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Published in:
International Journal of Social Psychiatry

DOI:
10.1177/00207640231196751

Publication date:
2024

Document version:
Accepted manuscript

Citation for pulished version (APA):
Assing Hvidt, E., Wehberg, S., Andersen, C. M., Søndergaard, J., & Larrabee Sonderlund, A. (2024). Individual differences in empathy in Danish university students: A cross-sectional study. *International Journal of Social Psychiatry*, *70*(1), 113-121. https://doi.org/10.1177/00207640231196751

Individual differences in empathy in Danish university students: a cross-sectional study

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Keywords: Empathy; cognitive empathy; emotional empathy; university students; mental health, prosocial behavior.

Background

Empathy has been discussed and researched throughout centuries and across academic disciplines with the common interest to understand how human beings respond to the experiences of others (Davis, 1983a, 1996). Whilst disagreeing on definitional issues, most scholars across disciplines agree that empathy is a multidimensional construct, involving interdependent emotional and cognitive components that can be both dispositional and learned as well as beneficial or not (Hatcher et al., 1994; Hoffman, 1977; Hojat, 2016).

Emotional (or *affective*) empathy essentially denotes the instinctive responsiveness to others' experiences whereas cognitive empathy refers to the intellectualized appreciation of another person's state of mind (Davis, 1983a; Maibom, 2017; Spreng et al., 2009). These different types of empathy may cause distinct experiences of empathy which in turn may lead to different behaviors (Davis, 1983a; Malbois & Hurst-Majno, 2022). In terms of the emotional components of empathy, both beneficial and deleterious effects may arise. You may feel concern and compassion towards someone's misfortune, which might in turn galvanize helping behavior. Or you may feel emotionally overwhelmed and ill-at-ease, and as a result be apprehensive and withdraw from the situation. Similarly, with respect to cognitive empathy, the intellectual understanding (e.g., through simulation or projection) of the other's situation might be right or wrong and thus result in a helpful or unhelpful response (Fernandez & Zahavi, 2021).

Overall, the type of empathy that enables positive other-oriented responsiveness is widely believed to be supportive of adaptive social- and prosocial behaviors, interpersonal relationships, and mental well-being (Eisenberg et al., 2015; Hatcher et al., 1994; Konrath et al., 2011). On the other hand, empathy that is characterized by excessive emotional involvement and

distress are associated with social dysfunction (extreme shyness and introversion, social anxiety) and low self-esteem (Konrath et al., 2011).

Given these different outcomes, it makes sense to conceptualize and operationalize empathy as a multi-dimensional construct in empirical studies (Konrath et al., 2011; Spreng et al., 2009). Although some measures of empathy contain items tapping both the emotional and cognitive components (e.g., Hogan's *The Empathy Scale* from 1969 or Mehrabian and Epstein's *The Emotional Empathy Scale* from 1972), responses to items are oftentimes summed to produce a single empathy score (Davis, 1983b). In this study, we investigated differences in empathy in a sample of Danish university students using social psychologist Mark Davis' (1983b) multidimensional scale, *The Interpersonal Reactivity Index* (IRI). We also gauged the validity of *The Jefferson Scale of Empathy – Student version* (JSE-S) - a widely used measure of primarily cognitive empathy in the context of medical majors.

Our aims were to: 1) explore empathy, operationalized in terms of the IRI, in our sample, 2) correlate IRI subscale scores with JSE-S using a sample of medical majors, 3) examine the associations between IRI subscale scores and study major, sex, age and parental status.

Research methods

Study design and participants

The study was designed as a national, cross-sectional study (Andersen et al., 2020). The study population was recruited from four universities in Denmark all of which offer medical educations: University of Copenhagen (UC), Aarhus University (AU), Aalborg University (AAU), and the University of Southern Denmark (SDU). Specifically, all medical majors in their 1st, 3rd, or 6th year

from the former three universities were invited to participate. From the latter (SDU), all students in their 1st, 3rd, or final year, regardless of study major, were invited to participate.

Data collection and ethics

Quantitative data were collected in October 2020 through an online questionnaire (programmed in the electronic survey system, SurveyXact developed by Rambøll (Ramboll, 2021)).
Students were invited to the study by email. Specifically, they were sent an information letter about the project and what their participation would entail. The letter also stated how their data would be used and that all data would be handled according to the General Data Protection Regulation (GDPR). The study was also advertised on university websites and online student magazines. Students were informed that their participation in the study was voluntary, and that responder analysis would be conducted. The Research Ethics Committee (REC) of SDU approved the study (case number 20/5351). The study was also registered with the Danish Data Protection Board (journal number 10.181.). SDU approved all data processing activities regarding this project in accordance with GDPR, including the permission to extract students' social security number and other relevant background information, including current semester, enrolment date, age, and sex from the faculties' enrolment lists. Information on whether the students have children or not, were collected in the questionnaire.

Empathy scales in the questionnaire

Only medical majors filled out both the JSE-S and the IRI. All other participants completed only the IRI. JSE-S consists of 20 items measuring medical majors' personal orientation toward empathy and interpersonal skills with respect to patient care (Hojat, 2016). For each item, the students'

response is measured on a 7-point Likert scale. Reverse coded items in JSE-S were: 1, 3, 6, 7, 8, 11, 12, 14, 18, 19. A total sum score was calculated. If one or two items had missing values, then these were replaced by the respondent's mean score. JSE-S has been extensively validated internationally. The JSE-S total score ranges from 20 to 140, with higher values indicating a higher degree of empathy.

IRI is a self-report scale also, measuring cognitive and emotional empathy on four distinct subscales: 1. "Fantasy" (FS) which assesses the individual's tendency to cognitively identify with fictitious characters through imagination, 2. "Perspective Taking" (PT), which gauges the individual's cognitive ability to understand things from another's perspective and mindset, 3. "Empathic concern" (EC) which is an emotional reaction (e.g., sadness, concern, compassion) to another person's hardship oftentimes galvanizing pro-social attitudes and behavior (volunteering, charity acts), and 4. "Personal distress" (PD) which describes an emotional reaction of distress caused by perceiving another person's plight. Respondents' response on the IRI 28-items is measured on a 5-point Likert scale from 0 to 4. Each subscale (PT, EC, FS, PD) is defined as an average score across seven items with a higher score indicating a higher level of empathy. Several validation studies in different settings indicate high factorial validity and reliability of the IRI (Manarte, 2017).

Both scales were translated into Danish according to the WHO's guidelines for forward-backward translation (World Health Organisation, 2018) and cognitive interviews were conducted with ten Danish medical majors (Garcia, 2011). An overview of the other scales included in the questionnaire can be found in Assing Hvidt et al. (2020).

Outcomes, explanatory factors and statistical analysis

Our main outcome was self-reported empathy as measured using the IRI. Explanatory factors were study major (grouped into 1. medical majors, 2. other health majors, 3. other majors, see Table 1), sex (male/female), age (grouped into 18-24 years old /25+ years) and parental status (children yes/no)). Participant sex was derived from the students' social security number and thus ultimately reflect sex and not necessarily gender. Therefore, we refer to sex in the following.

We present baseline characteristics of our sample stratified by study major and test for differences with Chi-squared tests, excluding potential missing values. Next, we display mean and standard deviation (SD), median and interquartile range (IQR), and range (minimum-maximum) of the four IRI components by participant groups. In the subgroup of medical majors, we estimate the Pearson correlation coefficients between IRI components and JSE-S and present corresponding scatterplots. To study the association between explanatory factors and the four IRI outcomes, we estimate separate univariable and multivariable linear regression models, overall and stratified by sex. Throughout the analyses, a p-value below 0.05 was considered statistically significant. In addition, we compared responders to target group with respect to university, educational year, age, and sex by a Chi-squared test, excluding potential missing observations.

Results

Participant characteristics

Among a sample of 14,702 students invited to participate in the study, 2,595 students (65.1% women) completed the questionnaire (18%). From SDU participants were recruited among medical majors, other health majors and other majors (see Suppl. material, part 1).

From the remaining three universities, only medical majors were recruited. A responder analysis is included as supplementary material, (see Suppl. material, part 2). Most study participants were

from SDU (83.0%, n = 2154), followed by AAU (8.2%, n = 213), UC (6.3%, n = 164), and AU (2.5%, n = 64). In terms of study major, 25.9% (n = 672) were medical majors (medical majors), 10.7% (n = 277) majored in a health-related field other than medicine (other health majors), and 63.4% (n = 1646) were from non-health-related fields (other majors). Most participants were in their first year of study (45.1%, n = 1170), with the remaining sample evenly split between 3rd-year (28.2%, n = 732) and final-year (26.7%, n = 693) students. Most participants were between 18 and 24 years old (64.7%, n = 1678). Most students had no children (92.6%). These patterns remained relatively stable when disaggregating the sample by student category (see Table 1).

In line with our first aim, we generated means and standard deviations for the IRI scales by each baseline characteristic (Table 2). Overall, IRI scales revealed similar scores across all baseline characteristics except for sex where women tended to score higher (IRI total mean score = 2.51) than men (IRI total mean score = 2.17). Also, with a total sample average of 1.47, PD scores were not only below the scale midpoint of 2, but also considerably lower than any of the other IRI scales which ranged between 2.28 (FS, men) and 3.02 (EC, women).

In line with our second aim, we correlated medical majors' JSE-S scores with IRI scales (Figure 1). Our analyses revealed positive moderate correlations between the JSE-S and the PT (r = .40), FS (r = .36), and EC (r = .40) IRI subscales. Contrasting this general trend, PD again stood out as the only subscale that correlated inversely with the JSE-S (r = -.10).

Finally, in line with our third aim, we further explored the associations between empathy and study major, sex, age, parental status (Table 3). Overall, study type was statistically significantly associated with three out of the four IRI scales, namely PT, EC and PD. There were no statistically significant differences between majors on the FS scale. Medical majors scored higher than other health majors and other majors on the PT scale (estimated mean point difference = .11, p<.05 and

.16, $p<.001$, respectively) and higher than other majors (but not higher than other health majors) on the EC scale (estimated mean point difference = .14, $p<.001$). Additionally, medical majors scored lower than other health majors and other majors on the PD scale (estimated mean point difference = -.33, $p<.001$ and -.48, $p<.001$, respectively).

Consistently, women scored statistically significantly higher than men, where estimated mean point differences ranged from .07 (PT) over .36 (PD) and 0.43 (FS) to .51 (EC).

Students who were between 18 and 24 years old came in significantly lower on the EC subscale than their older counterparts (25+ years) (estimated mean point difference = -.09, $p<.01$). There was, however, no significant age differences in terms of PD or PT.

Finally, participants without children scored lower on the PT subscale (estimated mean point difference = -.11, $p<.05$) than students who did have children. Students without children also scored higher on the PD subscale than students with children (mean point difference = .26, $p<.001$), while no differences in terms of EC and FS were found.

Discussion

The current study examined the association between a sample of Danish university students' self-reported empathy and study major, sex, age, and parental status. Operationalizing empathy within the multi-dimensional IRI framework allowed us to differentiate between cognitive and emotional dimensions of empathy and assess any differences in their association with our explanatory factors. Our results showed that health majors scored statistically significantly higher on PT and EC than students from other study majors. Whilst EC is oftentimes associated with high emotional sensitivity, it is also linked with pro-social attitudes- and behaviors (Konrath et al., 2011). The most "other-oriented" scales of the IRI are thus EC and PT (Konrath et al., 2011). Personal distress (PD)

may cause the person to withdraw from any pro-social action and instead focus on their own personal distress (self-orientation).

Differentiating between the different types of beneficial and harmful empathy becomes especially relevant in study majors and professions where the implications of interpersonal responses are a primary concern. For example, empathy is considered an important component of professionalism in the caring- and health professions and several educational initiatives to support the development of so-called clinical empathy have been developed and implemented as part of the curriculum (Assing Hvidt, Ulsø, et al., 2022; Hojat, 2016). Clinical empathy is primarily conceptualized and operationalized in cognitive rather than emotional terms, i.e., understanding versus feeling (Mercer & Reynolds, 2002). This is because personal distress as an emotional response to a stressor is shown to impede helping behavior towards others as well as professionals' own mental wellbeing. Consequently, the abovementioned JSE-S scale is primarily concerned with measuring the cognitive dimensions of empathy (Andersen et al., 2020; Assing Hvidt, Søndergaard, et al., 2022).

Our results showed that the JSE-S correlated statistically significantly with the cognitive empathy subscales of the IRI. However, it should be noted that the correlations were moderate and that the JSE-S correlated to a comparable degree with the FS subscale which gauges a more emotional and less prosocial behavior than PT and EC (Konrath et al., 2011).

Assessing the differences in cognitive and emotional empathy among study majors, the self-selection and the indoctrination hypotheses might shed further light on the differences found in our study (Litten et al., 2018). Following the self-selection hypothesis, individuals make their choice of study based on their personality characteristics, including which empathy components predominates (Litten et al., 2018). Consequently, it is not surprising that individuals

high in PT and EC are more likely and willing to enroll in study majors and future caregiving occupations that require engagement in ethical and pro-social behaviors. Comparatively, health educations and future caregiving positions are not attracting people who sense (consciously or unconsciously) that their levels of personal distress increase when witnessing suffering. However, according to the indoctrination hypothesis, particular environments (organizational, educational) also influence and enhance certain personality traits that are beneficial to the environment (Litten et al., 2018). Thus, following this hypothesis, the result showing that health majors are higher in PT and EC than other study majors might also reflect the influence of educational cultures that highlight the cognitive and prosocial components of empathy (e.g., through empathy skills teaching) as an essential professional ability and learnable skill.

The self-selection and indoctrination hypotheses tap into ongoing discussions about whether empathy is a stable trait or a mutable (and learnable) state (Paro et al., 2014). These hypotheses also reflect the nature-nurture dichotomy so often evoked in relation to differences in empathy across sexes/genders. Consistent with a large body of evidence indicating positive associations between female sex and the more emotional components of empathy (in particular EC and PD) (Davis, 1983b), our results showed a clear sex effect (it should be noted that data on participant sex was derived from birth social security number and thus ultimately reflect sex and not necessarily gender) where female students scored higher than male students across each measure of empathy (overall as well as all subscales). This pattern is relatively consistent in the literature (Christov-Moore et al., 2014; Davis, 1983a; Kamas & Preston, 2021). However, whether they can be explained with reference to bio-physiological and evolutionary factors or socio- and cultural factors (or indeed all of them together) remains a question of debate (Hojat, 2016). Explaining the differences in empathy between sexes from a social psychology view, women's

higher empathy scores result, at least in part, from women being socialized into a “feminine” behavior (e.g., “caring”, “softhearted”, “agreeable”) and males into ”masculine” behavior (rational, decisive, agentic). In other words, social desirability biases in participant responses might explain some of the variation in these results. Explaining empathy sex differences in terms of evolutionary history and psychology, women’s maternal investment during the course of human evolution is speculated to have contributed to the development of caring attitudes and pro-social behaviors (Hojat, 2016).

Another pattern in the empathy literature – and one that is consistent with our results – is the positive correlation between empathy and age (Grühn et al., 2008; Oh et al., 2019). Specifically, students over the age of 25 scored higher on EC than their younger counterparts but were no different on any of the other empathy measures. Research also suggests that age is positively associated with PT and EC, but negatively related to PD (Davis, 1983b). From a psychological developmental perspective, this may be because cognitive empathy is a more mature form of empathy and emotional empathy (especially PD) an earlier more morally underdeveloped form of empathy (Hatcher et al., 1994; Hoffman, 1977). A study among high school students confirmed this developmental empathy thesis showing that the IRI empathy components PT and EC increased progressively for females (only) year by year, whereas personal distress decreased (Davis & Franzoi, 1991). Consequently, if PT increases with developmental cognitive and moral maturity, students with children might have a higher PT than those without as a function of age rather than parenthood. That is, students with children might tend to be older than students without.

Our results showed that students without children scored higher on PD (personal distress) than students with children and lower on PT. Related to the above-mentioned theory that parental

investments might contribute to the development of empathic attitudes that extend beyond one's off-spring, it might be theorized that child rearing can create an increased overall ability to take the perspective of others (PT).

Strengths and limitations

The present study has several strengths. First, our sample was large and included students at different degree levels across all the four major universities in Denmark. Second, the multi-dimensional operationalization of empathy that we employed, allowed us to tap into four distinct types of empathy, thus gaining a better understanding of this construct and its correlates. This represents a clear and novel contribution to the literature. Third, including the JSE-S bolstered the theoretical and practical value of our paper by allowing us to compare and contrast this highly used measure of empathy for health care students- and professionals with the IRI developed to the general adult population.

In terms of limitations to our study, we note the response rate of 18% and the ever-present biases that may be associated with self-selected samples in survey studies. Further, given the cross-sectional research design, we cannot infer the directionality of our results. This prevents us from making any firm conclusions about how different types of empathy relate to the other factors examined. Nonetheless, contextualizing our results within the broader evidence base (above), we generate plausible theories about the nature of these associations. Another limitation relates to the external validity of our results. While our sample was representative of the Danish university student population, our results may not generalize to other nationalities or cultures where empathy is expressed and understood in different ways. For example, past research has found differences in empathy across collectivistic and individualistic cultures, with the former

typically prioritizing and valuing empathy more than the latter (Chopik et al., 2016). To this point, however, it should also be noted that most empathy research to date has been conducted with U.S. student samples (Bas-Sarmiento et al., 2020). Our study of Danish students might thus provide sorely needed nuance to the evidence base.

Finally, interpreting our results, we would be remiss to disregard the fact that we collected our data during the COVID-19 pandemic. The consequent implementation of social distancing measures most likely caused significant personal distress in students across all study majors. The human toll and general devastation caused by the pandemic may have affected health majors' general feelings of empathy. For example, they might have felt increased empathy in response to widespread human suffering. Or they may have felt overwhelmed by the prospect of working on the frontline, diminishing empathy levels because of stress and burnout. Furthermore, medical, and other health majors might have felt that their study major and clinical training (navigating hospitals and hospital teams, talking to patients) accentuated the demand of their future job thus increasing their personal motivation for empathy and caring action. Moreover, many health majors engaged in supporting the medical workforce, assisting in simple procedures related to infection prevention and control. The feeling of being able to contribute meaningfully to society, by virtue of their training, as it went through a devastating pandemic, might have increased PT and EC and lowered PD in health majors as observed in our sample. Regardless, as it is likely that the effects of the pandemic are reflected in our data in one way or another, we urge the reader to consider this as they interpret our results.

Conclusion

Our study results show that large differences in empathy exist between university students and study majors with health majors scoring higher on the empathy components (PT and EC) than students from non-health-related study disciplines who score higher than health majors on personal distress (PD). It may be that individuals choose their study based on their personality characteristics, including which empathy types predominate (in support of the self-selection hypothesis) and it may be that educational cultures nurture specific components of empathy to a higher degree than others as part of an educational and professional socialization (in support of the indoctrination hypothesis). The findings of this study also support well-established correlations between empathy and female sex and empathy and age. Furthermore, study findings show a positive correlation between having children and PT and having no children and PD.

Overall, our results highlight 1. the appropriateness of investigating empathy as a multidimensional versus a global construct in young adult populations (including university students) and 2. the importance of focusing on differences in empathy across different student characteristics. Given that PD has been linked with antisocial attitudes- and behaviors, it might be relevant to consider how students scoring high in PD can best be supported in emotion regulation, e.g., through compassion education for prosocial behavior and well-being.

Author contributions

Elisabeth Assing Hvidt: Conceptualization, Funding acquisition, Methodology, Investigation, Writing- Original draft preparation, Writing-Reviewing and Editing Sonja Wehberg**:** Conceptualization, Investigation, Formal analysis, Data curation, Writing- Reviewing and Editing. Christina Maar Andersen: Conceptualization, Funding acquisition, Methodology, Investigation, Writing- Reviewing and Editing. Jens Søndergaard: Conceptualization, Funding acquisition, Writing-Reviewing and Editing. Anders Larrabee Sønderlund**:** Formal Analysis, Writing- Original draft preparation, Writing-Reviewing and Editing.

Declaration of conflicting interest

None

Data availability

Data will be made available on request.

Funding

Funding was received from [The Independent Research Fund Denmark], Grant number: [8108-00021B]. The funding body was not involved in the design of the study.

Acknowledgement

We wish to thank all students who took their time for filling out the survey.

Material

Table 1. Baseline characteristics of participants, overall and by study type. The p-values refer to a Chi-squared test between respondents and non-respondents, excluding potential missing values.

Characteristic		**All**	**Medical majors**	**Other health majors**	**Other majors**	**p-value**
		N (%)	**N (%)**	**N (%)**	**N (%)**	
		2595 (100.0)	672 (100.0)	277 (100.0)	1646 (100.0)	
Sex	Male	905 (34.9)	165 (24.6)	68 (24.5)	672 (40.8)	<0.001
	Female	1690 (65.1)	507 (75.4)	209 (75.5)	974 (59.2)	
Age	18-24	1678 (64.7)	434 (64.6)	136 (49.1)	1108 (67.3)	<0.001
	25+	917 (35.3)	238 (35.4)	141 (50.9)	538 (32.7)	
Study year	1st	1170 (45.1)	280 (41.7)	90 (32.5)	800 (48.6)	<0.001
	3rd	732 (28.2)	212 (31.5)	69 (24.9)	451 (27.4)	
	Final	693 (26.7)	180 (26.8)	118 (42.6)	395 (24.0)	
Parental status (children)	Yes	192 (7.4)	32 (4.8)	39 (14.1)	121 (7.4)	<0.001
	No	2403 (92.6)	640 (95.2)	238 (85.9)	1525 (92.6)	

Table 2. Estimated means (SD: standard deviations) of IRI scales by participant groups.

Characteristic		**N**	**IRI PT**	**IRI FS**	**IRI EC**	**IRI PD**
	All	2595	2.70 (0.6)	2.56 (0.8)	2.84 (0.7)	1.47 (0.7)
Study major	Medical majors	672	2.82 (0.6)	2.66 (0.8)	2.98 (0.6)	1.17 (0.6)
	Other health majors	277	2.73 (0.6)	2.56 (0.8)	2.98 (0.6)	1.46 (0.7)
	Other majors	1646	2.65 (0.6)	2.52 (0.8)	2.75 (0.7)	1.59 (0.7)
Sex	Male	905	2.64 (0.6)	2.28 (0.8)	2.49 (0.7)	1.28 (0.7)
	Female	1690	2.73 (0.6)	2.71 (0.8)	3.02 (0.6)	1.57 (0.7)
Age	18-24	1678	2.68 (0.6)	2.58 (0.8)	2.82 (0.7)	1.53 (0.7)
	25+	917	2.74 (0.6)	2.52 (0.8)	2.88 (0.6)	1.36 (0.7)
Study year	1st	1170	2.65 (0.6)	2.57 (0.8)	2.80 (0.7)	1.51 (0.7)
	3rd	732	2.74 (0.6)	2.59 (0.8)	2.87 (0.7)	1.46 (0.8)
	Final	693	2.74 (0.6)	2.52 (0.8)	2.86 (0.6)	1.40 (0.7)
Parental status (children)	Yes	192	2.80 (0.5)	2.46 (0.8)	2.92 (0.6)	1.19 (0.7)
	No	2403	2.69 (0.6)	2.57 (0.8)	2.83 (0.7)	1.49 (0.7)

Figure 1. Heatplot of pairwise correlations between IRI subscales and JSE-S in the subsample of medical majors (n=672).

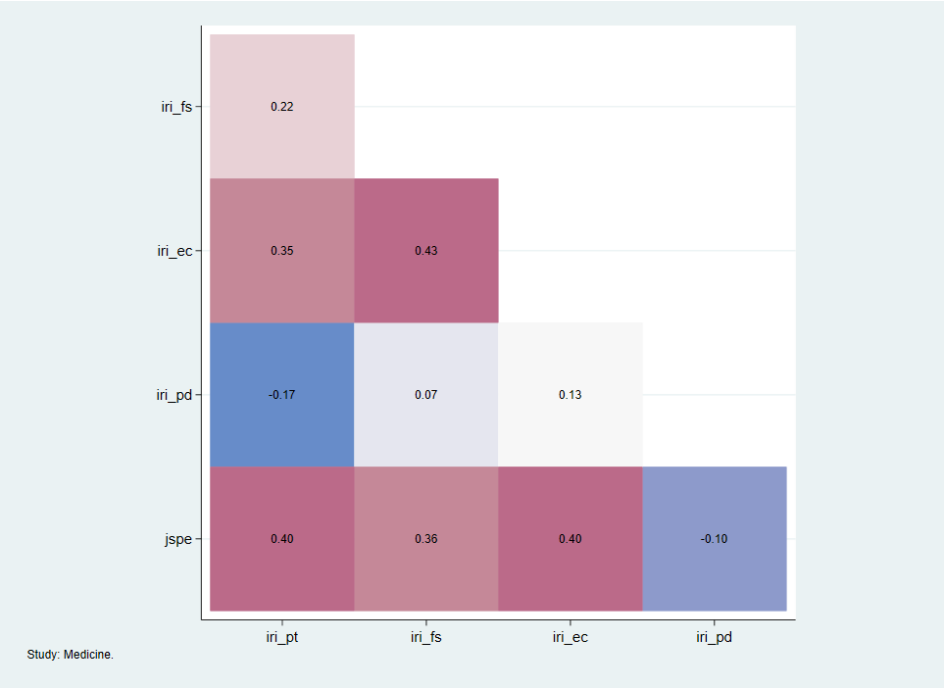

Table 3. Estimated regression coefficients and corresponding 95% confidence intervals in parentheses from separate multivariable linear regression models for the four IRI scales (N=2,595). Overall Wald-test p-values for categories with more than two levels are in italics.

	IRI PD		**IRI PT**		**IRI EC**		**IRI FS**	
Variable	**Estimate (95% CI)**	**p-value**	**Estimate (95% CI)**	**p-value**	**Estimate (95% CI)**	**p-value**	**Estimate (95% CI)**	**p-value**
Female Sex	0.36 (0.30; 0.41)	<0.001	0.07 (0.02; 0.12)	0.0050	0.51 (0.46; 0.57)	<0.001	0.42 (0.36; 0.48)	<0.001
Study type: Medical major	Ref	*<0.001*	Ref	*<0.001*	Ref	*<0.001*	Ref	*0.0755*
Other health majors	0.33 (0.23; 0.42)	<0.001	-0.11 (-0.20; -0.03)	0.0095	-0.02 (-0.10; 0.07)	0.7097	-0.09 (-0.20; 0.02)	0.0951
Other majors	0.48 (0.42; 0.55)	<0.001	-0.17 (-0.22; -0.11)	<0.001	-0.15 (-0.20; -0.09)	<0.001	-0.08 (-0.15; -0.01)	0.0334
Age: 18-24 years old	Ref		Ref		Ref		Ref	
25+	-0.08 (-0.14; -0.02)	0.0059	0.03 (-0.02; 0.09)	0.1912	0.06 (0.01; 0.12)	0.0245	-0.02 (-0.09; 0.04)	0.5026
Children: Yes	-0.27 (-0.38; -0.17)	<0.001	0.10 (0.00; 0.19)	0.0435	0.05 (-0.05; 0.14)	0.3532	-0.09 (-0.21; 0.03)	0.1370
No	Ref		Ref		Ref		Ref	
Constant	0.94 (0.87; 1.01)		2.75 (2.69; 2.81)		2.57 (2.51; 2.64)		2.36 (2.28; 2.44)	

Supplementary material

Part 1
Overview of study majors

Medical major
Medicine
Other health majors
Audiology
Biomechanics
Clinical Nursing
Health Professional
Obstetrics and Midwifery
Occupational Therapy
Pharmacology
Physiotherapy
Population Health
Psychology
Sports and Health
Other majors
American Studies
Applied Mathematics
Biochemistry and Molecular Biology
Biology
Biomedical Informatics
Biomedicine
Business Administration
Business Economics
Computer Science
Cultural Sociology
Culture and Communication
Danish
Data Science
Design Studies
Economy
Engineering
English
Environmental and Resource Management
European Studies
German
History
Journalism

Law
Library Science and Knowledge Communication
Literary Studies
Market and Management Anthropology
Media Science
Medical Chemistry
Middle Eastern Studies
Multicultural Pedagogy and Danish as a Second Language
Pedagogy
Philosophy
Physics
Political Science
Product Design
Religion
Social Science
Sociology and Cultural Analysis
Spanish and Spanish-American Studies
Tourism Management
Web Communication

Part 2: Responder analysis

Charcteristic		All	Responders	Non-responders	p-value
		N (%)	N (%)	N (%)	N (%)
Overall		14702 (100.0)	2595 (17.7)	12107 (82.3)	
Study major	Medical majors	4178 (100.0)	672 (16.1)	3506 (83.9)	0.005
	Other health majors	1452 (100.0)	277 (19.1)	1175 (80.9)	
	Other majors	9072 (100.0)	1646 (18.1)	7426 (81.9)	
University	AAU	406 (100.0)	64 (15.8)	342 (84.2)	<0.001
	AU	1306 (100.0)	213 (16.3)	1093 (83.7)	
	KU	1552 (100.0)	164 (10.6)	1388 (89.4)	
	SDU	11438 (100.0)	2154 (18.8)	9284 (81.2)	
Major by university	Medical majors AAU	406 (100.0)	64 (15.8)	342 (84.2)	<0.001
	Medical majors AU	1306 (100.0)	213 (16.3)	1093 (83.7)	
	Medical majors KU	1552 (100.0)	164 (10.6)	1388 (89.4)	
	Medical majors SDU	914 (100.0)	231 (25.3)	683 (74.7)	
	Other health majors SDU	1452 (100.0)	277 (19.1)	1175 (80.9)	
	Other majors SDU	9072 (100.0)	1646 (18.1)	7426 (81.9)	
Sex	Male	6650 (100.0)	905 (13.6)	5745 (86.4)	<0.001
	Female	8052 (100.0)	1690 (21.0)	6362 (79.0)	
Age	18-24	9514 (100.0)	1678 (17.6)	7836 (82.4)	
	25+	5164 (100.0)	917 (17.8)	4247 (82.2)	
	Missing	24 (100.0)		24 (100.0)	
Study year	1	6279 (100.0)	1170 (18.6)	5109 (81.4)	
	3	4361 (100.0)	732 (16.8)	3629 (83.2)	
	Final	4062 (100.0)	693 (17.1)	3369 (82.9)	

Participant representativeness

To estimate participant representativeness, we compared responders with non-responders on available socio-demographic and educational variables. While age was evenly matched between responders and non-responders, differences in gender, university, and study major representation were evident. Specifically, women were significantly overrepresented among responders (35% men vs 65% women, $p<.0001$, Chi^2). The University of Copenhagen was underrepresented among responders (6.3% vs. 11.5%) while University of Southern Denmark was overrepresented (83.0% vs. 76.7%). Further, other majors (61.3% vs. 63.4%) and medical majors (25.9% vs. 29.0%) featured slightly less frequently among responders while other health majors were slightly overrepresented

among responders (63.4% vs. 61.3%). These differences were only small, but given the large sample size, they were nonetheless statistically significant ($p<.0001$; Chi^2).

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