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ABSTRACT

Self-Selection into Health Professions*

The health sector requires skilled, altruistic, and motivated individuals to perform complex tasks for which ex-post incentives may prove ineffective. Understanding the determinants of self-selection into health professions is therefore critical. We investigate this issue relying on data from surveys and incentivized dictator games. We compare applicants to medical and healthcare schools in Italy and Austria with non-applicants from the same regions and age cohorts. Drawing on a wide range of individual characteristics, we employ machine learning techniques for variable selection. Our findings show that higher cognitive ability, greater altruism, and the personality trait of conscientiousness are positively associated with the likelihood of applying to medical or nursing school, while neuroticism is negatively associated. Additionally, individuals with a strong identification with societal goals and those with parents working as doctors are more likely to pursue medical education. These results provide evidence of capable, altruistic, and motivated individuals self-selecting into the health sector, a necessary condition for building a high-quality healthcare workforce.

JEL Classification: I1, J24, J4

Keywords: self-selection, health professions, altruism, cognitive ability, personality traits, machine learning

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1 Introduction

Job performance is affected by two main factors: ability to attract and recruit the ‘right’ people and the design of ex-post control tools (e.g., Lazear, 1986, 2000; Besley, 2005; Besley and Ghatak, 2005). The former largely depends on *self*-selection—the process by which individuals decide to apply for a job based on their personal characteristics, preferences, and perceived fit for the role—and screening—the process of evaluating applicants to assess their qualifications and determine their suitability for the position they have applied for. The second factor is ex-post control tools such as performance pay, merit-based promotions, training/education programs, and professional guidelines. It aims to align the interest of employees with those of employers. Notably, the self-selection of well-suited individuals is a necessary condition for the other factors to be effective: in the extreme case where only unsuitable candidates are interested in a job, screening and ex-post mechanisms can do little more than damage control.

This paper examines self-selection into the health sector, where job performance depends not only on employees’ skills, but also on their personal characteristics and preferences, such as pro-social motivation and altruism (e.g., Arrow, 1963; Li et al., 2017; Ashraf et al., 2020; Casalino et al., 2024). In this context, attracting and recruiting the ‘right’ individuals – both competent and motivated – is likely to be more effective than employing ex-post control schemes. When able and motivated individuals are drawn to the job, employers can indeed mitigate the use of incentive mechanisms. This is relevant because incentive mechanisms can crowd out motivation (for a comprehensive survey, see Gneezy et al., 2011) and are particularly challenging to implement in the health sector due to the pervasiveness of multi-tasking, team work, and the difficulties in verifying the quality of healthcare services (e.g., Chalkley and Malcomson, 1998; Dulleck and Kerschbamer, 2006).¹ Under the opposite scenario, where low-ability *and* low-motivation individuals enter the workforce, incentive schemes may prove effective in mitigating the adverse selection along the ability (Lazear, 2000) but not along the motivation dimension (Jones et al., 2023). In healthcare, control mechanisms such as guidelines may not guarantee that selfish healthcare professionals act in the best interest of the patients (e.g., Werner and Asch, 2007; Roland and Dudley, 2015). Moreover, while one may argue that offering high wages serves as an alternative tool to correct the self-selection of unsuitable candidates, this can actually exacerbate adverse selection by reducing the share of applicants with a strong vocation for the job (e.g., Heyes, 2005). Finally, one cannot necessarily rely on medical school education to foster pro-social attitudes, as it appears to do little to nurture students’ altruism (Attema et al., 2025). The analysis of self-selection is thus particularly important in the healthcare sector.

A correct empirical identification of self-selection requires two key components (e.g., Friebe et al., 2019). First, a sample of individuals that has expressed an interest in entering the labor market under scrutiny but have not yet undergone the screening process. Indeed, if one studies successful applicants—such as health university students or employees—pinning down self-selection and distinguishing it from school or employer screening, as well as from education or training or peer effects, becomes challeng-

¹In the case of publicly provided services, bureaucratic inefficiencies may further hinder the effectiveness of incentive schemes (e.g., Crozier, 1964; Wilson, 1989).

ing² Additionally, eliciting hypothetical job preferences could be problematic, as they may be biased by, e.g., social desirability. In this paper, we therefore consider individuals attending preparatory courses for selective admission tests to medical and healthcare programs (e.g., nursing, obstetrics, physical therapy) in Italy and Austria: these individuals are at a pre-screening stage and demonstrate a real, non-hypothetical interest in becoming health professionals. The second component for a correct identification of self-selection is a group of individuals to whom applicants can be appropriately compared. Since a high school diploma is a prerequisite for admission to medical and healthcare schools in Italy and Austria, our natural comparison group consists of high school graduates from the same geographic area and age cohort (hence they are eligible to apply for the same schools) who, however, state they are interested in pursuing other careers; we refer to them as non-applicants.

Once the two groups needed to properly identify self-selection are available, the next crucial step is determining the relevant characteristics for comparing applicants and non-applicants. One might strive to work in the health sector out of a desire to heal the sick (e.g., Fedele, 2018), or, in the case of doctors, to pursue a prestigious and relatively lucrative career, or simply because it is the field in which their parents or relatives are employed. Indeed, research on intergenerational mobility has provided evidence of the heritability of the medical profession (e.g., Polyakova et al., 2020; Barone and Mocetti, 2021). Moreover, both ability and motivation matter for job performance in healthcare. Health professionals are indeed expected to demonstrate cognitive ability and a commitment to continuous learning (e.g., Miller et al., 2010), as well as pro-sociality and altruism (e.g., Arrow, 1963); additionally they should exhibit compassion (e.g., Malenfant et al., 2022), high levels of work motivation (e.g., Heyes, 2005), and possess specific personality traits, such as a high degree of conscientiousness and a low degree of neuroticism (e.g., Louwen et al., 2023).

Based on the above considerations, we use data from questionnaires and incentivized dictator games to collect detailed information on 670 applicants to medical and healthcare programs in Italy and Austria and 647 non-applicants from the same countries. Our dataset includes measures of cognitive ability (Raven test), altruism (dictator game and other self-reported measures), personality traits (BIG-5), public service motivation (compassion and self-sacrifice), work motivation (intrinsic motivation, identification, and extrinsic motivation), as well as demographic factors such as gender, mother tongue (either German or Italian), and family network (i.e., whether parents/relatives are/were active in the health sector). Overall, 20 covariates and all possible two-way interactions are considered, resulting in 210 potential explanatory variables (20+190). From the initial sample of 1,317 individuals, we excluded subjects with at least one missing covariate and those who answered a control question that should have been left unanswered; this question was included to improve the quality of the questionnaire and screen out participants who answered without reading. From the sample of non-applicants, we also removed those declaring to be interested in a healthcare career. The final sample comprises 998 subjects.

We study which and how the aforementioned covariates influences the likelihood of individuals applying to medical or healthcare schools versus not applying. Given the high dimensionality of the regression

²For example, Ashraf et al. (2020) show that emphasizing financial benefits of healthcare positions attracts high-skilled individuals at the expense of prosocial ones. However, this adverse selection outcome vanishes among successful applicants, due to the employer’s screening process.

model, we employ a machine learning approach based on Lasso (Chernozhukov et al., 2016a,b) to select the variables that explain self-selection into the health professions. We then estimate the magnitude of those variables' effects using logit regressions. Our findings can be summarized as follows. Individuals who exhibit the following characteristics have a higher likelihood of applying to a career in the healthcare sector: (i) higher cognitive ability, (ii) greater altruism, (iii) higher conscientiousness, and (iv) lower neuroticism. By contrast, compassion appears to play no role. Some interesting differences arise between the applicants to medical schools and the applicants to healthcare schools. First, cognitive ability is particularly important for prospective doctors, whereas conscientiousness matters a lot for aspiring healthcare professionals. Second, two dictator games have been administered to participants, one with the recipient Doctors Without Borders (MSF), a charity serving a medical cause, and the other with World Wide Fund for Nature (WWF), which focuses on environmental issues. Interestingly, donations to both charities predict the decision to apply to healthcare schools, whereas only donations to MSF are relevant for aspiring medical doctors; this suggests that the latter show specific 'health-related' altruism, while applicants to healthcare schools display more 'general' altruism. Third, having parents who are or were doctors matters for applicants to medical schools, whereas having parents who are or were health professionals does not influence applications to healthcare schools. Finally, individuals with stronger identification (i.e., those who value their prospective health job because it enables them to contribute to a societal goal, such as treating and caring for sick people) are more likely to apply to medical schools but not to healthcare ones. The interacted covariates selected by the Lasso procedure highlight gender and cultural differences (i.e., between groups having German or Italian as mother-tongue); for instance, being more conscientious matters more for female applicants than for male ones. All in all, our results show that applicants to healthcare careers exhibit several personal characteristics that are deemed desirable in health professionals. They also highlight the importance of having parents who are medical doctors in influencing the choice to pursue the same path.

To the best of our knowledge, this paper is the first to empirically investigate self-selection into health professions. Our finding that the 'right' individuals are drawn to the profession represents a valuable and reassuring contribution, as it fulfills a necessary condition for building a high-quality healthcare workforce. Compared to the existing research on self-selection, which we review below and which typically elicits hypothetical job choices or relies on university students or workers, we consider individuals making real choices who have not yet undergone screening, specialized education, or training. As such, our analysis follows Friebe et al. (2019) and, as mentioned above, more effectively pinpoints self-selection. Friebe et al.'s experimental study considers police applicants in Germany and compares them to high school graduates from the same region and age cohort who have not applied to the police. The authors pre-select *ex-ante* two desirable characteristics for police officers, namely trustworthiness and a willingness to enforce norms of cooperation, and find evidence of positive self-selection along these dimensions. Focusing on healthcare, our analysis makes two contributions. First, healthcare jobs seem to be more diverse than in policing, as they encompass various categories (e.g., general medical practitioners or specialists, mental health professionals, nursing, midwifery, allied health professionals), along with roles in research, policy, public health, and education. To account for this heterogeneity, our range of potential determinants of

self-selection is somewhat broader than that of [Friebel et al. \(2019\)](#). In particular, we include cognitive ability, justified by the necessity of continuous learning for healthcare professionals to deliver high-quality care, and family network, reflecting the presence of occupational heritability in medicine; we also allow for a wider range of motivational and personality traits. Second, given our broader set of potential determinants, we do not preselect any variables *ex ante*. Instead, we employ machine learning approach to identify the relevant covariates driving the self-selection into healthcare professions.

Related literature. Our paper relates to three streams of literature; in what follows, we outline these streams and highlight our contributions to, or differences from, each. The first stream of literature our paper contributes to analyzes factors that drive self-selection into different professions. [Gill et al. \(2023\)](#) and [Holmén et al. \(2023\)](#) consider the financial sectors in Germany and Sweden, respectively, and report less trustworthy individuals aspiring to work in finance. [Schneider et al. \(2024\)](#) consider so-called immoral industries in Switzerland (e.g., gambling, monetary intermediation, and weapons) and find similar results. [Banerjee et al. \(2015\)](#) and [Hanna and Wang \(2017\)](#) find that less honest students aspire to become public servants in India, while [Barfort et al. \(2019\)](#) report the opposite for Denmark. [Serra et al. \(2011\)](#) and [Kolstad and Lindkvist \(2013\)](#) explore self-selection in the health sectors of Ethiopia and Tanzania, respectively; they find that among students enrolled in medical and nursing programs, those who prefer to work in the public health sector exhibit stronger pro-social preferences than those interested in the private for-profit health sector. [Li \(2018\)](#) report that less altruistic US medical students are more likely to choose high-income specialties. As already mentioned, some of these contributions elicit hypothetical job choices, and all rely on university students or workers; doing so, they are less effective in identifying self-selection compared to the present paper and [Friebel et al. \(2019\)](#).

Second, our findings relate to a growing body of experimental literature exploring how financial incentives influence the characteristics of individuals willing to enter labor markets where social preferences and motivation affect performance. [Deserranno \(2019\)](#) finds that expectations of higher earnings discourage prosocial candidates from applying for an NGO position that encompasses commercial and health promotion activities in Uganda. By contrast, [Dal Bó et al. \(2013\)](#) report that higher salaries for civil service jobs attract more competent and more motivated candidates.³ [Ashraf et al. \(2020\)](#) run a field experiment within a nationwide recruitment drive for a new health care position in Zambia to test whether career benefits attract competent individuals at the expense of prosocially motivated ones. A different focus is provided by [Bernhofer et al. \(2025\)](#), who consider individuals that have already decided to apply for a healthcare career but have not yet been admitted, to explore how financial incentives affect their performance on admission tests. In these papers, both the treatment and the control groups include individuals that are interested in applying to the job under scrutiny. Our approach is different because, in order to pinpoint self-selection, the comparison group consists of individuals who are *not* interested in a healthcare career.

Finally, we relate to the health economics literature that estimates the altruistic preferences of healthcare students and professionals, as well as those of non-healthcare students. Experimental settings typi-

³This advantageous selection outcome aligns with the theoretical predictions of [Fedele \(2018\)](#), who explores the nursing sector.

cally use modified dictator games where altruism is measured by the trade-offs between own and other’s payoffs. Some experiments report higher altruistic motivation of medical compared to non-medical students, e.g., [Hennig-Schmidt and Wiesen \(2014\)](#); [Brosig-Koch et al. \(2016, 2024\)](#). Employing [Fisman et al.’s \(2007\)](#) experimental paradigm with graphical representations of dictator games, [Li et al. \(2017\)](#) find that US medical students are less altruistic and more efficiency focused than the general population. Using the same experimental paradigm, [Li et al. \(2022\)](#) show that US physicians are more altruistic than medical students. [Huang et al. \(2025\)](#) link measures of altruism to physicians’ drug prescriptions patterns. [Attema et al. \(2023\)](#) test how medical education relates to German medical students’ patient-regarding altruism. They find that patient-regarding altruism is highest among freshmen, declines during medical studies, and increases again in the final year, when students assist in clinical practice. [Attema et al. \(2025\)](#) explore the stability of social preferences in medical students using a longitudinal experiment. None of these studies, however, looks at altruism as a potential determinant of self-selection into healthcare or medical studies, which is the focus of our analysis.

2 Sample, institutional background, and methods

In this section, we first describe our sample and the institutional background. We then provide details about the questionnaire. Finally, we spell out our empirical approach.

Sample and institutional Background. Our sample comprises two different sets of individuals: (i) high-school graduates applying to medical and healthcare schools;^{[4](#)} (ii) a representative sample of high-school graduates from the same geographic area and age cohort who do not apply to medical and healthcare schools.

Specifically, the first group consists of high-school graduates attending admission test preparatory courses offered by *Movimento Universitario Altoatesino* (MUA; South Tyrolean University Movement) and *Südtiroler Studierendenvertretung* (SH.ASUS; South Tyrolean Students Representation), two student organizations located in Bolzano-Bozen, South Tyrol, Italy, where Italian and German are the two official languages. MUA offers a course in Italian for students preparing to enter Italian medical schools, as well as two courses, one in Italian and one in German, for prospective health professionals, primarily targeting the local bilingual healthcare school. SH.ASUS organizes a course in German for students aiming to enter Austrian medical schools. We launched the first wave of a paper-based questionnaire to applicants for Italian medical and healthcare schools in the summer of 2018. Three additional waves followed in 2019, 2020, and 2021, also including applicants to Austrian medical schools, for a total of 670 individuals, 55% (369) of whom are medical school applicants and 45% (301) are healthcare school applicants.^{[5](#)} In Italy, applicants to these schools are selected on the sole basis of their score on two different tests, one for medicine and one for the other healthcare professions; the same occurs for Austrian medical schools. Overall, we administered the questionnaire to four distinct groups of applicants: prospective physicians

⁴Healthcare specialties include Physical Therapy, Nursing, Obstetrics, Speech Therapy, Nutritional Therapy, Occupational Therapy, Prevention Techniques, Biomedical Technology, Dental Hygiene, and Medical Radiation Technology.

⁵Due to the pandemic, in 2020 we switched from the paper-based version to a digital version that was designed using the software Qualtrics.

and health professionals attending courses in Italian, who received the questionnaire in Italian, and prospective physicians and health professionals attending courses in German, who received it in German.

In 2020, our questionnaire was administered online to a representative sample of 18-19 year-old individuals with high-school diploma from Northern Italy (including South Tyrol) and Austria. 647 participants were selected by the survey companies SWG, which administered the questionnaire in Italian to the Italian sample, and Gallup, which administered the questionnaire in German to the Austrian population.

As mentioned in the introduction, we excluded subjects with at least one missing covariate (181 subjects) and those who failed an attention test (68 subjects), as well as, from the sample of non-applicants, those declaring to be interested in a healthcare career (70 subjects). The final sample thus includes 998 subjects.

Questionnaire. We combine experimental and survey measures to elicit relevant information on the respondents. Table [1](#) provides the list of 20 covariates we use in our analysis, while Appendix [A](#) provides the full questionnaire. We are interested in understanding whether applicants and non-applicants differ in terms of altruism, personal characteristics like cognitive ability, motivation, and personality traits, as well as family background. We are also interested in exploring gender and cultural differences.

We measure altruism with two batteries of questions. First, we administer two dictator games: as mentioned, one with MSF as the recipient and the other with the WWF; the order of the recipients is randomized. The dictator game is incentivized for applicants, with two participants per group (30 in total) randomly selected to actually receive the money (100 Euros); it is instead not incentivized for non-applicants. Second, we ask questions involving self-reported measures of altruistic actions related to financial donations, blood donations, and volunteering in the past 12 months.

Moving on to personal characteristics, the questionnaire contains a measure of cognitive ability, defined as the number of correct answers in the 12-item Raven’s Standard Progressive Matrices Test (Set E, [Raven and Court, 1998](#))⁶. We also collect self-reported school grades, but do not use them as they are difficult to compare across schools and countries. We include variables for personality traits, stemming from the 10-item BIG-5 questionnaire ([Gosling et al., 2003](#); [Guido et al., 2015](#)): *neuroticism* is the personality trait associated with negative emotions, such as anxiety, depression, and self-doubt; *extraversion* is instead related to positive emotions, such as excitability, sociability, and talkativeness; *openness* assesses how creative, open-minded, and imaginative a person is; *conscientiousness* is related to responsibility, carefulness, and diligence; finally, individuals scoring high on *agreeableness* are kind, helpful, generous, trusting, and trustworthy.

In terms of motivation, we distinguish several types. First, we construct public service motivation measures using a subset of the Public Service Motivation questionnaire based on [Perry and Wise \(1990\)](#) and developed by [Perry \(1996\)](#): *compassion* is the willingness to identify others’ well-being and help

⁶Raven’s standard progressive matrices test is a visual task of abstract reasoning aimed at quantifying cognitive skills such as reasoning and problem-solving. The test requires examinees to infer a rule to generate the next items in a series, or to determine whether a presented design is consistent with the rule ([Leavitt, 2011](#)). Set E is the most difficult one among five sets and it was selected after validation with first-year undergraduate students in the bachelor’s program in Economics and Management, Free University of Bozen-Bolzano; the other, simpler sets did not provide sufficient variation in the number of correct answers across students.

those in need; *self-sacrifice* is the willingness to substitute service to others for tangible personal rewards.⁷ Second, work motivation measures derives from the 9-item Motivation at Work Scale (MAWS) questionnaire based on [Deci and Ryan \(1985\)](#) and proposed by [Gagné et al. \(2010\)](#): *intrinsic motivation* refers to doing a job because it is interesting and enjoyable; in case of *identification*, a job is valued by an individual because it helps reaching a good societal goal; *extrinsic motivation* refers to doing a job simply to get rewards or avoid punishments. Personality traits and motivational items are all measured through 5-point Likert scales.

To measure the dynastic component, we ask respondents whether they have at least one parent and/or one relative (grandparents, aunts, uncles, siblings) working/having worked as a physician or health professional. For medical school applicants, we inquire only about physicians, while for healthcare school applicants, we focus solely on health professionals. In contrast, for non-applicants, we ask about both physicians and health professionals.

Finally, we examine the role of gender and language, the latter defined by the language of the questionnaire, either German or Italian, administered to each respondent. In Table [1](#) we indicate the scale of the covariates, and in Table [2](#) we provide their descriptive statistics. In conducting the empirical analysis, however, we standardize all non-dichotomous variables to facilitate the interpretation and the comparison among the estimated coefficients. The standardization occurs by subtracting the mean and dividing by the standard deviation.

Empirical approach. We have 20 covariates and account for all possible two-way interactions, resulting in a total of $20 + \frac{20!}{2!(20-2)!} = 210$ potential explanatory variables. The dependent variable is binary, indicating whether an individual applies to medical or healthcare schools, or does not apply. Given the high dimensionality of this logistic regression model, we employ a machine learning approach to select variables and estimate coefficients ([Chernozhukov et al., 2018](#)).

The estimation implements the double-selection approach of [Belloni et al. \(2014\)](#) that allows to perform valid inference based on model-selection with Lasso. In particular, we perform the estimation in R using `rlassologit`, which is provided in the `hdm` package ([Chernozhukov et al., 2016a,b](#)). The `rlassologit` command prompts a logistic regression with Lasso regularization, a penalized likelihood estimation approach. Following [Belloni et al. \(2013\)](#), we perform statistical inference on β , representing the impact of the covariates on a binary outcome. The estimation is based on the (negative) log-likelihood function associated with the logistic function:

$$\Delta_i(\beta) = \log\{1 + \exp(\beta X')\} - Y_i(\beta X').$$

The binary variable Y indicates either applicants ($Y = 1$) or non-applicants ($Y = 0$), while X indicates the set of regressors outlined in Table [1](#).

Lasso minimizes the forecast error but introduces bias in the estimated coefficients, because it penalizes the absolute values directly. For this, we use post-Lasso, which consists of running a logit regression on the covariates selected by Lasso to debias the coefficients (e.g., [Belloni et al., 2014](#)). Following ([Belloni](#)

⁷The full Public Service Motivation questionnaire includes additional items related to, for example, attraction to policy-making and civic duty, that we considered of less direct relevance to the health sector.

Table 1: List of covariates

Variable	Description	Scale
<i>Experimental measures of altruism</i>		
Donation to MSF	Monetary amount (in Euro) donated to Médecins sans frontières (MSF)	[0,100]
Donation to WWF	Monetary amount (in Euro) donated to World Wide Fund (WWF)	[0,100]
<i>Self-reported measures of altruism</i>		
Financial donation	Binary variable indicating financial donation	{0,1}
Blood donation	Binary variable indicating blood donation	{0,1}
Volunteering	Binary variable indicating volunteering activity	{0,1}
Cognitive ability	Number of correct answers in Raven test	[0,12]
<i>Personality traits</i>		
Neuroticism	(pers4r + pers9)/2	[1,5]
Extraversion	(pers1r + pers6)/2	[1,5]
Openness	(pers5r + pers10) /2	[1,5]
Conscientiousness	(pers3r + pers8) /2	[1,5]
Agreeableness	(pers2 + pers7r)/2	[1,5]
<i>Motivational measures</i>		
Compassion	(PSM1+PSM2+PSM3+PSM4)/4	[1,5]
Self-sacrifice	(PSM5+PSM6+PSM7+PSM8)/4	[1,5]
Extrinsic motivation	(MAWS2+MAWS6+MAWS9)/3	[1,5]
Identification	(MAWS3+MAWS5+MAWS10)/3	[1,5]
Intrinsic motivation	(MAWS1+MAWS4+MAWS7)/3	[1,5]
<i>Family network, language, gender</i>		
Parents	Binary variable indicating if parents are physicians [for medical school applicants]/other healthcare professionals [for healthcare school applicants]	{0,1}
Relatives	Binary variable indicating if grandparents/aunts/uncles/siblings are physicians [for medical school applicants]/other healthcare professionals [for healthcare school applicants]	{0,1}
German	Binary variable indicating German speakers	{0,1}
Female	Binary variable indicating female gender	{0,1}

Notes. For the full set of items of the questionnaire, see Table [A.1](#) in Appendix [A](#).

[et al., 2014], we choose a theory-driven penalty λ . The `hdm` approach for logistic regression includes the initial estimation of the regression function via post-lasso logistic regression [Chernozhukov et al., 2018].

In the next section, we first report some descriptive statistics and then discuss the results of implementing this empirical approach.

3 Results

Descriptive statistics. Table 2 presents the descriptive statistics for all covariates, separately analyzed for non-applicants, healthcare school applicants, and medical school applicants.

We observe substantial differences between applicants and non-applicants. In particular, the experimental measures of altruism indicate that applicants donate substantially more to MSF and to WWF than non-applicants. This difference is likely to be underestimated, as only applicants participate in an incentivized dictator game where actual money is donated; it is well-known that individuals tend to be less generous when actual money is at stake (for a meta-analysis, see [Larney et al., 2019]). Moreover, while non-applicants display very similar donations to MSF and WWF (47 vs. 44 EUR), there is quite a difference for medical-school applicants (72 vs 64 EUR) and, to a lesser extent, healthcare-school applicants (72 vs 67 EUR), showing how their altruism is particularly oriented towards health-related issues, as one would expect for people willing to undertake such a career. The recent meta-analysis by [Umer et al., (2022)] show that donations for charity recipients generally fall in the 40% to 60% range. On this basis, our descriptive statistics point to relatively high altruism of applicants. Perhaps surprisingly, applicants appear less likely to report making financial and blood donations, while self-reported volunteering is higher.

Cognitive ability is remarkably higher for medical school applicants and, to a lesser extent, those applying to healthcare schools. Also personality traits (especially neuroticism and conscientiousness) and motivational measures (especially, identification) seem to differ between applicants and non-applicants.

As for basic demographics, we observe that 70% of medical school applicants are females and 38% are German speakers (i.e., they are administered the questionnaire in German). Among the healthcare school applicants, 83% are females and 57% are German speakers. Finally, 57% of non-applicants are females and 41% are German native speakers.⁸ Importantly, the share of German native speakers in the non-applicants' sample is not in itself informative, as it simply reflects the relative sizes of the Austrian and Northern Italian subsamples.

The percentage of females among medical school applicants is in line with national data in Italy.⁹ Furthermore, a recent study by the Italian National Federation of Nursing Professions Guilds (FNOPI) reveals that 76% of active nurses are women, which is consistent with our descriptive statistics.¹⁰ Finally, regarding family network, applicants are more likely than non-applicants to have parents or relatives who are/were active in the health sector.

⁸The average age of the three groups is rather similar, as expected: 18.91 for medical school applicants (s.d., 1.31), 20.50 for healthcare school applicants (s.d., 3.55), and 18.51 (s.d., 0.50) for non-applicants.

⁹A survey conducted by MedCampus in 2023 shows that 68% of Italian medical school applicants were women. For a succinct report of the survey results, see: <https://www.dottnet.it/articolo/32534013/si-avvicina-il-test-di-medicina-2-studenti-su-3-sono-donne>.

¹⁰For the FNOPI study, see: <https://www.fnopi.it/2024/03/08/8-marzo-infermiere-3/>.

Table 2: Descriptive statistics

	Non-applicants ($N = 489$)		Healthcare school applicants ($N = 219$)		Medical school applicants ($N = 290$)	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Donation to MSF	47.17	33.29	72.21	26.33	71.65	28.82
Donation to WWF	44.47	32.22	67.33	28.27	64.40	30.51
Financial donation	0.38	0.48	0.28	0.45	0.32	0.47
Blood donation	0.16	0.36	0.08	0.27	0.11	0.32
Volunteering	0.31	0.46	0.46	0.50	0.49	0.50
Cognitive ability	5.43	3.45	7.09	2.73	8.26	2.92
Neuroticism	3.15	0.88	2.74	0.84	2.72	0.84
Extraversion	3.03	0.91	3.39	0.83	3.22	0.88
Openness	3.48	0.96	3.56	0.88	3.56	0.91
Conscientiousness	3.31	0.78	3.93	0.70	3.90	0.71
Agreeableness	3.08	0.79	3.41	0.73	3.37	0.74
Compassion	3.65	0.76	3.74	0.51	3.78	0.54
Self-Sacrifice	3.29	0.82	3.37	0.58	3.58	0.60
Extrinsic motivation	3.59	1.05	3.20	0.80	3.38	0.86
Identification	4.03	0.89	4.29	0.59	4.50	0.50
Intrinsic motivation	4.16	0.89	4.36	0.54	4.54	0.43
Female	0.54	0.50	0.83	0.38	0.70	0.46
German	0.41	0.49	0.57	0.50	0.38	0.49
Parents (doctors)	0.06	0.24			0.14	0.34
Relatives (doctors)	0.22	0.42			0.28	0.45
Parents (health professionals)	0.14	0.35	0.24	0.42		
Relatives (health professionals)	0.30	0.46	0.34	0.47		

Beyond the measures discussed in the introduction that were included in the questionnaire, we refrain from making additional conjectures regarding the drivers of self-selection into the health sector. Rather, we let the machine learning approach select the relevant determinants. We begin by comparing medical school applicants to non-applicants. We then shift our focus to healthcare school applicants. While both applicant groups clearly share an interest in the health sector, their professional paths differ significantly. The medical profession is more prestigious, more financially rewarding and more demanding in terms of length of studies than other health professions; as such, it may require distinct characteristics. We therefore analyze the two groups separately.

Applicants to medical schools versus non-applicants. We now describe the findings of the machine learning approach to the analysis of self-selection into medical studies. The results of the Lasso for logistic regression are visualized in Figure 1a without interactions among covariates and in Figure 1b with interactions included. Our aim is to first explore which and how covariates relate to the decision to apply to medical school using a simple specification; we then refine our analysis by incorporating interactions, which allow for heterogeneity.

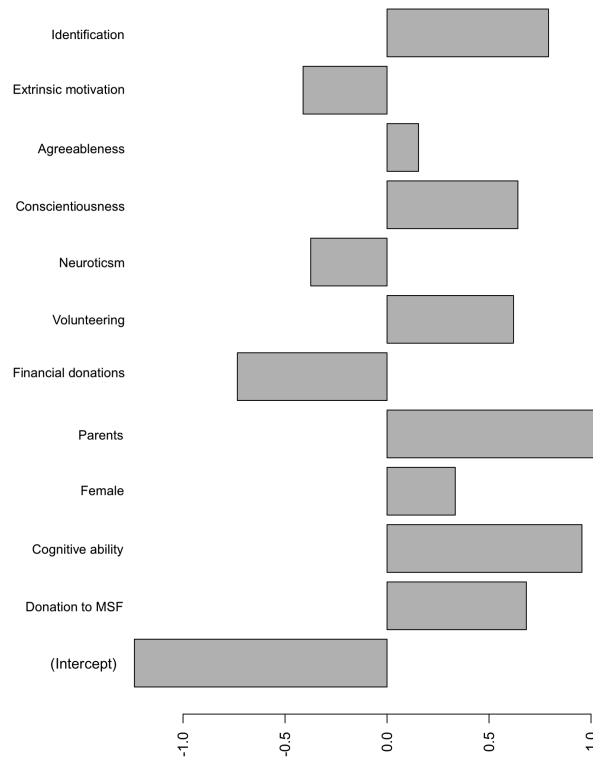
Starting with Figure 1a we find that the variables yielding non-zero coefficients capture individuals' altruism: donations to MSF and self-reported volunteering activity positively relate to the decision to apply to medical school. Stating to have done a financial donation is negatively related. More extrinsically motivated individuals are less likely to apply to medical school. Personality traits seem of importance: *Agreeableness* and *Conscientiousness* positively relate to the decision to apply to medical school, while *Neuroticism* shows a negative relationship. Having parents who worked or are still working as physicians

is positively associated with self-selection into medical schools; the same applies to female applicants. Finally, we observe a positive relationship between identification and cognitive ability, on the one hand, and the likelihood of applying to medical school, on the other hand.

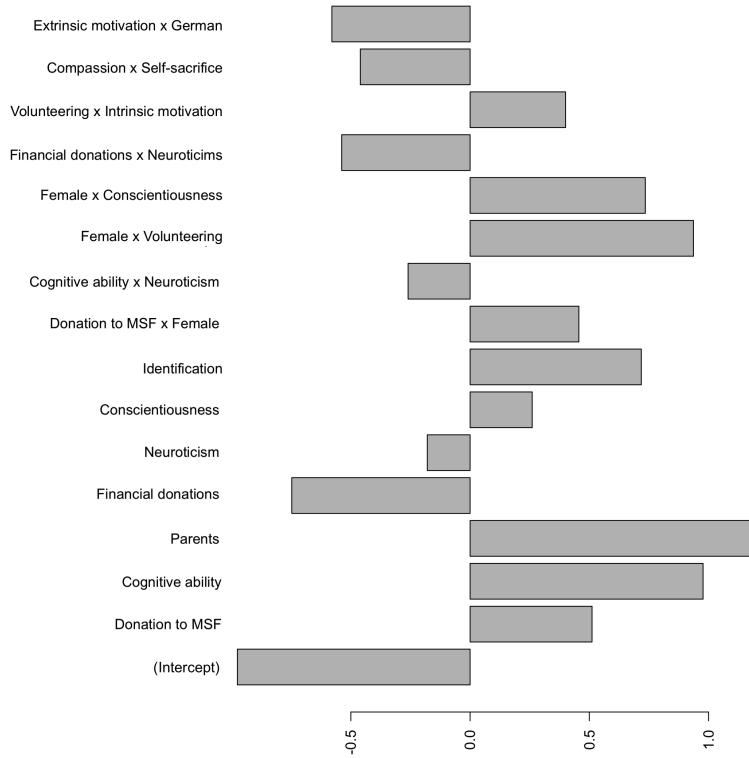
When including two-way interaction terms, Figure 1b shows that the non-zero coefficients and their signs are generally consistent with those in Figure 1a. An additional insight seems to be the presence of gender and cultural differences in the self-selection process, as four interactions selected through the Lasso procedure involve gender and language. CONSCIENTIOUSNESS and DONATION TO MSF are selected non-interacted and when being interacted with FEMALE meaning that being conscientious and donating to MSF matter more for female applicants to medical schools than for male applicants. Instead, VOLUNTEERING is only selected when interacted with FEMALE: self-reported volunteering activities matter only for females. Similarly, EXTRINSIC MOTIVATION appears only when interacted with GERMAN: extrinsically motivated individuals are less likely to apply only among German speakers.

Table 3 presents the average marginal effects from the double Lasso for logistic regressions. The baseline probabilities for applying to medical (and healthcare) schools are not inherently meaningful. In fact, the negative intercept coefficients shown in Figure 1 (and Figure 2) simply reflect that the number of applicants to medical (and healthcare) schools is smaller than the number of non-applicants in our sample. Therefore, the insight lies in the relative, rather than absolute, size of the coefficients. Cognitive ability has the largest coefficient magnitude among the standardized variables; see models (1) and (2). The combined effect of the two statistically significant personality traits is comparable in magnitude in model (1), meaning that a one-standard-deviation increase in conscientiousness and a one-standard-deviation decrease in neuroticism together have a similar impact to a one-standard-deviation increase in cognitive ability. Identification also matters, along with donations to MSF. Having parents who are or were physicians appears to be important, as the coefficient is significant and relatively large. Volunteering plays a role in model (1) and, in model (2), only for females and for individuals with stronger intrinsic motivation. Being conscientious matters in model (1), and it matters more for females in model (2).¹¹ Finally, financial donations are associated with a reduced likelihood of applying to medical schools, particularly among individuals with higher levels of neuroticism. This finding appears somewhat inconsistent with the evidence for prosocial motivations (e.g., positive coefficient of the DONATIONS TO MSF). However, we do not consider this discrepancy to be particularly relevant. First, the measure of FINANCIAL DONATION is based on a question (“Have you donated money to charitable organizations in the last 12 months?”, with yes/no as possible answers), which lacks the precision and experimental rigor of the dictator game. Second, as a self-reported variable, it may be subject to biases not present in the incentivized design of the dictator game. Third, the estimated effect of FINANCIAL DONATION is only marginally significant when compared to the more robust parameter associated with DONATION TO MSF.

¹¹The negative coefficient for the interaction between compassion and self-sacrifice is difficult to interpret.



(a) Basic model



(b) Model with two-way interactions

Figure 1: Non-zero coefficients selected through Lasso for medical-school applicants

Table 3: Drivers of application to medical schools

Variable	(1)	(2)
Donation to MSF	0.091*** (0.014)	0.063*** (0.023)
Financial donation	-0.098* (0.050)	-0.092* (0.051)
Volunteering	0.082** (0.034)	
Cognitive ability	0.127*** (0.013)	0.121*** (0.013)
Neuroticism	-0.050*** (0.013)	-0.022 (0.017)
Conscientiousness	0.085*** (0.015)	0.032 (0.022)
Agreeableness	0.021 (0.016)	
Extrinsic motivation	-0.055** (0.023)	
Identification	0.105*** (0.019)	0.089*** (0.021)
Female	0.045 (0.037)	
Parents	0.172** (0.067)	0.146** (0.066)
Donation to MSF \times Female		0.056 (0.034)
Female \times Volunteering		0.116*** (0.034)
Female \times Conscientiousness		0.091*** (0.030)
Cognitive \times Neuroticism		-0.032 (0.020)
Financial donation \times Neuroticism		-0.066** (0.035)
Volunteering \times Intrinsic motivation		0.049** (0.032)
Compassion \times Self-sacrifice		-0.057** (0.028)
Extrinsic motivation \times German		-0.072 (0.031)
Intercept	-0.165*** (0.034)	-0.120*** (0.025)

Notes: Estimates are average marginal effects from Lasso logistic regression models using `rlassologit()` with bootstrapped standard errors ($N = 779$). *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

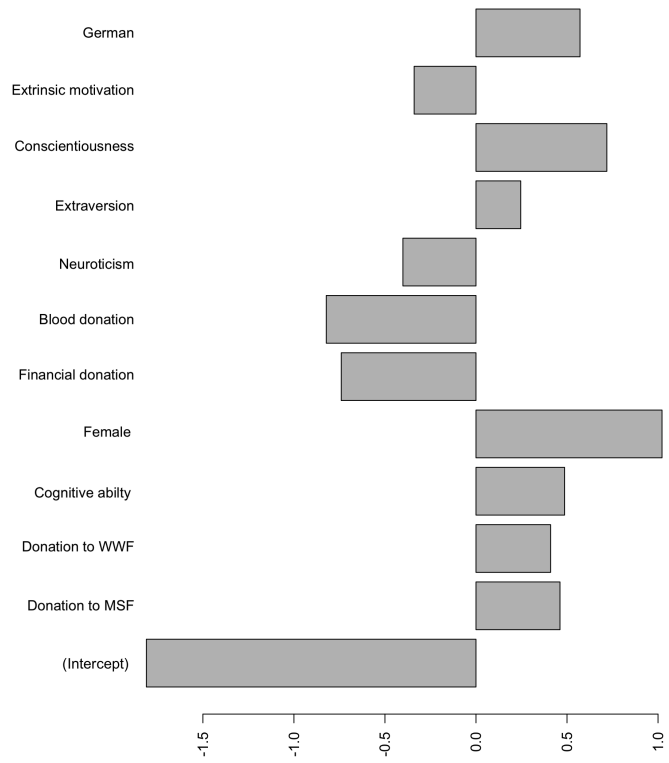
Applicants to healthcare schools versus non-applicants. The covariates explaining self-selection into healthcare schools, as identified by our Lasso approach, are similar to those found in medical schools: comparing Figure 2a with 1a, seven variables appear with the same sign in both cases, namely COGNITIVE ABILITY, DONATION TO MSF, CONSCIENTIOUSNESS, NEUROTICISM, EXTRINSIC MOTIVATION, FINANCIAL DONATION, and FEMALE. However, some relevant differences arise. Self-reported BLOOD DONATIONS are selected, with a negative sign. Being German also appears, though, as mentioned, this variable has no meaningful interpretation when not interacted with other covariates. Most interestingly, DONATION TO WWF is selected, unlike for applicants to medical schools, while parental background in health professions no longer plays a role.

When allowing for two-way interactions among covariates, Figure 2b displays gender and cultural differences in that five selected interacted variables include gender and three include language. Specifically, there seems to be stronger (positive) selection along the conscientiousness dimension for women compared to men, while only German speakers with high extrinsic motivation are less likely to apply.

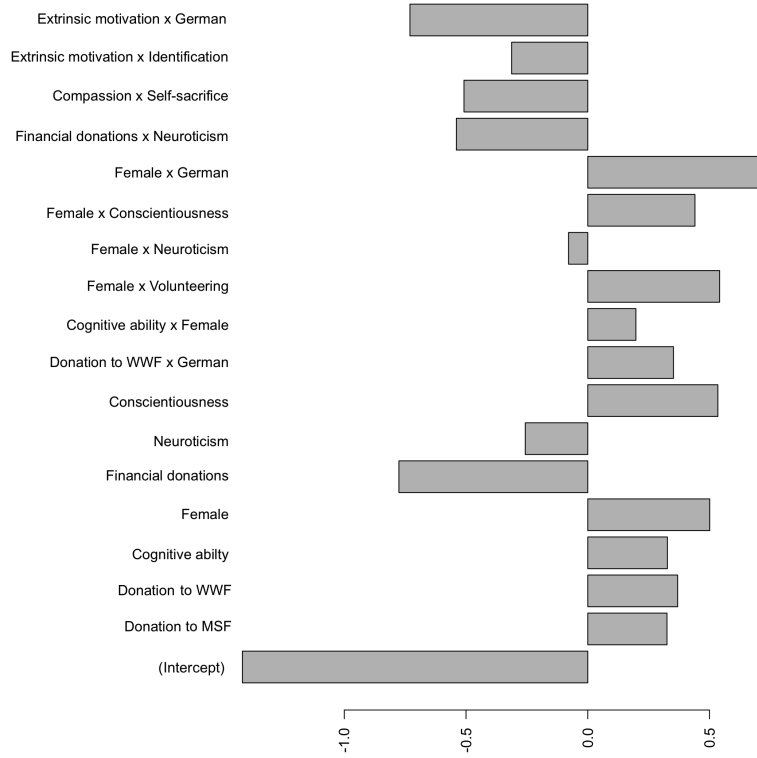
Looking at the average marginal effects presented in Table 4, model (1) shows that, among standardized variables, the largest coefficient is associated with CONSCIENTIOUSNESS, followed by COGNITIVE ABILITY and DONATIONS TO MSF. DONATIONS TO WWF and, with a negative sign, NEUROTICISM and EXTRINSIC MOTIVATION, have smaller magnitude.

Coming to dummy variables, females are more likely to apply to healthcare schools: this aligns with the descriptive statistics, which show that 83% of applicants to healthcare schools are female. Among the three other dummy variables selected by the Lasso approach in model (1) – GERMAN, BLOOD DONATION, and FINANCIAL DONATION – only the last one is (marginally) significant and selected in the two-way interacted model (2). Apart from this, including two-way interactions in the Lasso approach does not substantially alter the selection of non-interacted covariates.

However, model (2) show some gender-specific and language-related effects. Females with higher conscientiousness scores and reporting volunteering activity are more likely to apply to healthcare schools than males. Regarding language, individuals with high extrinsic motivation are even less likely to apply when being German speakers. The interaction FEMALE \times GERMAN shows that German-speaking females are more likely to apply than Italian-speaking ones. In conclusion, the negative and significant parameter associated to EXTRINSIC MOTIVATION \times IDENTIFICATION reveals that individuals with strong identification are less likely to apply when they are also interested in financial remuneration.



(a) Basic model



(b) Model with two-way interactions

Figure 2: Non-zero coefficients selected through Lasso for healthcare school applicants

Table 4: Drivers of application to healthcare schools

Variable	(1) Baseline	(2) With Interactions
Donation to MSF	0.062*** (0.021)	0.040** (0.020)
Donation to WWF	0.055** (0.021)	0.045* (0.023)
Financial donation	-0.099** (0.049)	-0.094* (0.050)
Blood donation	-0.110 (0.070)	
Cognitive ability	0.065*** (0.015)	0.040* (0.022)
Neuroticism	-0.054*** (0.016)	-0.031*** (0.024)
Extraversion	0.033 (0.021)	
Conscientiousness	0.096*** (0.016)	0.065** (0.026)
Extrinsic motivation	-0.046*** (0.015)	
Female	0.137*** (0.035)	0.061 (0.039)
German	0.077** (0.038)	
Donation to WWF \times German		0.043 (0.034)
Cognitive ability \times Female		0.024 (0.026)
Female \times Volunteering		0.066* (0.036)
Female \times Neuroticism		-0.010 (0.022)
Female \times Conscientiousness		0.053* (0.032)
Female \times German		0.085** (0.034)
Financial donation \times Neuroticism		-0.066 (0.043)
Compassion \times Self-sacrifice		-0.062*** (0.023)
Extrinsic motivation \times Identification		-0.038** (0.017)
Extrinsic motivation \times German		-0.089*** (0.022)
Intercept	-0.243*** (0.036)	-0.172*** (0.029)

Notes: Estimates are average marginal effects from Lasso logistic regression models using `rlassologit()` with bootstrapped standard errors ($N = 708$). *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4 Discussion and Conclusions

Understanding the characteristics that influence high school graduates' self-selection into health professions is an important issue for health policymakers and researchers alike. Our study focuses on Italy and Austria, examines medical and healthcare school applicants who demonstrated their interest in health professions by participating in preparatory courses for admission tests, and compare them to non-applicants along many dimensions. We find that applicants feature substantially higher levels of altruism, conscientiousness, and cognitive ability, while they exhibit lower neuroticism. Moreover, for medical school applicants, a stronger identification with societal goals is a main motivator to apply. Overall, our findings indicate that medical and healthcare schools are successful in attracting high-school graduates with desirable characteristics, i.e., traits that are valued across various organizations, particularly in the health sector, where ex-post employee monitoring is often ineffective or cumbersome.

In light of the prevailing shortage of healthcare workers, discussions on reforming medical and healthcare school admission criteria often focus on expanding the number of seats or introducing financial incentives for healthcare workers, such as performance-based payments. However, our analysis suggests that these measures may alter a self-selection process based on propitious characteristics. For example, one could imagine that making financial incentives highly salient might attract fewer prosocial applicants (e.g., [Deserranno, 2019](#)). So far, Italy and Austria appear to be successfully managing the matching mechanism between applicants and medical and healthcare schools and organizations, as reflected in our results.

We also find that a significant driver for medical school applicants is whether parents had been working as doctors. [Polyakova et al. \(2020\)](#) examined the occupational heritability in medicine and changes in heritability in Sweden. In line with our descriptive statistics, they show that 14% of physicians had a parent who was also a physician, with a tendency for this number to increase in recent years. Assessing the desirability of self-selection based on family ties to the medical profession is challenging, as the impact of such ties on the quality of care provided by physicians remains largely unexplored. Early exposure to the medical environment through parents or relatives may help students develop a clearer understanding of what a medical career entails, potentially leading to a better job match. Conversely, the decision to pursue medicine might stem from parental pressure or nepotism rather than genuine vocation, which could have negative consequences. Our findings reinforce the need for a deeper understanding of this dimension.

Gender also plays an important role in applications to healthcare schools, with women being more likely to apply; this possibly suggests that women perceive healthcare professions as more aligned with their interests and values. By contrast, medical school applications appear to be more gender-neutral, potentially reflecting a shift toward gender parity in the profession and a balanced appeal to all genders. A deeper understanding of these patterns could inform initiatives aimed at promoting diversity and equity in healthcare education.

Our study is not without limitations. As with many empirical studies, the extent to which our findings generalize to other contexts is not immediately clear. One potential concern is that our samples are

rather specific, questioning the external validity of the results. However, on established measures such as personality traits, motivation, and altruism, our sample aligns well with those used in other studies. Descriptive statistics for the five personality traits are indeed quite similar to other adult samples in Western societies, for example, the US population (e.g., [Soto and John, 2017](#)) and to a sample of German medical and non-medical students and physicians (e.g., [Attema et al., 2023, 2025](#); [Brosig-Koch et al., 2025](#)). Measures from the MAWS questionnaire are comparable to samples of health professionals from Italy ([Portoghese et al., 2020](#)) and health and social workers from other Western countries such as Sweden and the US (e.g., [Hsieh et al., 2012](#); [Jungert et al., 2013](#)). As mentioned, the donation levels reported for our non-applicants are consistent with the average values in [Umer et al. \(2022\)](#), a recent meta-analysis that reviews dictator games involving both unearned endowments, like in our case, and earned ones.

Taken together, our results indicate a positive selection of applicants into the health professions. In general, the extent to which institutional and cultural aspects – such as the precise role and tasks health professionals have in society as well as the combination of rewards and benefits together with career and training possibilities – influence these results in other countries is a fascinating question for future research. Addressing this would require a similar design with a cross-country perspective, a challenge we hope to explore in future research.

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A Questionnaire

Instructions. Hello! This questionnaire, which will take around 20 minutes to complete, is about decision-making processes. We highly appreciate your time and contribution. You will be asked to answer a number of questions. If something is not clear, feel free to ask anytime. The questionnaire contains two parts: A and B.

Part A (Raven Test). You have 8 minutes to answer the 12 questions in this test: You will be asked to complete a series of figures.^[12]

¹²The Raven Test is copyrighted, so the questions cannot be reported here: different editions of the *Manual for the Raven’s Progressive Matrices* can be found, e.g., at the following link: <http://www.johnraven.co.uk/pubs/manual/manual.html>

Part B. Take as much time as you need to answer the questions. There are no right or wrong answers.

Table A.1: Questionnaire and experimental tasks (translated from Italian and German)

Question and items	Response scale
Part A	
Raven 12-item test	12 graphical items
Part B	
Experimental task: Donation MSF	
<p>Question. You are called to make the following decision: you have 100 euros available and you have to decide how much of these 100 euros you keep for yourself and how much you donate to "Doctors Without Borders" (MSF), a non-profit organization that provides emergency medical assistance to people affected by war, epidemics, malnutrition or natural disasters.</p> <p>You can decide whether to: 1) keep it all for yourself; 2) donate it all to MSF; 3) keep a part for yourself and donate the rest to MSF.</p> <p>// Items: Amount to keep. Amount to donate to MSF. Total.</p>	Numerical response [0, 100]
Motivation at Work Scale (MAWS)	
<p>Question. (<i>Applicants</i>) I'm interested in the healthcare job I'm preparing for... (<i>Non-applicants</i>) a) What profession would you like to pursue? Open answer. b) The profession I have in mind interests me...</p> <p>// Items: 1. ... because the job will be fun [MAWS1]. 2. ... because the job will financially allow me a good standard of living [MAWS2]. 3. ... because the job corresponds to my personal values [MAWS3]. 4. ... because I really like this job [MAWS4]. 5. ... because I will achieve my life goals through this job [MAWS5]. 6. ... because of the salary [MAWS6]. 7. ...because I will enjoy the interesting tasks [MAWS7]. 8. ... this a control question: please do not answer [MAWS8]. 9. ... because I will earn good money with this job [MAWS9]. 10. ... because the job will enable me to achieve my professional goals [MAWS10].</p>	Fully disagree to fully agree [1,5]
Public Service Motivation (PSM)	

<p>Question. Indicate how much you agree/disagree with the following statements. // Items: 1. I find it hard to hold my feelings back when I see people in need [PSM1]. 2. The daily events often remind me how dependent we are on each other [PSM2]. 3. I have understanding for the situation of those in need for help [PSM3]. 4. For me, patriotism also means having regard for the well-being of others [PSM4]. 5. Serving the citizens would make me feel good even if no one paid me for it [PSM5]. 6. To me it is more important to contribute to society than to achieve my personal goals [PSM6]. 7. I believe that we have to put our civic duty before our own needs [PSM7]. 8. I am ready to take sacrifices for the good of society [PSM8].</p>	
	Fully disagree to fully agree [1,5]
Big Five (personality traits)	
<p>Question. To what extent do the following statements apply to you? // Items: I am rather reserved [pers1r]. I trust others easily and believe in the good in people [pers2]. I am lazy and tend to be idle [pers3r]. I am relaxed and am not easily stressed [pers4r]. I have little artistic interest [pers5r]. I am outgoing and sociable [pers6]. I tend to criticize others [pers7r]. I complete tasks thoroughly [pers8]. I easily become nervous and insecure [pers9]. I have a vivid imagination and am creative [pers10].</p>	
	Fully disagree to fully agree [1,5]
Experimental task: Donation WWF	
<p>Question. You are called to make the following decision: you have 100 euros available and you have to decide how much of these 100 euros to keep for yourself and how much to donate to the World Wildlife Fund (WWF), a non-profit organization that contributes to the defense and conservation of nature.</p> <p>You can choose to: 1) keep it all for yourself; 2) donate it all to WWF; 3) keep a part for yourself and donate the rest to WWF. //</p> <p>Items: Amount to keep. Amount to donate to WWF. Total.</p>	
	Numerical response [0, 100]
Questionnaire	

<p>Question 1. (<i>Applicants</i>) You are currently preparing for the entrance exams for: // Items: Medicine, Dentistry, and Veterinary Medicine. Another profession in healthcare (please specify). (<i>Non-applicants</i>) In which field do you plan to carry out your profession? // Items: Public sector. Private economy. Non-profit-organisation.</p> <p>Question 1bis (<i>only Non-applicants</i>). In which sector would you like to carry out/do you perform your profession? // Items: Education. Health-Care. Social service. Agriculture. Industry. Other services/industries.</p>	<p>Single choice</p> <p>Single Choice</p>
<p>Question 2. Is there/was there a doctor in your family? // Items: Yes: at least one parent (mother or father) is/was a doctor. Yes: at least one relative (grandfathers/grandmothers/uncles/aunts) is/was a doctor. Yes: at least one of my siblings (brother/sister) is studying medicine, is/was a doctor. No.</p>	<p>Multiple Choice</p>
<p>Question 3. Is there someone in your family who works/has worked in the healthcare sector (other than as a doctor)? // Items: Yes: at least one parent (mother or father). Yes: at least one relative (grandfathers/grandmothers/uncles/aunts). Yes: at least one of my siblings (brother/sister) is studying a subject in healthcare, works/has worked in healthcare. No.</p>	<p>Multiple Choice</p>
<p>Question 4 (<i>only Applicants</i>). Suppose you will not pass the admission test which you are preparing for. Your second choice is // Items: same career (take the same admission test next year). Different career in the health sector. Different career in the social sector (e.g., social cooperatives, NGOs, etc.). Other (please specify).</p>	<p>Multiple Choice</p>
<p>Question 5 (<i>only Applicants</i>). In your opinion, what is the monthly net starting salary of newly hired employees in the South Tyrolean healthcare sector who practice the sanitary profession you are currently preparing for?</p>	<p>Single value</p>
<p>Question 6. Have you donated money to charitable organizations in the last 12 months?</p>	<p>Yes/No</p>

Question 7. Have you volunteered in the last 12 months? //	Yes/No
Question 8. Have you donated blood in the last 12 months? //	Yes/No
Question 9. (<i>Applicants</i>) What is the minimum monthly wage you would accept for the healthcare profession you are preparing for, if you were at the beginning of your career and working in South Tyrol? (<i>Non-applicants</i>) What is the minimum monthly wage you would accept at the beginning of your career for the job you are preparing for (or you are already doing)? Please give a single value.	Single value
Question 10. What is your native language? // Items: German. Italian. Ladin. Other (please specify).	Single choice and free response
Question 11. Which high school did you attend? // Items: Classical Lyceum. Scientific Lyceum. Other Lyceum. Technical institute. Vocational school in the health and care sector. Other vocational school. Other (please specify).	Single choice and free response
Question 12. What was your final exam grade in high school? // Items: /101 (101 = 100 with distinction)	Numerical Response
Question 13. What were your grades in Mathematics and Italian or German in the last year of high school? // Items: / 10 or 5 (Math) /10 or 5 (Italian or German)	Numerical response
Personal Data	
Question. Gender // Items: Female. Male.	Single Choice
Question. Age // Items: Years.	Numerical response