ORIGINAL ARTICLE

Detecting mental health stigma in medical education: A cross-sectional study of differences in medical students' knowledge, attitudes, and behaviors across six years of training

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ABSTRACT

Background: Medical students often face psychological distress, worsened by mental health stigma.
Aims: This study examines how stigma-related knowledge, attitudes, and behaviors evolve over six years of medical education and explores socio-demographic and psychosocial predictors of these changes.
Methods: A cross-sectional study conducted during the 2022/2023 academic year involved 969 medical students, with 527 participants. Tools included the Mental Health Knowledge Schedule (MAKS-I), Community Attitudes to Mental Illness Scale (CAMI-I), and Reported and Intended Behavior Scale (RIBS-I), alongside socio-demographic data.
Results: Findings showed a steady improvement in students' mental health knowledge, attitudes, and behaviors, especially in the final two years. Academic and clinical experiences played a key role in shaping these views. However, a notable increase in mental health issues was observed in the later years. Positive changes were predicted by factors such as personal or family experiences with mental health issues, being older, and being female.
Conclusions: The study emphasizes the need for integrating mental health education and stigma-reduction strategies throughout medical training. Although attitudes and knowledge improved, the rise in mental health

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issues underscores the importance of continued support and tailored interventions to enhance the well-being of medical students. (www.actabiomedica.it)

Key words: stigma; medical students; discrimination; mental health; education; stereotype; public stigma

Introduction

The term "stigma" was first introduced by the Greeks to refer to a mark used to identify and ostracize individuals, such as a slave, criminal, or traitor (1). In the field of mental health, stigma has come to denote any negative association that leads to the exclusion and discrimination of individuals due to their psychopathological condition (1,2). Mental health stigma takes various forms, including public stigma (societal negative reactions), structural stigma (discrimination embedded in laws and institutional practices), self-stigma (internalization of negative perceptions), perceived stigma (fear of social rejection), experienced stigma (actual discrimination), label avoidance (avoiding treatment to escape the mental illness label), courtesy stigma (discrimination faced by family members and caregivers), and spiritual stigma (negative religious beliefs that attribute mental illness to sins or divine punishment) (1,3–7). At the core of mental health stigma is a cognitive and social framework in which the behaviors of individuals with mental health issues become for discrimination. These triggers foster stereotypes, which in turn lead to prejudice and a negative emotional responses, culminating in discriminatory actions with profound consequences for the lives of those affected (8–10). In the literature, two main theoretical models emerge to explain public stigma: the Attribution Theory (11) Perception of Dangerousness Theory (12). Attribution Theory posit that mental disorders are often perceived as controllable, thereby placing responsibility on the individuals who suffer from them. On the other hand, Perception of Dangerousness Theory characterizes individuals with mental health issues as dangerous or violent. These perceptions provoke negative emotional reactions, such as anger, frustration, and fear, which lead to behaviors of exclusion, isolation, and social discrimination. The consequences for those with mental health issue are severe. Affecting their ability to secure employment, housing, and maintain relationships (6,8,11). Individuals with mental health conditions who internalize negative beliefs about their mental disorders may view discrimination and prejudice as insurmountable, resulting in decreased self-esteem and self-efficacy (13–15). This mindset can also increase the likelihood that they will avoid seeking help and accessing healthcare services due to the fear or shame of being labeled and stigmatized (16). Such avoidance has significant consequences for their prognosis and the course of their condition, often leading to delays in intervention and limitations in recovery prospects (17). The stigma associated with mental illness creates significant barriers to both access and quality of care, negatively impacting both patients and healthcare providers. Although recent years have seen a positive shift in global attitudes toward mental health stigma, stigmatizing attitudes persist among healthcare professionals, leading to inadequate preparation for treating patients with mental health issues (18). As a result, stigmatization also diminishes the quality of physical healthcare for individuals with mental illnesses, who often receive substandard treatment for their physical health concerns, as their symptoms are frequently misattributed to their mental condition (19,20). Numerous studies across various countries have identified stigmatizing attitudes among medical students, underscoring the importance and urgency of early interventions in medical education (18,21). These attitudes often involve the perpetuation of stereotypes about patients with mental illnesses, such as aggression and unpredictability, and viewing the field of mental health as stressful and emotionally taxing (21). Stigma also affects the willingness of physicians and medical students to seek help for their mental

health issues. This reluctance to seek assistance often leads to an over-reliance on self-treatment, which can have significant negative consequences for their health and personal lives, as well as an elevated risk of suicide within caregiving professions (19,22,23). One study found that only 22% of medical students with depression utilized mental health counseling services, citing barriers such as stigma, lack of confidentiality, and fear of being recorded (24). Therefore, addressing stigma within medical schools is crucial for shaping positive attitudes towards mental health disorders. The educational structure should promote knowledge and foster improved attitudes among medical students regarding mental health issues (25). Notably, students' attitudes toward individuals with mental illness may improve as they advance through their medical condition (18,21). Therefore, the aim of this study is to investigate how different elements of stigma (knowledge, attitudes, and behaviors) evolve over the course of different years of study among medical and surgery students, with socio-demographic and psychosocial factors considered as potential predictors—defined as variables that may influence or explain the changes in stigma-related outcomes across the years.

Materials and Methods

This cross-sectional study collected data from students enrolled in the Medicine and Surgery program at the University of Modena and Reggio Emilia (UNIMORE) during the 2022/2023 academic year. UNIMORE, founded in 1175, is among Italy's top 10 large universities, serving over 28,000 students, including 3,500 postgraduates (26). In 2022/2023, 969 students were enrolled in the Medicine and Surgery program, with 217 in the first year (22.4%), 176 in the second (18.2%), 149 in the third (15.4%), 155 in the fourth (16.0%), 132 in the fifth (13.6%), and 140 in the sixth (14.4%).

Measurement

In September 2022, all enrolled students were asked to complete a socio-demographic questionnaire and three psychometric questionnaires: the Mental Health Knowledge Schedule (MAKS-I), the Community Attitudes to Mentally Illness Scale (CAMI-I) and the Reported and Intended Behaviour Scale (RIBS-I). Students who consented to complete the questionnaires and signed the informed consent form were asked to provide the following socio-demographic information: sex, gender at birth, age, year of study, highest level of parental education, whether they are working students (at least 10 hours per week), previous participation in stigma awareness events, and whether they have a close friend or first- or second-degree relatives who have or have had a mental illness. The Italian version of the Mental Health Knowledge Schedule (MAKS-I) (27,28) is a self-administered questionnaire consisting of 12 items, each rated on a Likert scale ranging from 1 ("Strongly Disagree") to 5 ("Strongly Agree"). Responses of "Don't know" are assigned a neutral score of 3, in line with the scoring guidelines. The MAKS-I questionnaire is divided into two sections: the first six items can be summed to generate a total score that reflects knowledge of stigma-related mental health topics, with higher scores indicating greater knowledge of mental illness. Items 7 through 12 evaluate recognition and familiarity with six distinct conditions. The Community Attitudes to Mental Illness (CAMI-I) Scale is a self-administered questionnaire that measures attitudes towards individuals with mental illness. Participants rate 27 statements on a scale from 1 ("Strongly Disagree") to 5 ("Strongly Agree"), with higher scores indicating a more positive attitude (29,30). The Italian version of the Reported and Intended Behaviour Scale (RIBS-I) (31,32) is a self-administered questionnaire consisting of eight items that assess reported and intended behaviors. The first four assess past behaviors across domains such as living, working, or maintaining relationships with someone with a mental health issue. The last four items evaluate the respondent's intentions to engage in these behaviors in the future, scored on a scale from 1 (Strongly Disagree) to 5 (Strongly Agree). The total intended behavior score is derived from summing the responses to these items, with higher scores indicating a greater willingness to interact with individuals with mental health problems.

Data collection

This study did not specifically involve participants with a lived experience of mental health issues, as the

focus was on medical students, some of whom may or may not have experienced mental health challenges. Each student was asked to complete the questionnaires described above in October 2022, March 2023, and June 2023. The questionnaires were administered on paper, and the anonymity of the respondents was ensured. For the MAKS-I, CAMI-I, and RIBS-I questionnaires, the average of the scores obtained across the three administrations will be considered.

Statistical analysis

The data were analyzed using descriptive and inferential statistics. Descriptive statistics (means, standard deviations, frequencies, and percentages) summarized the socio-demographic characteristics and psychometric questionnaire responses. Comparisons between study years were made using one-way ANOVAs, with year as the independent variable and scores from MAKS-I, CAMI-I, and RIBS-I as dependent variables. If data were not normally distributed, the Kruskal-Wallis test and Dunn's test with Bonferroni correction were used. Significant ANOVA results were followed by Tukey's HSD post-hoc test. Assumptions of normality, variance homogeneity, and multicollinearity were checked before analysis. Multiple regression analyses explored the influence of socio-demographic factors (age, gender, parental education, and stigma awareness event participation) on stigma outcomes. Key assumptions for linearity, normality of residuals (via Shapiro-Wilk test), homoscedasticity (checked through residual plots), multicollinearity (VIF < 10), and independence of residuals (Durbin-Watson statistic) were verified before proceeding with the regression analysis.

Adherence with ethical standards

This study has received ethical approval from the Ethics Committee of the Northern Emilia Area (https://www.aou.mo.it/ComitatoEticoAVEN) with protocol number AOU 0025386/22 (08/09/2022).

Results

The response rates for each year were as follows: 120 out of 217 students (55.3%) in the first year, 95 out of 176 (54.0%) in the second year, 75 out of 149 (50.3%) in the third year, 98 out of 155 (63.2%) in the fourth year, 87 out of 132 (65.9%) in the fifth year, and 52 out of 140 (37.1%) in the sixth year. Table 1 provides a comprehensive overview of the demographic and psychosocial characteristics of the respondents across the six years of the Medicine and Surgery degree program.

Socio-demographic profile of the sample

The mean age of the entire sample is 21.69 (±2.13). The gender distribution at birth remains relatively consistent across all years, with a slightly higher percentage of female students in most years. Most students reported that their parents had a degree or a master's degree, with the highest percentage in the third year (50.42%). The percentage of working students peaked in the fourth year (16.33%). Mental health issues were reported by 18.10% in the first year, rising to 39.22% in the sixth year. Family members affected by mental health issues were highest in the sixth year (53.85%), and friends affected peaked in the fifth year (45.36%). Participation in stigma awareness events was low, with the highest in the sixth year (22%).

Descriptive statistics of total scores for MAKS-I, CAMI-I, and RIBS-I

Table 2 presents descriptive statistics—mean, range, median, and mode—for the total scores of MAKS-I, CAMI-I, and RIBS-I across the six years of the Medicine and Surgery course. For MAKS-I, the average score increases from 22.48 in the first year to 24.06 in the sixth, with the median rising from 22.5 to 24 and the mode from 22 to 26. CAMI-I scores rise steadily from 108.20 to 117.83, with the range widening from 45-127 to 97-128. RIBS-I scores increase from 15.97 to 17.73, with the range narrowing from 6-20 to 12-20, and the mode remaining at 20 from the second year onward.

Comparisons between different years of study for the MAKS-I, CAMI-I, and RIBS-I questionnaires

Given that the distributions of the MAKS-I, CAMI-I, and RIBS-I scores are non-parametric, as

Table 1. Demographic and psychosocial characteristics of medical and surgery students by year of study.

		First year	Second year	Third Year	Fourth year	Fifth year	Sixth year
Age (mean, SD)		19.48 (±1.51)	20.59 (±1.28)	21.52 (±1.19)	22.45 (±1.11)	23.55 (±1.59)	24.44 (±1.07)
Sex at birth (N, %)	Male	46 (38.66%)	34 (35.79%)	23 (30.67%)	36 (36.74%)	32 (36.78%)	25 (49.02%)
	Female	73 (61.34%)	61 (64.21%)	52 (69.33%)	62 (63.27%)	55 (63.22%)	26 (50.98%)
Gender identity (N, %)	Male	46 (38.66%)	33 (34.74%)	23 (30.67%)	36 (36.74%)	32 (36.78%)	25 (49.02%)
	Female	73 (61.34%)	60 (63.16%)	52 (69.33%)	61 (62.25%)	52 (59.77%)	25 (49.02%)
	I don't identify with a gender binary	0	2 (2.10%)	0	1 (1.01%)	3 (3.45%)	1 (1.96%)
Highest level of parental education (N, %)	Elementary school	1 (0.84%)	2 (16.67%)	4 (33.33%)	3 (25%)	1 (8.33%)	1 (8.33%)
	Middle school	5 (4.20%)	2 (16.67%)	2 (10%)	4 (20%)	3 (15%)	4 (20%)
	High school	47 (39.50%)	46 (20.72%)	29 (13.06%)	32 (14.41%)	41 (18.47%)	27 (12.16%)
	Degree/master's degree	60 (50.42%)	34 (14.98%)	27 (11.89%)	52 (22.91%)	35 (15.42%)	19 (8.37%)
	Ph.D.	6 (5.04%)	9 (21.43%)	13 (30.95%)	6 (14.29%)	7 (16.67%)	1 (2.38%)
Working student	Yes	13 (10.83%)	15 (15.79%)	6 (8%)	16 (16.33%)	13 (14.94%)	4 (7.69%)
	No	107 (89.17%)	80 (84.21%)	69 (92%)	82 (83.67%)	74 (85.06%)	48 (92.31%)
Have you ever experienced or are you currently experiencing a mental health issue?	Yes	21 (18.10%)	21 (23.33%)	22 (30.14%)	36 (37.11%)	22 (25.58%)	20 (39.22%)
	No	95 (81.90%)	69 (76.67%)	51 (69.96%)	61 (62.89%)	64 (74.42%)	31 (60.78%)
Do you currently have, or have you ever had, a family member who is or has been affected by a mental health issue?	Yes	38 (31.93%)	32 (34.04%)	31 (41.89%)	44 (45.36%)	34 (40.48%)	28 (53.85%)
	No	81 (68.07%)	62 (65.96%)	43 (58.11%)	53 (54.64%)	50 (59.52%)	24 (46.15%)
Do you currently have, or have you ever had, a friend who is or has been affected by a mental health issue?	Yes	64 (31.93%)	53 (34.04%)	33 (41.89%)	61 (45.36%)	62 (40.48%)	40 (53.85%)
	No	55 (68.07%)	41 (65.96%)	41 (58.11%)	35 (54.64%)	24 (59.52%)	12 (46.15%)
Have you ever attended awareness events (seminars, conferences, etc.) on the topic of stigma?	Yes	9 (7.50%)	6 (6.45%)	9 (12%)	9 (9.18%)	4 (4.60%)	11 (22%)
	No	111 (92.50%)	87 (93.55%)	66 (88%)	89 (90.92%)	83 (95.40%)	39 (78%)

evidenced by both the Shapiro-Wilk and Kolmogorov-Smirnov tests showing statistically significant results ($p<0.001$), appropriate non-parametric methods were employed for further analysis. Specifically, the Kolmogorov-Smirnov test results were as follows: for the MAKS-I, the K-S statistic was 22.09 with $p < 0.001$; for the CAMI-I, the K-S statistic was 39.51 with $p < 0.001$; and for the RIBS-I, the K-S statistic was 15.64 with $p = 0.008$. Table 3 describes the results of Dunn's post hoc test for pairwise comparisons between different years of study for the MAKS-I, CAMI-I, and RIBS-I questionnaires. For the MAKS-I questionnaire, significant differences were found between the first and sixth years ($z = -3.40$, $p < 0.001$, pBonf = 0.010,

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Table 2. Mean, range, median, and mode of total scores for MAKS-I, CAMI-I, and RIBS-I across the six years of the medicine and surgery course.

	MAKS-I						CAMI-I						RIBS-I					
	First year	**Second year**	**Third Year**	**Fourth year**	**Fifth year**	**Sixth year**	**First year**	**Second year**	**Third Year**	**Fourth year**	**Fifth year**	**Sixth year**	**First year**	**Second year**	**Third Year**	**Fourth year**	**Fifth year**	**Sixth year**
Mean (DS)	22.48 (±2.78)	22.39 (±2.78)	22.71 (±2.78)	23.39 (±2.78)	23.24 (±2.78)	24.06 (±2.78)	108.20 (±11.57)	111.81 (±9.73)	198.83 (±11.36)	112.22 (±9.60)	113.13 (±8.73)	117.83 (±7.71)	15.97 (±15.97)	16.59 (±16.59)	16.07 (±16.07)	16.45 (±16.45)	16.74 (±16.74)	17.73 (±17.73)
Range (m – M)	15 – 28	17 – 30	17 – 28	18 – 28	17 – 29	17 – 30	45 - 127	86 – 127	85 – 127	78 – 128	77 – 129	97 – 128	6 – 20	7 – 20	6 –20	8 – 20	8 – 20	12 – 20
Median	22.5	22	23	24	23	24	112	113	112	114	114	119.5	16	17	16	17	17	18
Mode*	22	21	23	24	24	26	112	120	110	119	113	124	16	20	20	20	20	20

*if multiple modes are present, the first one is reported.

Table 3. Dunn's post hoc test for pairwise comparisons between different years of study for the MAKS-I, CAMI-I, and RIBS-I questionnaires.

	MAKS-I				CAMI-I				RIBS-I			
Comparison	*z*	*p*	p_{Bonf}	p_{Holm}	*z*	*p*	p_{Bonf}	p_{Holm}	*z*	*p*	p_{Bonf}	p_{Holm}
1-2	0.63	0.530	1	1	-2.39	0.017	0.255	0.136	-1.64	0.102	1	0.918
1-3	-0.49	0.626	1	1	-1.16	0.245	1	1	-0.46	0.645	1	1
1-4	-2.48	0.013	0.198	0.145	-2.70	0.007	0.103	0.062	-0.99	0.321	1	1
1-5	-1.94	0.053	0.795	0.477	-3.10	0.002	0.029	0.019	-1.85	0.064	0.961	0.640
1-6	-3.40	<0.001	0.010	0.010	-6.03	<0.001	<0.001	<0.001	-3.71	<0.001	0.003	0.003
2-3	-1.02	0.306	1	1	1.01	0311	1	1	1.02	0.310	1	1
2-4	-2.94	0.003	0.049	0.042	-0.28	0.780	1	1	0.62	0.534	1	1
2-5	-2.41	0.016	0.235	0.157	-0.73	0.463	1	1	-0.24	0.807	1	1
2-6	-3.77	<0.001	0.002	0.002	-3.91	<0.001	0.001	0.001	-2.27	0.023	0.352	0.282
3-4	-1.73	0.083	1	0.666	-1.28	0.199	1	1	-0.44	0.661	1	1
3-5	-1.27	0.203	1	1	-1.69	0.092	1	0.643	-1.23	0.221	1	1
3-6	-2.73	0.006	0.096	0.077	-4.60	<0.001	<0.001	<0.001	-3.03	0.002	0.036	0.034
4-5	0.44	0.659	1	1	-0.47	0.641	1	1	-0.95	0.393	1	1
4-6	-1.32	0.187	1	1	-3.69	<0.001	0.003	0.003	-2.80	0.005	0.077	0.067
5-6	-1.66	0.096	1	0.674	-3.22	0.001	0.019	0.014	-2.02	0.043	0.646	0.474

pHolm = 0.010), and between the second and sixth years (z = -3.77, p < 0.001, pBonf = 0.002, pHolm = 0.002). These results indicate that students' scores on the MAKS-I scale in the sixth year were significantly different from those in the first and second years. In the CAMI-I questionnaire, significant differences were also noted between the first and sixth years (z = -6.03, p < 0.001, pBonf < 0.001, pHolm < 0.001) and between the second and sixth years (z = -3.91, p < 0.001, pBonf = 0.001, pHolm = 0.001). These results suggest that students' attitudes towards mental illness, as measured by the CAMI-I, were significantly different in the sixth year compared to the first and second years. For the RIBS-I questionnaire, the most significant difference was found between the first and sixth years (z = -3.71, p < 0.001, pBonf = 0.003, pHolm = 0.003). Additionally, significant differences were observed between the third and sixth years (z = -4.60, p = 0.002, pBonf = 0.036, pHolm = 0.034) and between the fourth and sixth years (z = -3.69, p < 0.001, pBonf = 0.003, pHolm = 0.003).

Multiple regression analyses

The assumptions required for conducting the multiple regression analysis are thoroughly addressed. The figures below include a detailed examination of linearity, normality of residuals, homoscedasticity, independence of residuals, and multicollinearity. The assessment of homoscedasticity (Figure 1) revealed that the assumption was met in the MAKS and CAMI models, as the residuals appeared to be evenly distributed around zero with no discernible patterns, indicating constant variance across all levels of the predicted values. However, in the RIBS model, there is a potential presence of heteroscedasticity, as evidenced by a slight funnel-shaped pattern in the residual plot, where the dispersion of residuals increases with higher predicted values. This suggests that the variance of the errors may not be constant in the RIBS model, and further investigation or adjustments may be necessary to address this issue. Due to the high Variance Inflation Factor (VIF) (Table 4) value associated with the "Sex at Birth"

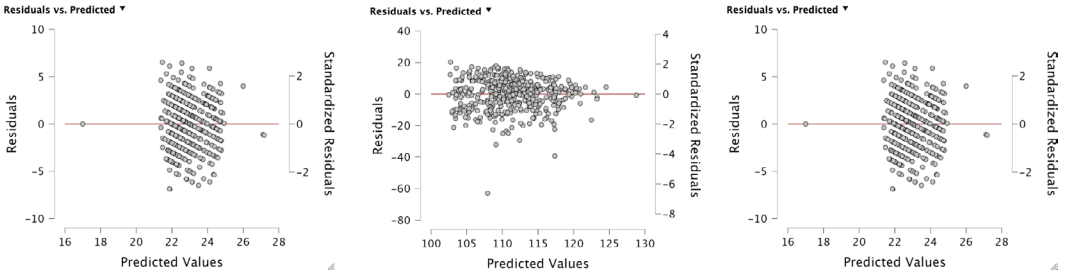

Figure 1. Testing for homoscedasticity.

Table 4. Test of multicollinearity (Variance Inflation Factor).

	VIF
Age	1.68
Sex at birth	12.08
Gender identity	3.48
Year of study	1.67
Highest level of parental education	1.03
Working student	1.01
Have you ever experienced or are you currently experiencing a mental health issue?	1.09
Do you currently have, or have you ever had, a family member who is or has been affected by a mental health issue?	1.07
Do you currently have, or have you ever had, a friend who is or has been affected by a mental health issue?	1.08
Have you ever attended awareness events (seminars, conferences, etc.) on the topic of stigma?	1.01

Table 5. The independence of residuals assessed using the Durbin-Watson statistic.

	Autocorrelation	Statistic	p
MAKS-I	0.02	1.96	0.65
CAMI-I	-0.03	2.05	0.63
RIBS-I	0.01	1.97	0.68

variable (VIF = 12.08), which exceeds the commonly accepted threshold of 10, we decided to exclude this variable from further analysis. The Durbin-Watson statistic values (Table 5) for all three models (MAKS-I: 1.96, CAMI-I: 2.05, RIBS-I: 1.97) are very close to 2. This indicates that there is no significant evidence of autocorrelation in the residuals for any of the models. The reported autocorrelation values are very close to zero for all models (MAKS-I: 0.02, CAMI-I: -0.03, RIBS-I: 0.01), further confirming the absence of significant autocorrelation in the residuals.

The multiple regression analysis (Table 6) reveals how various socio-demographic and psychosocial factors contribute to the scores on the MAKS-I, CAMI-I, and RIBS-I questionnaires. The results indicate that age plays a significant role in influencing MAKS-I scores, with older participants tending to have higher scores (Unstandardized Coefficient = 0.01, $p < 0.001$). Gender identity also emerged as a key predictor across all models. Specifically, individuals identifying with a non-binary gender had higher MAKS-I scores (Unstandardized Coefficient = 1.03, Standard Error = 1.18), while identifying as female was associated with higher CAMI-I (Unstandardized Coefficient = 5.03, $p < 0.001$) and RIBS-I scores (Unstandardized Coefficient = 0.85, $p = 0.001$). Furthermore, personal experience with mental health issues significantly predicted higher scores in both the MAKS-I (Unstandardized Coefficient = 1.33, $p < 0.001$) and CAMI-I (Unstandardized Coefficient = 3.35, $p = 0.002$) models, reflecting greater knowledge and more positive attitudes toward mental illness. In the RIBS-I model, participation in stigma awareness events was an important predictor, with those who had attended such events reporting higher scores (Unstandardized Coefficient = 0.67, $p = 0.02$).

Discussion

This study aimed to investigate how different elements of stigma - such as knowledge, attitudes, and

Table 6. Multiple regression analysis results for predictors of MAKS-I, CAMI-I, and RIBS-I scores.

		MAKS-I				CAMI-I				RIBS-I			
		Unstandardized	**Standard Error**	**Standardized°**	**p**	**Unstandardized**	**Standard Error**	**Standardized°**	**p**	**Unstandardized**	**Standard Error**	**Standardized°**	**P**
Age		0.01	0.09	0.006	<0.001	0.40	0.33	0.08	0.22	0.11	0.10	0.08	0.23
Gender identity*	Female	0.03	0.25	/	0.90	5.03	0.91	/	<0.001	0.85	0.26	/	0.001
	I don't identify with a gender binary	1.03	1.18	/	0.38	12.98	4.37	/	0.003	2.83	1.27	/	0.03
Year of study		0.20	0.11	0.12	0.08	0.81	0.42	0.13	0.05	0.04	0.12	0.02	0.76
Highest level of parental education		0.06	0.15	0.02	0.71	-0.53	0.56	-0.04	0.35	-0.05	0.16	-0.01	0.77
Working student		-0.35	0.36	/	0.33	-0.28	1.33	/	0.84	0.34	0.39	/	0.38
Have you ever experienced or are you currently experiencing a mental health issue?		1.33	0.28	/	<0.001	3.35	1.06	/	0.002	0.91	0.31	/	0.003
Do you currently have, or have you ever had, a family member who is or has been affected by a mental health issue?		0.08	0.25	/	0.77	0.88	0.95	/	0.35	0.24	0.27	/	0.39
Do you currently have, or have you ever had, a friend who is or has been affected by a mental health issue?		0.59	0.26	/	0.02	1.03	0.95	/	0.28	0.67	0.28	/	0.02
Have you ever attended awareness events (seminars, conferences, etc.) on the topic of stigma?		0.21	0.41	/	0.62	4.16	1.52	/	0.006	0.62	0.44	/	0.16

*Sex at birth was excluded from the analysis due to its high VIF value. °Standardized coefficient can only be compute for continuous predictors.

behaviors - evolve over the year of study among medical and surgery students, with socio-demographic and psychosocial factors considered as potential predictors of these changes.The socio-demographic data reveal an increase in reported mental health issues over the years, with rates rising from 18.10% in the first year to 39.22% in the sixth year. These findings are consistent with a systematic review and meta-analysis of 195 studies conducted across 47 countries, which found that 27% of medical students exhibited signs of mental health issues, particularly depression, with 11.1% experiencing suicidal ideation, and only 15.7% of those affected seeking help (33). However, the literature offers conflicting data on the progression of distress throughout the study years. Some studies suggest that burnout is more pronounced and satisfaction lower in the first and third years, while resilience tends to increase, particularly especially in the fourth year (34,35). Conversely, one study found that depressive symptoms were more severe in the second and fourth years compared to the first (36). Other evidence suggests that distress may worsens in the middle of the program but improves in the final year (37–39). Additionally, our data indicate and increasing percentage of students reporting mental health issues within their family, peaking in the sixth year for family members (53.85%) and in the fifth year for friends (45.36%). This trend suggests an environment that psychological difficulties are not isolated but rather widespread within the student community. Further studies could explore the causes of distress within the social network of this population group. However, experiencing mental distress within their own social circle may have contributed to a reduction in stigma, leading to improved attitudes and behaviors toward individuals with mental health challenges. A study by Moreira et al. (2021) investigating mental illness stigma among Portuguese medical students found that stigma was lower among those with a personal or family history of mental illness, suggesting that such experiences might heighten their sensitivity to mental distress and foster a more empathetic understanding (40). Similarly, our results indicate that fifth- and sixth-year students not only report higher rates of personal and family history of mental distress but also demonstrate greater engagement in stigma awareness events, with participation rates reaching 22% in the sixth year. Despite these encouraging findings, the data underscore the enhance the accessibility and effectiveness of these initiatives. Brenner and colleagues (2024) support the idea that mental health initiatives, even within academic settings, can play a crucial role in addressing and combating stigma (41). The average scores on the MAKS-I, CAMI-I, and RIBS-I questionnaires show a positive trend from the first to the sixth year, indicating a gradual improvement in knowledge, attitudes, and behaviors related to mental health among medical students. The results reveal significant differences between the first and second years compared to the sixth year, highlighting a substantial change in students' perceptions and attitudes as they progress through their educational program. Beyond the previously mentioned hypotheses, another possible reason for this improvement could be that, at the UNIMORE, medical students only begin the Psychiatry course and their clinical internship in mental health services in their fifth year. Specifically, our study revealed significant differences in the MAKS-I questionnaire scores between the first and sixth years, as well as between the second and sixth years. Similarly, the CAMI-I results indicate a shift in attitudes towards mental health, with significant differences between the first and sixth years and between the second and sixth years. This change suggests that exposure to the academic curriculum, clinical experiences, and possibly personal events can significantly influence awareness and knowledge of mental illnesses. Some studies have investigated the evolving attitudes of medical students and found that those who have completed a psychiatry course tend to have more positive attitudes toward individuals with mental illness (42,43). Additionally, the results from the final years of the course may reflect a process of personal and professional maturation, where interactions with patients and colleagues contribute to a more empathetic and informed perspective. The RIBS-I results indicate that sixth-year students are significantly more willing to engage with individuals with mental health challenges compared to earlier years, with notable differences not only from the first year but also from the third and fourth years. This finding may indicate that, over time, students develop greater confidence and competence in addressing mental health issues, supported by their

academic and clinical training. A review highlights the lack of research on the effectiveness of interventions aimed at reducing stigma among medical students, emphasizing the need to develop and evaluate targeted initiatives this population (44). Furthermore, our results underscore the need for increased psychological support within medical degree programs, as students are particularly vulnerable to psychological distress, including anxiety, depression, and burnout, which can negatively impact their learning process, lifestyle, and overall health (33,34,39). Therefore, it is essential to prioritize mental health within the medical curriculum, incorporating initiatives that raise awareness, reduce stigma related to mental health, and foster emotional resilience among students (41,45). Regarding the predictors, it has been observed that individuals who have personally experienced, or are currently experiencing, mental health challenges tend to exhibit a deeper understanding of mental health issues. This personal experience is associated with more positive attitudes and a greater willingness to engage in inclusive behaviors toward others facing similar challenges. Furthermore, those who have, or have had, a friend with mental health issues also tend to demonstrate a higher level of mental health knowledge and a stronger inclination to act inclusively toward individuals with mental health difficulties (46,47). Age also appears to be a predictor, with older individuals generally associated with greater knowledge about mental health. This could potentially be linked to broader life experiences and exposure to diverse situations (48,49). Additionally, gender differences have emerged, with women generally showing more positive attitudes and a higher readiness to engage in supportive behaviors toward those with mental health challenges. This suggests that female gender may be associated with greater sensitivity and responsiveness to mental health issues (50). One limitation of this study is its cross-sectional design, which limits the ability to establish causal relationships between variables. While it provides insights into how stigma evolves during medical education, it cannot determine whether changes are due to the curriculum, external factors, or personal experiences. Another limitation is the reliance on self-reported data, which may introduce response bias, particularly given the sensitive topic of mental health stigma. This could skew results, either underestimating or overestimating stigma-related knowledge, attitudes, and behaviors. Additionally, since the study was conducted at a single institution, its findings may not be generalizable to other universities with different cultural or educational contexts. The results underscore the need for ongoing support and training for medical students on mental health. While improvements in knowledge and attitudes are promising, the prevalence of mental health issues among students shows the need for a more supportive academic environment. Efforts to increase participation in stigma awareness events and targeted interventions could further enhance student well-being. Future research should track the evolution of knowledge, attitudes, and behaviors over six years, involving a larger sample across various institutions. Further studies are also needed to develop interventions to combat stigma and promote stronger psychological support for medical students.

Ethic Approval: This study has received ethical approval from the Ethics Committee of the Northern Emilia Area (https://www.aou.mo.it/ComitatoEticoAVEN) with protocol number AOU 0025386/22 (08/09/2022).

Conflict of Interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

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