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Title: Personality traits are associated with cognitive empathy in medical students but not with its evolution and interventions to improve it.

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Introduction

Empathy in the context of medical education and patient care is defined as a cognitive attribute that involves an understanding of patients' experiences, concerns and perspectives including a capacity to communicate this understanding and an intention to help preventing and alleviating pain and suffering [1]. Both cross-sectional and longitudinal studies have shown a decline in cognitive empathy during medical education, especially during the first years [1]. Such decline might result, at least partially, from a decreased value given to empathy and the learning of self-distancing coping strategies [2]. However, cognitive empathy is crucial to improve several medical outcomes, such as adherence [1, 3]. Thus, interventions aiming at preserving medical students' cognitive empathy have been developed [1, 3, 4]. For instance, the role of Balint groups, that help dealing with emotional issues in the context of the doctor-patient relationship, has been examined among four-year medical students in a randomized trial [2, 4]. A 3-month training of 7 sessions of 1.5-hour Balint groups has been found to weakly, but significantly, increase cognitive empathy when comparing this intervention to a control [2].

However, the factors associated with the evolution of cognitive empathy during the medical curriculum remain poorly understood. For instance, both gender and anticipated specialty choice are associated with cognitive empathy in medical students, but may not predict its evolution [1]. At entry into medical school, students' cognitive empathy assessed with the Jefferson Scale of Empathy - Student version (JSE-S) has been associated cross-sectionally with both Agreeableness and Openness, two out of the five personality traits of the Short Big Five model [5, 6]. These associations may explain the relationship between cognitive empathy and specialty choice [7]. Nevertheless, to our knowledge, prospective associations between personality traits and subsequent changes in cognitive empathy during medical school have not been examined. In addition, it is unknown whether personality traits could moderate the effect of an intervention on cognitive empathy. Such knowledge could help to target those students who could benefit most from interventions.

Prior data from a two-site randomized trial showed the efficacy of an intervention to promote cognitive empathy among fourth-year medical students [2]. The aim of the present study was to explore the associations between personality traits, using the Short Big Five Inventory [8], and cognitive empathy at baseline and its changes at 3-month follow-up, using the JSE-S [1]. These associations took into account several other individual factors potentially linked with cognitive empathy such as gender,

anticipated specialty choice, parental level of education, living status and financial insecurity [1, 9]. In addition, a randomization in two groups (i.e. a 3-month training of 7 sessions of 1.5-hour Balint groups versus no intervention) allowed examining whether the effect of the intervention depended upon personality traits. The hypotheses were that some personality traits will be associated with cognitive empathy at baseline and that these traits will moderate the role of the intervention in the improvement of cognitive empathy.

Method

The present study consisted of a secondary analyses from a two-site randomized trial conducted from October 2015 to December 2016 among fourth-year medical students at Paris Diderot and Paris Descartes Universities (Paris, France) [2]. This trial obtained ethical approval from the Institutional Review Board of Paris Descartes University, Paris, France (n°00001072).

The JSE-S encompasses 20 Likert-type items answered on a 7-point Likert-type scale and can range from 20 to 140 with higher scores suggesting higher levels of cognitive empathy (Cronbach's alpha = 0.89 and $r = 0.65$ for test-retest reliability) [10]. All the JSE-S psychometric properties are detailed in authors' studies [10-13]. Because of a technical problem, data were systemically missing for one JSE-S item (i.e. "Physicians should try to stand in their patients' shoes when providing care to them"), but the internal consistency in our sample (Cronbach's alpha: 0.77 and 0.80 at baseline and follow-up, respectively) allowed computing a one-dimension global score based on the mean item value multiplied by 20 [2]. The Short Big Five Inventory scale is based on 10 Likert-type items leading to scores at five scales with higher scores indicating higher intensity for each of the following personality traits: Extraversion, Conscientiousness, Agreeableness, Neuroticism and Openness [8].

All the statistical analyses were based on linear regressions models introducing the scores of the five personality traits as independent variables in five different models, using a two-sided alpha a priori set at 0.05. Dependent variables were either baseline JSE-S total score or change in JSE-S total score, i.e. JSE-S total score at 3-month follow-up minus JSE-S total score at baseline. In multivariable analyses dealing with baseline JSE-S total score, the following covariables were introduced in the model: gender, parental education, living status, paid job and anticipated specialty choice. In those

dealing with change in JSE-S total score, the following covariables were also introduced in the model: baseline JES-S total score and randomization group. Then, we searched for potential interactions between each personality trait and the group of randomization.

Results

The characteristics at baseline of the 311 included participants are displayed in Table 1. At a 3-month follow-up, the mean JSE-S total score of all participants decreased by -0.16 (SD:10.01). Like the primary study [2], there was an increase in the JSE-S total score in the intervention group (1.22 (SD:9.10)), and a decreased on the JSE-S total score in the control group (1.64 (SD:10.74)) with a significant between-group difference ($p=0.012$). In both univariable and multivariable analyses, the JSE-S total score at baseline was positively associated with Extraversion and Conscientiousness and negatively with Neuroticism (Table 2). In contrast, we found no associations between personality traits at baseline and JSE-S changes (Table 2). In addition, there were no interactions between each personality trait and the group of randomization (smallest $p = 0.204$).

Discussion

In the present study, Extraversion, Conscientiousness and Neuroticism were associated with cognitive empathy. In contrast, prior literature showed associations with Agreeableness and Openness [5, 6]. However, these previous studies concerned students in the first-year of medical school. Cognitive empathy may be influenced by different personality traits according to different stages of the curriculum. The present study extends prior findings by showing that, like gender or anticipated specialty choice [1], personality may be associated with cognitive empathy, but not with its course, at least in the short term. Furthermore, the effects of an intervention promoting cognitive empathy did not depend upon personality traits. This conclusion is consistent with a prior study examining the learning of the communication skills among students in psychology [14]. Notably, interventions to improve cognitive empathy could be short-lived. For instance, such short term benefits were observed after seven weekly Balint-group sessions, reflecting that these interventions might help changing how to

deal with emotional issues as soon as they started. Future research should examine whether these benefits could increase over time and persist after stopping the intervention.

Some limitations should be acknowledged. First, the changes in cognitive empathy were examined over a short period of follow-up. However, the role of personality traits may only become apparent after a longer follow-up period. Second, we assessed the changes in cognitive empathy using self-reported answers at the JSE-S rather than collecting patients' perceptions of the students' empathic skills. Furthermore, despite a good internal consistency of the JSE-S, we cannot exclude that the missing item could be particularly sensitive to personality traits. Third, even if the Big Five model is an internationally validated model for assessing personality, some aspects of personality may have been overlooked. Fourth, we observed no moderating effect of personality traits on a specific intervention based on Balint groups, but this does rule out such a moderating effect regarding other interventions.

Overall, the present study confirms the links between personality and cognitive empathy. This finding suggests that personality should be taken into account in observational studies examining the correlates of cognitive empathy. Results also suggest that medical students may benefit from strategies designed for improving their cognitive empathy regardless of their personality.

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Table 1. Baseline characteristics of the included participants according to randomization group.

	All the participants (n=311)	Control group (n=161)	Intervention group (n=150)	Statistical comparison	
Discrete variables	N(%)	N(%)	N(%)	Chi2	P
Gender					
Men	127(40.8)	54(36.0)	73(45.3)	2.805	0.094
Women	184(59.2)	96(64.0)	88(54.7)		
Parental education					
At most 2-years post-graduate	33(10.6)	16(10.7)	17(10.6)	0.001	0.975
More than 2-years post-graduate	278(89.4)	134(89.3)	144(89.4)		
Living status					
Other	72(23.2)	37(24.7)	35(21.7)	0.916	0.632
Alone	84(27.0)	37(24.7)	47(29.2)		
With parents	155(49.8)	76(50.7)	79(49.1)		
Anticipated specialty choice					
Intensive care, surgery and non-clinical specialties	78(25.1)	43(28.7)	35(21.7)	1.983	0.191
Other specialties	233(74.9)	107(71.3)	126(78.3)		
Paid job					
Yes	260(83.6)	129(86.0)	131(81.4)	1.216	0.270
No	51(16.4)	21(14.0)	30(18.6)		
Continuous variables	Mean(SD)	Mean(SD)	Mean(SD)	t	p
JSE-S total score at baseline	109.81(11.00)	109.37(11.82)	110.22(10.19)	-0.681	0.496
Personality traits					
Extraversion	6.69(1.82)	6.69(1.80)	6.70(1.85)	-0.043	0.965
Agreeableness	6.28(1.46)	6.29(1.54)	6.27(1.38)	0.118	0.906
Conscientiousness	7.75(1.64)	7.84(1.69)	7.66(1.59)	0.979	0.329
Neuroticism	5.47(1.69)	5.49(1.70)	5.45(1.69)	0.208	0.836
Openness	5.43(1.42)	5.49(1.38)	5.37(1.46)	0.748	0.455

N: number of subjects. SD: Standard Deviation. Personality traits were assessed with the Short Big Five Inventory. Baseline cognitive empathy was measured with the Jefferson Scale of Empathy - Student version (JSE-S). Changes in cognitive empathy were computed as follows: JSE-S total score at 3-month follow-up minus JSE-S total score at baseline. Significant results at $p < 0.05$ are presented in bold.

Table 2. Associations between personality traits and cognitive empathy (n=311).

Personality traits	Dependent variables							
	Baseline cognitive empathy				Changes in cognitive empathy			
	B	95% CI		p	B	95% CI		p
	min	max			min	max		
Unadjusted								
Extraversion	1.569	0.917	2.220	<0.001	-0.042	-0.656	0.572	0.892
Agreeableness	0.829	-0.011	1.669	0.053	-0.186	-0.954	0.583	0.635
Conscientiousness	1.388	0.651	2.125	<0.001	-0.169	-0.854	0.516	0.628
Neuroticism	-0.886	-1.607	-0.165	0.016	0.329	-0.332	0.990	0.329
Openness	-0.324	-1.189	0.542	0.462	-0.462	-1.249	0.325	0.249
Adjusted								
Extraversion	1.431	0.782	2.080	<0.001	0.469	-0.111	1.050	0.112
Agreeableness	0.837	0.008	1.667	0.048	0.112	-0.598	0.822	0.757
Conscientiousness	1.200	0.429	1.971	0.002	0.307	-0.364	0.978	0.369
Neuroticism	-1.109	-1.836	-0.382	0.003	-0.109	-0.742	0.524	0.735
Openness	-0.085	-0.951	0.782	0.848	-0.444	-1.176	0.288	0.233

95% CI: Interval of Confidence at 95%. Personality traits were assessed with the Short Big Five Inventory. Cognitive empathy was measured with the total score at the Jefferson Scale of Empathy - Student version (JSE-S). Changes in cognitive empathy were computed as follows: JSE-S total score at 3-month follow-up minus JSE-S total score at baseline. Adjusted analyses for baseline cognitive empathy included the following covariables: gender, parental education, living status, paid job and anticipated specialty choice. Adjusted analyses for changes in cognitive empathy further included cognitive empathy at baseline and randomization group. Statistical analyses are based on linear regression models. Significant results at $p < 0.05$ are presented in bold.