. One standard deviation increase in the fluency score increases the probability of screening by 2.5 percentage points. The effect of the GP score is line with the one we have discussed above. The interaction between the GP quality score and the verbal fluency indicator displays a negative and slightly significant marginal effect. Remarkably, controlling for the verbal fluency is not sufficient to explain the large and significant effect of years of education.

Our results suggest a weak and not significant substitutability between education/cognitive abilities and GP quality but so far we have not taken into account the potential endogeneity of the GP score. We use a control function approach to test whether spurious correlation and endogeneity drives our results. The GP score is instrumented using the quartiles of the flu vaccination coverage and the smoking rate at regional level. The IV estimates in columns 3 and 4 of Table 4 show that, on average, the effect of the quality of primary care physicians is not statistically different from zero. Most importantly, when we allow the effect of education and verbal fluency to vary with the quality of the general practitioner, we find evidence of a strong and significant complementarity. The effect of an additional year of education on the propensity to screen for breast cancer increases by 0.5 percentage points if the GP score is exogenously increased by one unit. Similarly, the marginal effect of verbal fluency increases by 0.2 percentage points when the GP score increases by one unit.

4.2. Colonoscopy

We turn now to the analysis of the relation between education and the propensity for colonoscopy. Results are reported in Table 5. The first regression shows that the effect of an extra year of education is quantitatively comparable to the one we have found for mammography. Similarly, there is a positive a slightly significant correlation between GP

[19] In SHARE the fluency indicator is obtained by asking respondent to name as many animals as she or he can in exactly one minute. Each respondent is then given a score, which is equal to the number of animals that she or he can name. More details on this indicator can be found in Dewey and Prince (2005), and Christelis, Jappelli and Padula (2006).

quality and the propensity to screen for colon cancer. The interaction between years of education and GP quality score shows a negative and not significant effect, in line with the results we found for mammography.

Consistent with the fact that the test is universally recommended both to males and female above age 50, the marginal effect of the gender dummy is not statistically different from zero. Age and the presence of a partner have an effect similar to those found for mammography. The probability of undertaking a colonoscopy increases with income (by 1.6 percent for every 1 percent increase in income). It is also positively associated with social activities (1.9 points for each additional social activity). These results offer additional support for the hypothesis that formal and informal channels both increase awareness of health risks. Also in this case, longer waiting times have a negative and significant effect on the decision to screen for colon cancer.

Unlike our previous results, fluency has a very small and not significant effect on the probability of screening. We also find a weak and not significant substitutability between cognitive skill and the ability of the GP. Interestingly, when we control for cognitive skills, age has a positive and significant effect on the decision to screen for colon cancer.

As for mammography, the picture changes when we control for the possible endogeneity of the GP score. The marginal effects of the interactions terms are positive and strongly significant. Reassuringly, the size and the significance level of the effects are in line with the ones for mammography. Also in this case the results point towards a strong and significant complementarity between education (verbal fluency) and quality of the general practitioner.

Two important conclusions can be drawn from these results. First, it is important to take into account the potential endogeneity of the GP choice when studying how the quality of physicians affects health related behaviors. Second, the strong effect of education on the propensity to undertake preventive screening can be partially explained by the higher ability to process and internalize the information received by the health care system.

5. Conclusion

The positive association between health outcomes and education is widely documented, but little is known about the actual source of this correlation. The most common explanations emphasize the role of preferences and resources. In this paper, we seek to determine whether information explains the nexus between schooling and the demand for health procedures. In order to isolate the role of information, we analyze whether information obtained from primary health care institutions acts as a complement to or as a substitute for schooling and cognitive abilities in patients' decision to have two cancer screening tests done: mammography and colonoscopy.

To proxy for information we use an indicator of general practitioner quality and assume that better-quality GPs are more valuable, in giving their patients better (more relevant and timely) information. Once we control for the possible endogeneity of the GP quality, we find that the health-education gradient is steeper for those who have a better GP. The most likely explanation for our analysis of compliance is that better educated individuals screen more because are more likely to internalize the information received by their GPs. In a nutshell, while everyone has access to a GP, only the better educated can take full advantage of the information provided by the GP. In addition, the results highlight the importance of social interactions: who are more socially active individuals are also more likely to have the tests run.

Our results have three important implications. First, estimates of the health-education gradient are biased unless there is an explicit control for the quality of the information provided by the health care system. Second, external sources of health-related information and education are at least in part complements. Finally, since information provided by the general practitioner does not reduce health disparities, targeted programs should be designed to increase individual awareness on virtuous health behaviors.

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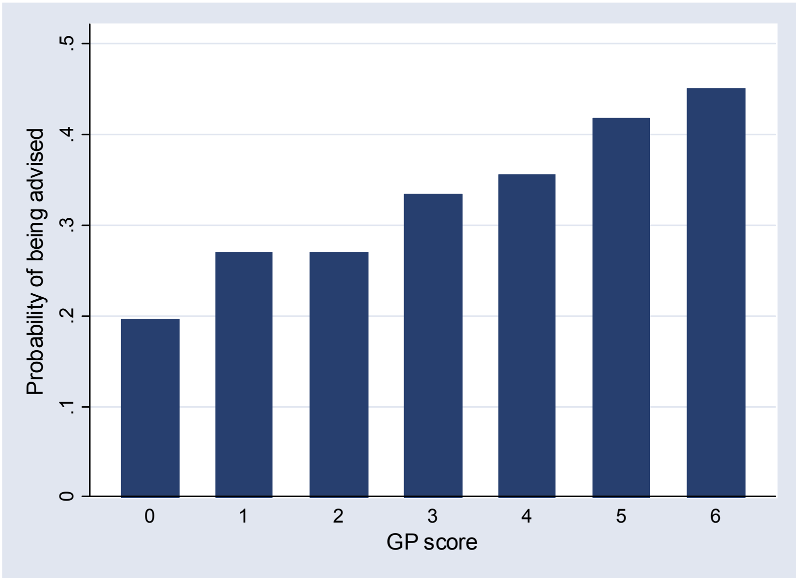
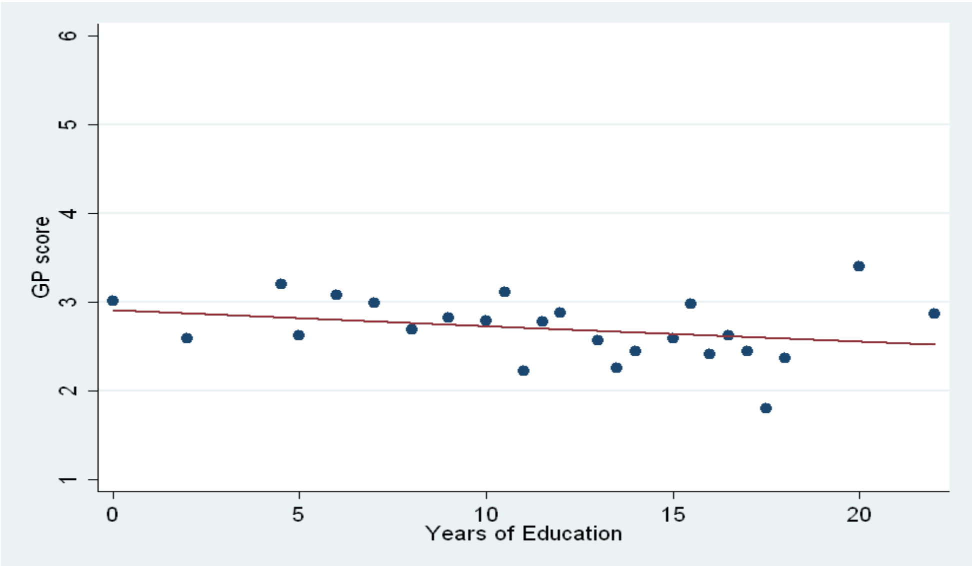
Figure 1
Probability of being advised to get a flu vaccination



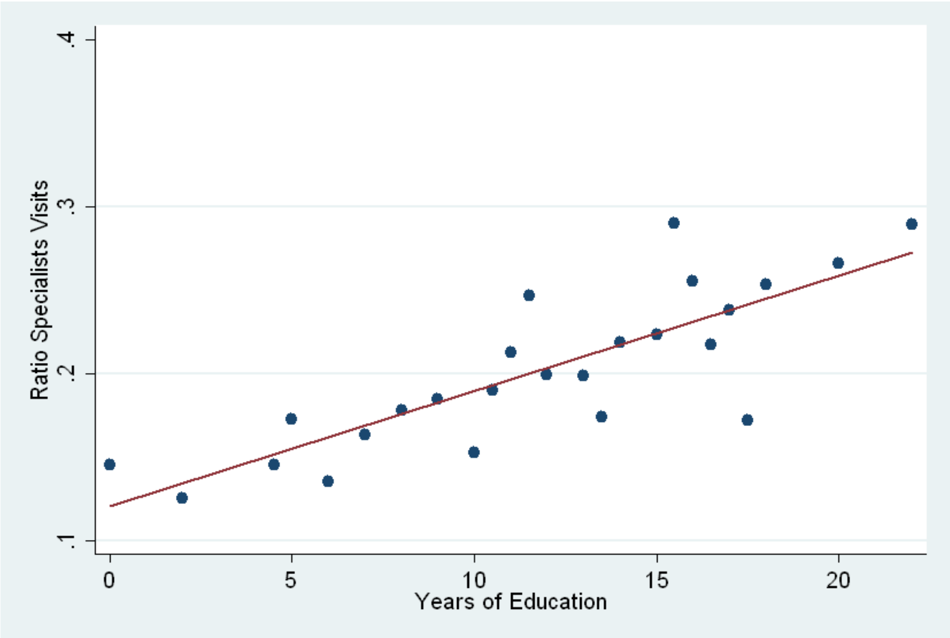
Note. The figure plots the probability of an individual aged 65+ being advised to get a flu vaccination in the year before the survey against the GP score.

Figure 2
Quality of General Practitioner and Education



Note. The figure plots the GP quality score against years of education. The sample includes all the individuals in the age group 50-85.

Figure 3
Type of physician and education



Note. The figure plots the ratio of visits with specialists versus years of education. The ratio is defined as the number of contacts with specialists over the total number of contacts with doctors in the last 12 months. The sample includes all the individuals in the age group 50-85.

Table 1
Preventive screening compliance

	Mammography	*Colonoscopy*	
		Women	*Men*
Austria	0.61	0.26	0.25
Germany	0.43	0.25	0.26
Spain	0.53	0.08	0.08
Italy	0.58	0.15	0.13
France	0.73	0.23	0.28
Denmark	0.22	0.14	0.15
Switzerland	0.43	0.20	0.22
Belgium	0.64	0.15	0.15
Total	0.54	0.18	0.19

Note. The table reports the relative frequency by country of mammography and colonoscopy. The sample includes 12,405 men and 15,177 women aged 50-85.

Table 2
Quality of General Practitioners

	GP coverage	*GP score distribution*							*Mean*	*No. of Observations*
		0	*1*	*2*	*3*	*4*	*5*	*6*		
Austria	0.94	0.17	0.14	0.14	0.16	0.11	0.08	0.20	2.95	1560
Germany	0.94	0.20	0.12	0.16	0.17	0.14	0.10	0.10	2.62	1794
Spain	0.97	0.15	0.12	0.13	0.17	0.15	0.12	0.16	3.03	1500
Italy	0.98	0.25	0.15	0.16	0.15	0.13	0.08	0.09	2.35	1453
France	0.93	0.07	0.12	0.17	0.21	0.20	0.14	0.10	3.18	1137
Denmark	0.97	0.25	0.18	0.17	0.15	0.14	0.07	0.05	2.13	1143
Switzerland	0.91	0.13	0.17	0.15	0.25	0.15	0.09	0.07	2.69	632
Belgium	0.89	0.12	0.14	0.17	0.20	0.18	0.10	0.09	2.84	2382
Total	0.94	0.17	0.14	0.16	0.18	0.15	0.10	0.11	2.74	11601

Note. The table reports GP coverage and the GP score distribution by country. GP coverage is the percentage of individuals who say they have a GP. The GP score ranges 0-6.

Table 3
Sample statistics for selected variables

	Mammography		Colonoscopy	
	Yes	No	Yes	No
Age	63.341	68.922	66.201	65.001
	(8.749)	(10.882)	(9.352)	(10.083)
Has partner (Y/N)	0.743	0.593	0.743	0.749
	(0.437)	(0.491)	(0.437)	(0.433)
Female	1.000	1.000	0.552	0.563
	(0.000)	(0.000)	(0.497)	(0.496)
Years of education	10.046	9.523	11.162	10.131
	(4.358)	(4.618)	(4.241)	(4.592)
Verbal Fluency	0.427	0.325	0.446	0.379
	(0.495)	(0.469)	(0.497)	(0.485)
Has children (Y/N)	0.903	0.873	0.896	0.884
	(0.296)	(0.333)	(0.306)	(0.320)
Retired (Y/N)	0.397	0.496	0.593	0.501
	(0.489)	(0.500)	(0.491)	(0.500)
Log household income	10.431	10.229	10.516	10.391
	(1.077)	(1.103)	(1.034)	(1.082)
Social activities	0.860	0.706	0.921	0.792
	(1.072)	(0.989)	(1.109)	(1.049)
GP score	2.714	2.635	2.981	2.668
	(1.873)	(1.968)	(1.879)	(1.923)
Regional Waiting time	1.639	1.891	1.371	1.843
	(2.004)	(2.306)	(1.752)	(2.243)
Germany	0.116	0.184	0.221	0.143
	(0.321)	(0.387)	(0.415)	(0.350)
Spain	0.126	0.135	0.055	0.142
	(0.332)	(0.342)	(0.228)	(0.349)
Italy	0.138	0.117	0.095	0.134
	(0.345)	(0.322)	(0.293)	(0.341)
France	0.133	0.058	0.134	0.089
	(0.340)	(0.233)	(0.340)	(0.285)
Denmark	0.040	0.167	0.078	0.105
	(0.197)	(0.373)	(0.268)	(0.307)
Switzerland	0.041	0.062	0.062	0.054
	(0.198)	(0.241)	(0.241)	(0.225)
Belgium	0.241	0.156	0.163	0.206
	(0.428)	(0.363)	(0.369)	(0.404)
Observations	3318	2890	2021	8841

Note. The table reports the means of the variables used in the estimation; standard deviations in parenthesis.

Table 4
Compliance with mammography test

	Probit Estimates		*IV estimates*	
Education	0.0094***	0.0078***	0.0045***	0.0075***
	(0.0025)	(0.0026)	(0.0014)	(0.0029)
GP score	0.0085**	0.0086**	-0.0017	0.0039
	(0.0043)	(0.0042)	(0.0341)	(0.0348)
Education×GP score	-0.0005		0.0049**	
	(0.0009)		(0.0019)	
Fluency		0.0033**		0.0018**
		(0.0014)		(0.0008)
Fluency×GP score		-0.0010*		0.0030**
		(0.0006)		(0.0013)
Age	-0.0122***	-0.0118***	-0.0117***	-0.0115***
	(0.0010)	(0.0010)	(0.0019)	(0.0018)
Has partner	0.0994***	0.0982***	0.0955***	0.0940***
	(0.0181)	(0.0180)	(0.0197)	(0.0194)
Has children	0.0579**	0.0553**	0.0553**	0.0532*
	(0.0244)	(0.0245)	(0.0278)	(0.0281)
Log income	0.0164*	0.0142*	0.0173*	0.0147
	(0.0084)	(0.0084)	(0.0090)	(0.0090)
Retired	0.0603***	0.0615***	0.0566**	0.0564**
	(0.0195)	(0.0195)	(0.0227)	(0.0231)
Social activities	0.0197**	0.0167*	0.0203**	0.0169*
	(0.0086)	(0.0087)	(0.0099)	(0.0099)
Waiting time	-0.0090**	-0.0091**	-0.0088*	-0.0094**
	(0.0043)	(0.0043)	(0.0045)	(0.0045)
Country Dummies	Yes	Yes	Yes	Yes
Observations	5990	5962	5990	5962
Cragg Donald Rank Statistic			2.521	2.718
P value			0.001	0.000
Anderson Rubin Statistic			5.128	6.685
P value			0.000	0.000
Hansen J Statistic			40.381	66.565
P value			0.000	0.000

Note. The sample includes individuals aged 50-85. We report marginal effects of each variable, with standard errors in parenthesis. One star denotes significance at the 10 percent level; two stars at the 5 percent level; one star at the 1 percent level. The IV probit is calculated using a two stage procedure based on the control function approach. The instruments used are the quartiles of the flu vaccination coverage and the smoking rate calculated at regional level. Marginal effects are calculated as average partial effects following the procedure suggested by Wooldridge (2002). Standard errors are calculated with 250 bootstrap repetitions.

Table 5
Compliance with colonoscopy test

	Probit Estimates		*IV estimates*	
Education	0.0095***	0.0036**	0.0045***	0.0037**
	(0.0026)	(0.0016)	(0.0014)	(0.0017)
GP score	0.0084*	0.0114***	-0.0078	0.0388
	(0.0043)	(0.0028)	(0.0365)	(0.0251)
Education×GP score	-0.0004		0.0048**	
	(0.0009)		(0.0021)	
Fluency		0.0007		0.0006
		(0.0008)		(0.0005)
Fluency×GP score		-0.0002		0.0022**
		(0.0003)		(0.0009)
Female	0.0956	0.0000	0.0849	0.0095
	(0.0678)	(0.0107)	(0.0759)	(0.0141)
Age	-0.0123***	0.0027***	-0.0115***	0.0016
	(0.0010)	(0.0007)	(0.0020)	(0.0013)
Has partner	0.0974***	-0.0034	0.0925***	-0.0012
	(0.0185)	(0.0138)	(0.0203)	(0.0145)
Has children	0.0591**	0.0251	0.0545*	0.0295
	(0.0260)	(0.0171)	(0.0313)	(0.0181)
Log income	0.0157**	0.0104**	0.0164*	0.0128**
	(0.0078)	(0.0053)	(0.0086)	(0.0056)
Retired	0.0594***	0.0169	0.0576**	0.0057
	(0.0200)	(0.0127)	(0.0234)	(0.0148)
Social activities	0.0189**	0.0111**	0.0188*	0.0129**
	(0.0084)	(0.0050)	(0.0099)	(0.0058)
Waiting time	-0.0095**	-0.0049*	-0.0092*	-0.0045
	(0.0045)	(0.0029)	(0.0048)	(0.0032)
Country Dummies	Yes	Yes	Yes	Yes
Observations	10552	10495	10552	10495
Cragg Donald Rank Statistic			3.329	3.627
P value			0.000	0.000
Anderson Rubin Statistic			3.034	2.583
P value			0.000	0.001
Hansen J Statistic			25.441	29.702
P value			0.005	0.002

Note. The sample includes individuals aged 50-85. We report marginal effects of each variable, with standard errors in parenthesis. One star denotes significance at the 10 percent level; two stars at the 5 percent level; one star at the 1 percent level. The IV probit is calculated using a two stage procedure based on the control function approach. The instruments used are the quartiles of the flu vaccination coverage and the smoking rate calculated at regional level. Marginal effects are calculated as average partial effects following the procedure suggested by Wooldridge (2002). Standard errors are calculated with 250 bootstrap repetitions.