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The relationship of psychological health and primary emotional traits in medical students

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ABSTRACT

Introduction: Several studies have called for attention to medical students' well-being. Building on the neuroevolutionary affective neuroscience perspective that views primary emotional systems as central to well-being and the foundation of personality, this study investigated the facets of medical students' psychological well-being that are challenged and the relationships between emotional traits, psychological well-being, and depression.

Methods: In a single-center cross-sectional study, medical students' primary emotional traits (SEEKING, FEAR, ANGER, SADNESS, CARE, PLAY and Spirituality), psychological well-being dimensions (autonomy, environmental mastery, positive relations, self-acceptance, purpose in life, and personal growth), and depressive symptoms were assessed using the Affective Neuroscience Personality Scale; the Psychological Well-being Scale, which provides normative data; and the Beck Depression Inventory.

Results: Compared with the normative data, the medical students perceived lower psychological autonomy, positive relations, and self-acceptance but higher purpose in life. The medical students' emotional traits were related to specific psychological well-being facets and depression. SEEKING and, inversely, FEAR were related to well-being across dimensions and depressive symptoms.

Conclusion: Our findings are the first to show a link between emotional traits and specific facets of psychological health in medical students. Thus, this study encourages medical teachers to set learning environments that target multiple facets of well-being that harness primary emotional traits.

Introduction

The risk of experiencing poor psychological health during the first years of medical training has been widely documented (Aboalshamat et al. 2015; Bore et al. 2016; Tam et al. 2019), with medical students reporting greater depression severity than non-medical students and the general population (Dyrbye et al. 2006; 2006). To address this problem, several studies have urged policy-makers and educators to expand programs aimed at supporting medical students' well-being during their education, starting from their first years of training (Karp and Levine 2018; Colonnello et al. 2019; Kemp et al. 2019; Machado et al. 2019; Colonnello et al. 2020).

Given the role of emotions in learning and well-being during professional identity formation (Dornan et al. 2015; Weurlander et al. 2019; Colonnello et al. 2020) and the importance of promoting learning environments that sustain the fulfillment of students' basic needs (Neufeld and Malin 2020), the development of prevention programs would benefit from research addressing specific questions on what psychological well-being facets are challenged or preserved and what emotional traits are related to depression and the facets of well-being in medical students. However, studies investigating these questions remain scarce. Thus, the aim of this study was to address these

Practice points

- Medical students' primary emotional traits are related to depression and the distinct aspects of psychological well-being.
- SEEKING and, inversely, FEAR relate to several well-being dimensions and to depression.
- Medical curricula must consider the specific well-being dimensions challenged during medical training.
- Medical curricula must consider the relationship between basic emotional traits and well-being.

questions with the overarching aim of identifying the emotional traits that deserve attention while designing a supportive learning environment in medical education.

This study was based on the neuroevolutionary affective neuroscience perspective, which represents a promising framework for broadening the understanding of the relationship between basic emotional needs, depression, and well-being. In this perspective, basic emotional tendencies are genetically determined and refined throughout development and, through interactions with the environment, are the foundation of personality (Davis and Panksepp 2011, 2018).

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Medical students' psychological health

Several studies have converged in highlighting the importance of taking into account medical students' affectivity and basic needs during medical training. For example, previous research has shown an inverse relationship between medical students' depression risks and secure attachment style, that is, the perception of self-confidence and positive relations (Colonnello et al. 2022), and between students' psychological health and social support and resilience (McLuckie et al. 2018; Neufeld and Malin 2019).

A significant contribution to understanding the factors involved in medical students' well-being derives from studies grounded on the self-determination theory (SDT). According to the SDT, individuals' well-being and optimal functioning are related to how well their psychological needs are satisfied. Individuals are viewed as naturally prone to the fulfillment of their basic needs of competence, autonomy, and relatedness (Deci and Ryan 2000). Thus, the learning environment may foster psychological health and the activation of individuals' inner resources by facilitating the satisfaction of these needs (Deci and Ryan 2000; Ryan and Deci 2002). In this vein, medical students' perceived stress has been found to be related to the frustration of their basic psychological needs, which may diminish the protective effects of individual factors such as mindfulness and resilience (Neufeld et al. 2020). Similarly, medical students' well-being perception has been found to be related to the satisfaction of their need for autonomy, relatedness, and competence, though indirectly, through resilience (Neufeld and Malin 2019) In addition, students' general well-being is related to students' ratings of instructor autonomy support (Neufeld and Malin 2020).

The findings on the satisfaction of basic psychological needs, stress, and psychological well-being in medical students naturally led to questions as to what well-being facets are challenged and must be targeted in interventions.

Ryff et al. (1989) conceptualized psychological well-being as complex and multifaceted, entailing the realization of personal potential through autonomy in making one's own decisions, mastering the surrounding environment to pursue one's own goals, experiencing purpose in life, nurturing feelings of affection and positive relations with others, feeling self-acceptance of personal strengths and weaknesses, and continuing personal growth (Ryff 1989, 2014; Ryff and Singer 1998).

Ryff's eudaemonic view of well-being advocates that individuals' self-realization is based on their personal potentials. The cross-species affective neuroscience theory views the evolutionarily preserved brain emotional systems as ingrained potentials that sustain adaptation (Panksepp 2011).

Affective neuroscience

Cross-species affective neuroscience research indicates that many complex psychological processes and mental representations are nurtured and guided by basic evolutionarily preserved subcortical emotional systems (expectation/SEEKING, FEAR, RAGE, LUST, CARE, PANIC/sadness, and PLAY) that humans share with other mammals and many vertebrates (e.g. Panksepp 1998, 2011; see Panksepp and Biven 2012 for a review). According to this neuro-evolutionarily informed approach, these primary emotional systems, which encode unconditional affective responses, affect more cognitively mediated mental processes related to thoughts about the self and the world, and contribute to the development of personality traits throughout development (Northoff and Panksepp 2008; Panksepp and Northoff 2009).

These neurobiological potentials are the foundations of personality traits and remain sensitive to person-by-context interactions throughout life, with interesting implications for well-being and the learning environment. In this affective neuroscience evolutionary view, psychological health may be supported by environmental conditions that offer affordance for emotional tendencies to operate adaptively (Panksepp and Biven 2012). The development and validation of a self-report assessment tool, the Affective Neuroscience Personality Scale (ANPS), have made the assessment of primary emotional traits possible by estimating the putative expression and intensity of emotional systems (Davis and Panksepp 2011, 2018).

Following the perspective that well-being is multicomponent (Ryff 2014) and relies on the satisfaction of natural emotional-behavioral dispositions expressed in characteristic emotional traits (Panksepp 2011) and complementing SDT research findings on the role of psychological need satisfaction in medical students' well-being (Neufeld and Malin 2019), the present study was aimed at contributing to the research on medical students' well-being, with a focus on basic emotional traits.

We predicted that medical students' emotional traits are linked to several dimensions of psychological well-being. Given the affective neuroscience studies that have indicated that the SEEKING system sustains appetitive motivation, incentive states, and goal-directed activity (Panksepp and Biven 2012) and following Di Domenico and Ryan (2017) reasoning that this system may be involved in academic motivation, we predicted that medical students' SEEKING trait would be related to perceptions of experiencing purpose in life, environmental mastery, and continuing personal growth, that is, remaining open-minded to a dynamic, continual development of one's potential. We also expected a positive association between medical students' SEEKING and autonomy, given the initial evidence that links this system to divergent thinking (Reuter et al. 2005), and a negative association between autonomy and PANIC/sadness and underlying separation distress disposition. Furthermore, we expected that self-acceptance and positive relationships with others would be associated with traits grounded on basic social emotional systems (PANIC/sadness, PLAY, CARE). Finally, from the findings of Montag et al. (2017), we predicted that PANIC/sadness, FEAR, and, inversely, SEEKING would be associated with depression symptoms.

In summary, we investigated the well-being facets that are challenged or preserved in medical students in comparison with a normative age-matched population and the relationship between depression and specific facets of psychological well-being and emotional traits by using the affective neuroscience framework.

In light of the findings of previous studies that indicated gender differences in medical students' depression risk and

psychological health (Aboalshamat et al. 2015; Fond et al. 2018; but see Puthran et al. 2016), we investigated the relationship between emotional traits and psychological health, controlling for the gender factor.

Methods

Participants

The study was conducted at the University of Bologna, Italy. The University of Bologna is one of the top public universities in Italy based on the QS World University Rankings. In Italy, the 6-year medical degree course includes 360 credits based on the European Credit Transfer and Accumulation System (ECTS), and students are required to complete or be awarded 56 credits before the beginning of the second academic year. During the first biennial program, students learn about physics; chemistry; human body system, structures, and functions; psychology; and several pathologies.

All 540 enrolled medical students who were in the transition between the first and second academic years of the Medicine and Surgery Degree Program were invited to complete an online survey. The students were recruited at the beginning of a mandatory course. To encourage their participation, we informed them that they could participate in a follow-up meeting about the research results and, if interested, view their own scores in each questionnaire. Participation was voluntary.

Of the initial sample, 470 completed the questionnaires. As this correlational study was aimed at investigating the relationship between responses to different questionnaires, we excluded participants who did not answer all three questionnaires. After excluding the participants who did not answer all the questionnaires, the final sample was composed of 463 students (mean [SD] age, 20.32 [1.35] years; 278 women and 185 men; 95.9% Italian; mean [SD] ECTS credits, 51.87 [11.94] of the 56 ECTS credits required for the first academic year).

All participants provided informed consent. The procedure was approved by the institutional review board of the University of Bologna (IRB no. 273088).

Measures

On 3 separate days, the participants completed questionnaires on measures of emotional traits, psychological well-being, and depressive symptoms, along with a questionnaire on their basic demographic information (gender and age), as described below. The presentation order for the questionnaires was randomized across the participants, who were allowed to use a pseudonym for later anonymous access to their questionnaire scores. The decision to administer the questionnaires in 3 separate days was based on the need to meet the ethical committee request to limit the risks of student fatigue and the unavailability of short forms of the scales validated in the Italian population.

The Affective Neuroscience Personality Scale (ANPS) (Davis and Panksepp 2011; Giacolini et al. 2017) is the only scale based on the cross-species affective neuroscience perspective. In its version validated in the Italian population, the ANPS consists of 112 items that measure the following dimensions on a 4-point Likert scale (0 = strongly disagree, 3 = strongly agree): SEEKING, the tendency to explore new places, be curious, to search for solutions to problems, and to feel eagerness for new positive experiences; FEAR, the tendency to experience anxiety, worry, ruminating, tension, struggling with decisions, and sleep difficulties in times of stress; RAGE/ANGER, the proclivity to feel easily irritated and frustrated, and an urge to express anger; PANIC/SADNESS, the tendency to experience distress in times of social separation, to feel lonely, to cry, and to think about past relationships; CARE, nurturing tendencies for people in need, empathy, and feelings of affection; PLAY, the tendency to have fun, prefer social games involving physical contact, social humor, and laughing. Along with these dimensions, which represent six of the seven basic emotional systems, the ANPS includes a Spirituality dimension to measure the tendency to focus on transcendent values, experience a sense of connectedness with all creatures, have feelings of oneness with creation, and search for meaning in life. Although Spirituality is not envisioned as a basic emotional system, it has been included in the ANPS owing to its social relevance in clinical and non-clinical conditions. The ANPS, as in its original version, does not include a scale for the LUST system to avoid possible false responses due to the common reluctance to answer questions about sexuality (Davis and Panksepp 2011). In our sample, the Cronbach alpha values ranged from 0.73 to 0.87.

The Psychological Well-being Scale (Ryff 1989; Ruini et al. 2003) consists of 84 items measuring, on a 6-point Likert scale (1 = strongly disagree, 6 = strongly agree), six dimensions of psychological well-being: *autonomy*, experiencing a sense of independence and autonomy in decisions; *environmental mastery*, feeling of being able to manage one's own life and surroundings; *personal growth*, the feeling of having continual personal growth and openness to new experiences; *purpose in life*, having a sense of direction and goals in life, a feeling that life is meaningful; *positive relations with others*, a tendency to perceive relationships with others as positive and satisfying; and *self-acceptance*, a tendency to positively value oneself and one's past experiences. In our sample, the Cronbach alpha values ranged from 0.77 to 0.82.

The Beck Depression Inventory-Short Form (BDI-SF) (Beck and Beck 1972; Sica and Ghisi 2007) is a 13-item questionnaire that measures the severity of depressive symptoms on an intensity scale (0–3), with higher scores indicating greater depression severity. According to Beck and Beck (1972), scores of 0–4 correspond to no or not clinically significant depression; 5–7, mild depression; 8–15, moderate depression; and >16, severe depression. In this sample, the Cronbach alpha value was 0.80.

Statistical analyses

Descriptive statistics were used to calculate the mean scores and SDs. To address the first question related to the specific psychological well-being facets that are challenged among medical students, independent t tests were used to compare the participants' psychological well-being mean scores to the scores of the age-matched normative sample, as reported in Ruini et al. (2003). With respect to the

Table 1. Means and SDs of psychological well-being scores in medical students and in the Italian normative sample.

	Medical students		Normative sample			
	M	(SD)	M	(SD)	t	p
Autonomy	55.86	(9.30)	63.71	(10.17)	9.264	<0.0001
Environmental mastery	56.71	(10.83)	55.96	(14.43)	−0.709	0.4789
Personal growth	65.63	(7.88)	64.53	(10.26)	−1.441	0.1500
Positive relations with others	60.08	(8.8)	64.15	(11.04)	4.844	<0.0001
Purpose in life	64.71	(9.83)	61.46	(11.58)	−3.541	0.0004
Self-acceptance	56.75	(13.59)	59.89	(14.18)	2.572	0.0103

second question about the relationship of emotional traits to well-being and depression, Pearson correlation matrices were calculated to determine the associations between the variables, and separate multiple regressions were performed. In each model, either depression or one of the psychological well-being dimensions was entered as a dependent variable, and the seven emotional traits were simultaneously entered as predictors, controlling for the gender factor. In each model, the p value was corrected using the Bonferroni procedure (0.05/8) and set to 0.01. Following Cohen's (1988) recommendations, standardized beta (β) values of 0.10, 0.25, and 0.40 represent small, medium, and large effect sizes, respectively.

Results

Compared with the scores from the normative sample provided by Ruini et al. (2003), the medical students perceived lower scores for *psychological autonomy*, *positive relations with others*, and *self-acceptance* but higher scores for *purpose in life* scores (Table 1).

With respect to the relationship between the basic traits and well-being facets, the ANPS trait scores were related to several psychological well-being dimensions (Table 2).

SEEKING, ANGER, and, inversely, FEAR and PANIC/SADNESS were related to the *autonomy* dimension. SEEKING and, inversely, FEAR and SADNESS were related to *environmental mastery*, whereas SEEKING and ANGER and, inversely, FEAR were related to *personal growth*. Furthermore, CARE and PLAY and, inversely, FEAR and ANGER were related to *positive relations* with others. SEEKING and CARE and, inversely, FEAR and SADNESS were related to *purpose in life*. SEEKING, PLAY, and Spirituality were positively related and fear and sadness were inversely related to *self-acceptance*.

With respect to the depression scores, in our sample, 55.39% of the participants reported no or not clinically relevant depressive symptoms, 18.75% reported mild depression symptoms, 19.18% reported moderate symptoms, and 6.68% reported severe depression symptoms.

Depression was related to FEAR and SADNESS and, inversely, SEEKING and had weaker associations with ANGER, PLAY, and Spirituality. The coefficients for the relationships between well-being, depression, and emotional traits are presented in S1.

Discussion

We aimed to contribute to a better understanding of medical students' psychological health and basic emotional traits that must be supported while designing the learning environment in medical education. To the best of our knowledge, this is the first study to investigate the extent to which medical students' affective neuroscience primary emotional traits are linked to their perceived well-being in its various facets based on an eudaimonic perspective and to depressive symptoms.

We found that the medical students reported lower psychological well-being in specific dimensions of well-being than an age-matched normative sample. We found that the medical students had lower scores in psychological autonomy, self-acceptance, and positive relations with others. As predicted, the medical students' well-being and depression risk were significantly related to several primary emotional traits, and each trait was significantly related to at least one aspect of psychological well-being.

According to Ryff, autonomy refers to self-determining and self-regulating abilities. It is seen in an individual's tendency to rely on their own evaluations, to have a sense of freedom from conventions, and to not require approval from others (Ryff and Singer 1998, 2008). We found that autonomy was negatively associated with FEAR and PANIC/SADNESS and inversely associated to SEEKING. In a similar vein, the perception of being able to control and change one's own surrounding environment was related to higher SEEKING and lower FEAR and, to a lesser extent, to SADNESS traits, which suggests that an environment that acknowledges and modulates the arousability of these systems may sustain autonomy and feelings of mastery.

The awareness and acceptance of one's own strengths and weaknesses, that is, the self-acceptance dimension, were related to SEEKING, PLAY, and Spirituality and, inversely, to FEAR and SADNESS. This finding suggests that nurturing basic tendencies associated with positive affectivity, such as enthusiastically exploring resources in the outer world, positively cooperating with others, and experiencing reduced anticipatory fear, may be associated with an accepting stance toward different aspects of self. Presumably due to a self-reinforcing virtuous circle, exploration of the outer world enhances an individual's understanding and acceptance of different aspects of self, which in turn sustains further engagement with the outer world. In addition, we found that the SADNESS/separation distress disposition is inversely associated with self-acceptance, a finding in line with self-compassion and attachment studies that indicated that an inner sense of safeness and soothing is a key determinant of self-acceptance (Shaver et al. 2017).

In contrast to their reduced well-being in these domains (autonomy, positive relations, and self-acceptance), the medical students reported high scores for purpose in life. Their purpose in life, that is, the perception of directedness and intentionality in life, was inversely predicted by FEAR and SADNESS/separation distress. Given that anxiety (the cognitive expression of FEAR) is associated with intolerance of uncertainty (Dugas et al. 2001; Buhr and Dugas 2009), we can speculate that a FEAR tendency is associated with a

Table 2. The relationship between emotional traits and psychological well-being and depression, controlling for gender factor.

	Autonomy $AdjR^2 = 0.23, F = 17.77; p = 0.001$		Environmental mastery $AdjR^2 = 0.35, F = 32.69; p = 0.001$		Personal growth $AdjR^2 = 0.27, F = 22.09; p = 0.001$		Positive relations with others $AdjR^2 = 0.25, F = 19.82; p = 0.001$		Purpose in life $AdjR^2 = 0.21, F = 16.70; p = 0.001$		Self-acceptance $AdjR^2 = 0.41, F = 41.54; p = 0.001$		Depression $AdjR^2 = 0.29, F = 24.85; p = 0.001$	
	β	SE	β	SE	β	SE	β	SE	β	SE	β	SE	β	SE
Gender	0.02	0.04	−0.10*	0.04	−0.13*	0.04	−0.13*	0.04	−0.10*	0.04	−0.13*	0.04	0.06	0.04
SEEKING	0.39*	0.07	0.43*	0.07	0.51*	0.07	−0.1	0.07	0.29*	0.07	0.25*	0.06	−0.21*	0.07
FEAR	−0.35*	0.08	−0.58*	0.07	−0.28*	0.07	−0.34*	0.08	−0.44*	0.08	−0.60*	0.07	0.48*	0.07
ANGER	0.13*	0.06	0.06	0.06	−0.24*	0.06	−0.14*	0.06	0.05	0.06	0.08	0.05	−0.13*	0.06
CARE	−0.02	0.08	0.04	0.07	0.07	0.08	0.26*	0.08	0.23*	0.08	0.11	0.07	−0.07	0.07
SADNESS	−0.27*	0.07	−0.18*	0.08	−0.15	0.08	−0.1	0.08	−0.21*	0.08	−0.27*	0.07	0.29*	0.08
PLAY	0.05	0.08	0.02	0.06	−0.01	0.07	0.39*	0.07	−0.08	0.07	0.17*	0.06	−0.14*	0.07
Spirituality	0.04	0.06	0.06	0.05	0.03	0.05	0.10	0.06	0.04	0.06	0.17*	0.05	−0.14*	0.05

*$p < 0.01$.

reduced sense of direction and goals in life because of the tendency to perceive upcoming uncertain events as potentially threatening. On the other hand, this calls the attention to setting a learning environment that promotes purpose in life by reducing FEAR hyperactivation.

Purpose in life was also related to CARE and SEEKING tendencies. This brings us back to the basic constructs of CARE and SEEKING as emotional systems that direct attention and sustain goal-directed activities toward others (CARE) and the outer world (SEEKING) (Alcaro et al. 2007; Panksepp 2011). The link between the medical students' CARE trait and purpose in life is particularly interesting and deserves further investigation, especially considering that helping people is a common motivation for choosing medicine as a career (McManus et al. 2006) and that the activation of a CARE mindset enhances medical students' motivation toward learning materials and others' emotions (Colonnello et al. 2019, 2020). As further studies focusing on the relationship between this dimension of well-being and academic achievement may elucidate, academic motivation might be maintained by setting an environment that acknowledges and sustains the relationship between basic CARE needs and purpose in life.

With respect to depression, 25.86% of the students in our study experienced moderate-to-severe depression symptoms, a prevalence that closely matches that among other medical student populations (Rotenstein et al. 2016; Tam et al. 2019; Bert et al. 2020). The depression scores were related to FEAR and SADNESS and, inversely, to SEEKING. This finding is mostly congruent with Panksepp's view that depression arises from a sustained activation of separation distress along with diminished dopamine-driven SEEKING urges (Coenen et al. 2011). This result is also in line with a previous work by Montag et al. (2017) that showed a positive association between these personality traits and depression symptoms.

Collectively, our findings highlight the importance of considering the multifaced aspects of well-being that may be challenged and preserved among medical students and call attention to the relationship between affectivity and well-being aspects. However, these findings should be considered with caution for the following reasons: We conducted a cross-sectional study, which precludes the possibility to infer causality. This research was conducted only in one country, and the students were all recruited from a single institution, which is one of the top-ranked universities for medical degree programs at a national level. Therefore, the well-being and depression rates might not be representative of larger populations or students from other institutions, countries, or learning environments. Thus, for a deeper and broader understanding of the link between emotional traits and well-being in medical education, further research is warranted to extend our study to other countries and institutions that differ in competitiveness, medical programs, and culture.

Conclusions

Medical curricula must consider the various aspects of well-being and their relationships with basic emotional traits. Our findings have educational implications for planning medical learning curricula that support well-being. First,

medical curricula may contribute to the promotion of students' well-being by increasing students' and educators' awareness of the relationship between basic adaptive emotional systems and well-being, and the plasticity of emotional traits in response to environmental influences.

In addition, our findings suggest that medical students' well-being may be pursued by setting or readjusting learning environments to sustain the activation of affective tendencies related to specific well-being facets. For example, medical teachers could set a learning environment that sustains the satisfaction of their primal SEEKING urges, which have been hypothesized to be involved in intrinsic motivation and goal-directed activities (Panksepp and Biven 2012).

Furthermore, given that autonomy, positive relations, and self-acceptance are the main domains in which students may experience reduced well-being, educators and tutors could introduce programs that sustain and harness affective tendencies that contribute to these specific dimensions. For instance, given that positive relations with other dimensions were positively related to CARE and PLAY, students with reduced perceptions of positive relations may, for example, be encouraged to participate in peer-tutoring programs in which CARE and PLAY traits could be elicited and supported.

Within the limits of the present study, our findings set the stage for investigations to examine the role of primary emotional traits in well-being. Further research is needed to assess the extent at and mechanism by which satisfaction of primary emotional tendencies and needs increases psychological health during medical training.

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Author contributions

VC and PMR designed the study, collected data, analysed data, and wrote the manuscript. LG and MF reviewed drafts of the paper and approved the final draft. All authors approved the final manuscript for submission.

Disclosure statement

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

Glossary

Primary emotional traits: Emotional-behavioral dispositions emerging from neuroevolutionary ancient brain emotional systems.

Neuroevolutionary Affective Neuroscience: A scientific discipline that studies the emotional feelings of the brain. Affective neuroscience research ranges from the identification of primary emotional systems, their brain network organizations, related neurochemistry, and behavioral dispositions.

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