

Mechanisms of effective mentoring in undergraduate medical education: A Theory of Change mixed-methods study

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Abstract

Introduction: Mentoring programs are increasingly implemented in undergraduate medical education, yet little is known about the mechanisms and contextual conditions through which they generate benefits for students. This study aimed to identify the mechanisms underlying effective mentoring, examine relationship factors associated with successful mentor–student interactions, and develop an explanatory model to inform mentoring program design beyond a single institutional context.

Methods: The mentoring component of the Student Support Program (SSP) of the Faculty of Medicine at the University of Vic–Central University of Catalonia (FM UVic-UCC) was evaluated using a Theory of Change (ToC)-guided sequential exploratory mixed-methods design. Two focus groups were conducted—one with mentors (n=8) and one with medical students (n=6)—followed by a survey distributed among 162 fourth-, fifth-, and sixth-year medical students. Qualitative data underwent thematic analysis, quantitative data were analysed using bivariate and multivariate logistic regression, and findings were integrated into a final ToC model.

Results: Four interrelated mechanisms were identified as central to mentoring effectiveness. First, awareness of mentoring support facilitated engagement, whereas lack of information acted as a barrier. Second, students' perceived need for mentoring influenced both participation and the perceived value of the program. Third, regular and individualised contact were strongly associated with mentor–student relationship satisfaction (OR=9.36 and OR=8.10; $p<0.001$). Fourth, psychologically safe relationships emerged as a key enabling mechanism, where mentors' dual supportive-evaluative role showed a negative trend with relationship satisfaction (OR=0.37, $p=0.051$). Perceived academic, psychosocial, and professional impacts were all independently associated with overall satisfaction (OR=27.23, 32.51, and 35.67; $p<0.001$). The integrated ToC model indicates that mentoring outcomes arise through multiple interconnected relational pathways rather than program participation alone.

Discussion: This study provides a mechanism-based understanding of mentoring in undergraduate medical education. Effective mentoring appears to rely on four interacting conditions: awareness of available support, alignment between mentoring program (MP) and students' perceived needs, regular individualised contact, and psychologically safe mentor–student relationships. A dual supportive–evaluative role of mentors may undermine trust and warrants careful consideration in program design. The resulting ToC model provides a transferable framework for understanding, evaluating, and refining mentoring programs across educational contexts.

Background

Medical students face multiple challenges that extend beyond academic learning, including educational transitions, professional socialisation, and increasing emotional demands throughout their training (1–3). Evidence consistently shows high levels of burnout, psychological distress, depressive symptoms, and dropout intentions within this population, with important consequences for wellbeing, academic

achievement, and professional development. (4–6). As a result, student support and wellbeing have become central concerns in contemporary medical education (7).

Medical education has undergone a substantial transformation over recent decades, moving beyond traditional models focused primarily on knowledge transmission towards competency-based approaches that emphasise professionalism, reflective practice, self-regulated learning, and professional identity formation (8–10). Within this framework, medical schools are increasingly expected not only to develop students' clinical knowledge and skills but also to foster their personal and professional growth across the educational continuum (7–9).

Consequently, there has been growing interest in longitudinal educational strategies that support reflection, professional development, and navigation of the multiple transitions inherent to medical training, including mentoring and other learner-support approaches (3, 11, 12). Mentoring is commonly defined as a longitudinal developmental relationship in which a more experienced individual supports a learner's academic, professional, and personal growth through guidance, reflection, and career development (11, 13). A wide variety of mentoring approaches have been described in undergraduate medical education, ranging from formal institutionally coordinated programs to targeted initiatives designed to support students facing academic, professional, or personal challenges (11, 14). Depending on programme goals and institutional context, mentoring may contribute to academic guidance, career exploration, professional development, self-reflection, professional socialisation, and professional identity formation (10, 11, 13). As a result, mentoring is increasingly conceptualised not as a discrete intervention with a single outcome, but as a complex educational process operating through multiple, interconnected, and context-dependent developmental pathways (11, 15).

Consistent with this conceptualisation, mentoring programs have been associated with a broad range of reported benefits (12, 14, 16). Previous studies describe improved adaptation to medical school, enhanced professional development, support for career planning, stronger professional identity formation, and greater perceived psychosocial support (10, 12, 14, 17). Collectively, these findings suggest that mentoring is best understood as a multidimensional educational strategy that may contribute simultaneously to academic, professional, and psychosocial aspects of student development (10, 12, 16, 17).

Despite the increasing adoption of mentoring programs and the growing evidence describing their benefits, important limitations remain in the mentoring program evaluation literature (12, 14, 16). First, relatively few studies have explored mentoring from the perspectives of both students and mentors, limiting understanding of how mentoring relationships are experienced and interpreted by the different actors involved (12, 16). Second, most evaluations have focused on describing outcomes rather than explaining the mechanisms through which those outcomes are generated. Understanding how mentoring works, for whom, and under which contextual and relational conditions its benefits emerge is essential for designing programs that remain effective across different institutional settings (11, 15).

Because mentoring is a complex educational intervention involving multiple actors, relationships, and outcomes, ToC provides a useful framework for examining not only whether mentoring is effective, but also the mechanisms through which benefits emerge, and the contextual conditions required for their activation (18). Using ToC as an integrative framework, this study evaluated the mentoring component of the Student Support Program (SSP) of the Faculty of Medicine at the University of Vic–Central University of Catalonia (FM UVic-UCC), a comprehensive institutional initiative designed to provide academic, professional, and psychosocial support throughout the medical degree (16, 19). The SSP was developed in response to the growing recognition that medical students' needs extend beyond academic performance alone and require coordinated, longitudinal, and multidimensional support strategies (20, 21). Using a mechanism-oriented evaluation approach, this study aimed to identify the contextual conditions, relational processes, and mechanisms through which mentoring generates perceived academic, psychosocial, and professional benefits in undergraduate medical education, and to develop an explanatory model that may inform the design, implementation, and evaluation of mentoring programs beyond the study setting.

Methodology

Design

This sequential exploratory mixed-methods study comprised five phases, including the development of a ToC following Breuer et al.'s approach to guide and inform the study (18). The qualitative component used two focus groups with students and mentors separately, while the quantitative component consisted of a cross-sectional survey. The initial ToC was developed in the first workshop, with different profiles of key actors represented; finally, all findings were subsequently discussed in a final workshop with participants and integrated into the final ToC model (Fig. 1) (18) .

Specifically, ToC was used in program evaluation to articulate, through a graphic representation of several elements, how and why mentoring programs lead to specific impacts. In ToC, interventions are the activities taken to create change, and assumptions are the beliefs needed for these activities to succeed; outcomes are the short- and medium-term results that lead to the desired impact, and rationale is the explanation of how interventions produce outcomes; indicators are measurements used to track progress; and impact is the long-term change aimed to achieve (18). In this study, ToC was used to explore how mentoring activities were linked to academic, psychosocial and professional outcomes, and to develop an explanatory model of mentoring processes. First, an initial ToC workshop was held, which guided the development of a semi-structured question script for focus groups, available in Supplementary Material 1. After that, results were used to enrich the ToC and guide the preparation of the survey found in Supplementary Material 2. Finally, the ToC enabled the integration and interpretation of both sets of findings.

Setting

This study was conducted at the FM UVic-UCC, a privately managed institution. It was established in 2017 and currently enrolls 569 undergraduate medical students, with teaching delivered across its two campuses in Vic and Manresa.

Intervention description: The SSP of the FM UVic-UCC is described following the Template for Intervention Description and Replication (TIDieR) checklist (22). A detail TIDieR description of the SSP is provided in Supplementary Material 3. The SSP was implemented in 2021 with the aim of providing coordinated academic, professional and psychosocial support throughout the medical degree (19). The program comprises four complementary components: academic performance optimisation, medical residency entrance examination preparation, psycho-emotional care and mentoring. The present study evaluates the mentoring program of the SSP. Starting in the third year, each student is assigned a faculty mentor, typically a clinician-academic staff member, at a ratio of 5:1. The mentor remains assigned throughout the remainder of the medical degree, ensuring longitudinal support and continuity. Mentors provide academic, professional and psycho-emotional support, and conduct practicum assessments.

Study population: The eligible population comprised 227 fourth-, fifth and sixth-year medical students enrolled at FM UVic-UCC during the 2025–2026 academic year and 43 mentors, who consist of academic staff with clinical roles. For the qualitative approach, students, mentors, and key actors were recruited through an invitation email distributed by the SSP. The email included a brief explanation of the study objectives, participation requirements, and a form to express interest. For the student sample, the initial sampling design aimed to recruit nine students: three from the fourth year, three from the fifth year, and three from the sixth year of the medical degree, while ensuring gender parity and balanced representation across campuses. Eligibility criteria for students included having participated in the MP for at least one academic year and being enrolled in the fourth, fifth, or sixth year of the medical degree. For the mentor sample, the initial sampling design aimed to recruit nine mentors: three mentors with two years of mentoring experience, three with three years of experience, and three with four years of experience. Mentor eligibility required having at least one assigned student since the previous academic year. Key actors included representatives of the Faculty management and academic support services involved in the MP. For the quantitative substudy, the eligible population comprised all 227 fourth-, fifth-, and sixth-year medical students enrolled at FM UVic-UCC. However, in accordance with institutional data protection requirements, the survey could only be distributed to students who had previously provided consent to be contacted for research purposes ($n = 162$). A minimum sample of 115 participants was estimated using a 95% confidence level, 50% expected proportion, and 5% margin error. Sample size estimation was performed using the Datarus sample size calculator (see Supplementary Material 4) (23). Missing data were handled through deletion; cases with incomplete responses were excluded from the corresponding analysis.

Data collection

Data collection took place during the 2025–2026 academic year. The students' focus group was moderated by a peer student researcher (J.C.), while the mentors' focus group was moderated by two

peer faculty members (I.V. and L.C.). Data were audio-recorded, transcribed, pseudonymized, and stored on a secure institutional cloud. The survey was distributed by email. Data were collected using Research Electronic Data Capture and hosted at FM UVic-UCC (24, 25).

Qualitative analysis: Qualitative textual data from both focus groups underwent thematic analysis and were reported following *Standards for Reporting Qualitative Research* (26, 27). To enhance trustworthiness, two researchers coded independently (J.C. and I.V.); then grouped into categories and subcategories; discrepancies were resolved by consensus. The thematic analysis was conducted with an interpretive intent, aiming to develop analytically meaningful themes that explain patterns across participants' experiences, rather than to produce purely descriptive summaries of content. The dimensions of interest explored where: 1) perception of need for and awareness of the MP; 2) satisfaction with mentor-student relationship and perception of potential influencing factors such as mentor's gender, practicum assessment and frequency of meetings; 3) perceived impact and satisfaction across academic, psychosocial and professional supports of MP; 4) global satisfaction with the MP; and 5) recommendations for improvement of the MP.

Trustworthiness and reflexivity

Reflexivity was considered throughout the qualitative study. The student moderator (J.C.) was a younger peer of the participants and not involved in any evaluative or supervisory role, minimising power imbalances during focus groups; similarly, the faculty moderator (I.V.) was selected. The research team regularly discussed potential biases arising from their familiarity with the program and the institutional context, and analytic decisions were documented to enhance transparency and credibility.

Quantitative analysis: Quantitative data were analysed using IBM SPSS Statistics and RStudio (28, 29) and reported following the *Strengthening the Reporting of Observational Studies in Epidemiology guidelines* (30). Categorical variables were presented as absolute frequency and percentages, compared using a Chi-squared test. Likert scale variables were dichotomised (satisfied/high: scores 4–5; and dissatisfied/low: scores 0–3). This dichotomisation was chosen to facilitate clinically and programmatically meaningful interpretation of satisfaction thresholds and to meet the assumptions of logistic regression, acknowledging that this approach reduces granularity compared to ordinal methods. Numerical variables were presented as median and interquartile range, compared with the Mann-Whitney U test. Model assumptions were verified through linearity, Cook's distance, and Spearman's correlation available in Supplementary Material 5. Variables with significant bivariate associations ($p < 0.05$) entered multivariate logistic regression models adjusted for age, gender, academic year, and campus. The open-end question was analysed thematically to identify recommendations. Both approaches were integrated within the ToC. Through triangulation and comparison, an explanatory ToC model was developed to identify the mechanisms, contextual conditions and relational pathways through which mentoring was perceived to generate outcomes (18).

Results

Qualitative Results

Regarding the focus groups, the final sample consisted of six medical students from the fifth and sixth years (see Supplementary Material 6 with the students’ sociodemographic characteristics), representative of both university campuses – Vic and Manresa. None of the fourth-year students completed the selection survey. The final mentor focus group consisted of eight mentors from different medical specialties and years of program experience (see Supplementary Material 7 with the mentors’ sociodemographic characteristics). After completing a thematic analysis on both focus groups, organised into categories and subcategories, eight themes guided the analyses and were defined according to the main processes and aspects of the MP stated in the objectives (see Table 1). Findings from both focus groups were triangulated, combining students’ and mentors’ perspectives.

Knowledge about the Mentoring Program: Medical students described a systematic lack of awareness regarding the Mentoring Program (MP), particularly concerning mentor functions. Although the MP is presented during the welcoming session of the 3rd academic year, the information provided was perceived as minimal or insufficient. Mentors corroborated this lack of clarity regarding their own roles.

Need for the Mentoring Program: Medical students' perception of need for the MP varied. The most dependent students relied on mentors as problem-solving references, whereas the most independent students reported no perceived need. Mentors echoed this heterogeneity of need and attributed it in part to academic year progression. Both groups converged on the idea that the MP should be optional.

Mentor Assignment: The success depended on careful mentor selection and appropriate mentor-student matching. Regarding mentor selection, medical students considered motivation and commitment essential qualities. Both groups shared a similar view on matching in terms of dynamics, follow-up and communication.

Mentor-Student Relationship: Mentor-Student relationships led to two paths: positive or negative evolution. Positive evolution was based on continuity, trust and commitment fostered through regular contact, a strong bond and mentors’ genuine interest in students. Mentors highlighted the importance of early contact and continuity. Negative evolution led to poor experiences due to discontinuity, communication gaps, lack of commitment and contact, according to both groups. Mentors acknowledged that when active participation from their mentee was missing, they withdrew. Influencing factors in the mentor-student relationship were explored, including mentor gender, practicum assessment, and meeting frequency. Mentor gender did not emerge as a decisive factor. In contrast, meeting frequency – linked to physical proximity – was identified as a key factor, also reflected in mentors’ professional roles. Mentors similarly associated physical proximity with stronger relationship dynamics. Furthermore, when it comes to practicum assessment, students perceived mentors’ evaluative authority as shifting from supportive guidance to gatekeeping.

Table 1. Focus Group Integrated Thematic Analysis with representative quotations.

Framework	Theme	Category: subcategory	Representative quotation
Knowledge about the Mentoring Program	Lack of awareness	Insufficient information at 3rd year presentation	<i>"I went to the 3rd year presentation, and I don't remember them explaining anything" (Student 4)</i>
		Unclear mentor functions: academic, psychosocial and professional support	<i>"Students are uncertain of what is offered to them because they are not yet aware of the difficulties they will face" (Mentor 4)</i>
		Mismatch between expectations and real functions	<i>"I know nothing" (Student 1)</i>
Need for the Mentoring Program	Variety of need by student profiles	Independent medical students: lack of need	<i>"There are super independent students that don't need anyone – not just in the university setting, but in life in general" (Student 5)</i>
		Dependent medical students: plenty of need	<i>"You have someone you can turn to when you have questions" (Student 6)</i>
		Unaware of their own need: masked needs, failure to identify own needs, other needs	<i>"Third-year students are more attentive [...]. As time goes by, they become more autonomous because they know their environment and other students better" (Mentor 4)</i>
Mentor Assignment	Careful mentor selection	Select motivated and committed mentors	<i>"There should be a careful selection of the people who act as mentors, since students deserve high quality guidance and support [...]. A good selection process and commitment are essential" (Student 1)</i>
		Successful matching between mentor and student	<i>"Being matched with your mentor in terms of dynamics, follow-up and communication is key" (Student 6); "Let students choose their mentor based on affinities and knowing them beforehand" (Mentor 6)</i>
Mentor–Student Relationship	Evolution driven by engagement	Positive evolution: continuity, trust, commitment, regular contact, mentors' genuine interest	<i>"It's important that when someone commits to be a mentor, there is continuity so that a relationship of trust and growth can be</i>

			<i>established" (Student 5); "An initial face-to-face meeting humanizes the relationship, and as time goes by longitudinally works in favour" (Mentor 1)</i>
		Negative evolution: discontinuity, lack of commitment and contact, communication gaps	<i>"I only see my mentor on Mini-CEX days. If I ask for a meeting, he gives me an appointment three months later" (Student 2); "When there is a mismatch, I go to bare minimum, no more mentoring" (Mentor 5)</i>
	Influencing factors	Practicum assessment and meeting frequency	<i>"I think it [practicum assessment] causes anxiety to many students; it should be considered" (Student 4); "I don't think there is a gender difference. What makes the difference is whether they teach you or not" (Student 6)</i>
		Students' active participation in mentoring	<i>"Not being physically close has made the relationship colder, I only see them during Mini-CEX days" (Mentor 3)</i>
Support from social network beyond the MP	Stronger when based on health-related understanding	Family support: empathetic if health background; pressuring or uncomprehending if not	<i>"Both my parents are doctors, so they've experienced what it means to be at the bottom of the hierarchy" (Student 1); "My family doesn't always understand as they haven't gone through the same experience" (Student 6)</i>
		Peer medical students: most empathetic	<i>"Classmates from the faculty are the ones who provide the most support because they can understand you" (Student 6)</i>
		Administrative and clinical staff	<i>"Administrative and service staff solves all the problems. When I struggle, I usually contact the Student Support Program" (Student 4)</i>
Impact of the Mentoring Program	Overall positive impacts	Academic impact: workload management, goal setting, study techniques, academic feedback	<i>"Mine [mentor] is concerned about my grades and about helping me improve academically" (Student 1); "My mentor helps me with study techniques and all that" (Student 4)</i>

		Psychosocial impact: perceived support gives sense of security; received support gives empathy and self-confidence	<i>"Just knowing that you have one [mentor] already gives you a sense of security" (Student 1); "She takes an interest in my life beyond whether I answer multiple-choice questions correctly or not" (Student 5)</i>
		Professional impact: clinical improvement, professionalism, vocational guidance	<i>"My mentor takes the time to go over the results with me, explain my grades, identify areas of improvement, demand excellence and provide tools for history-taking and physical examination" (Student 1); "I try to transmit professionalism, respect, semiology and evidence-based medicine" (Mentor 4)</i>
Satisfaction with the Mentoring Program	Satisfaction dependent on mentor involvement and benefits perceived	Satisfied: strong mentor–student bonds and responsive mentors	<i>"Whenever I've reached out to her, I've received an immediate response" (Student 5); "I give them my phone number from day one [...] it helps communication flow" (Mentors 1 and 2)</i>
		Dissatisfied: lack of regular contact and mentor motivation	<i>"My mentor is not involved, motivated or willing... The other classmates who have the same mentor complain about the same thing" (Student 2)</i>
Recommendations to improve the MP	Early implementation and flexible mentor assignment	Preclinical implementation: university adjustment, language and cultural support	<i>"A mentor could help with adjusting to university, the language, and a new city... Feeling at home when you're coming from somewhere else is difficult" (Student 3)</i>
		Optional mentor assignment: flexibility, defined minimum activities	<i>"Give students the option to choose whether or not to participate in the program" (Mentor 6); "I would be in favour of having the minimum services that a mentor can offer" (Student 1)</i>
	Improvement of mentors' working conditions	Increased time per student, access to grade information, increased training	<i>"We need to have continuous training for mentors" (Mentor 2); "We should have more time, e.g. once a month, to explain doubts and areas of improvement" (Mentor 5)</i>

Support from the students' social network beyond the Mentoring Program: When mentor-student relationships had a negative evolution, students sought support from their sphere of influence, which included family, peer medical students, and other personnel. Family support varied according to whether family members had a medical background. Mentors highlighted that family background could have a negative impact. When family support was absent, students turned to their peer medical students, who were recognised as the most empathetic support. Other personnel were also recognised as a reliable source of support, especially administrative and clinical staff.

Impact of the Mentoring Program: Medical students perceived the MP impact in academic, psychosocial and professional areas, with varying intensity. In the academic support area, students said that mentors provided advice on workload management, goal setting and feedback. As mentioned above, practicum assessment was perceived as inequitable. In the psychosocial support area, students distinguished between the perceived support and received support. Regarding perceived support, students reported a higher sense of security. Mentors similarly recognised the value of their availability. Regarding received support, it positively impacted students' satisfaction and value of the program. In the professional support area, practicum assessments provided opportunities to improve clinical skills, though students' experiences varied. Mentors recognised the tension within their evaluative authority and support.

Satisfaction with the Mentoring Program: Medical students' satisfaction depended on mentor engagement and perceived value of the MP. Satisfied students highlighted strong bonds and responsive mentors as key factors. Dissatisfied students cited lack of regular contact as the most determining factor. Those who lacked sufficient support could not fully benefit from the MP's academic, psychosocial and professional support: Both groups converged on the view that well-implemented mentoring yields substantial benefits.

Recommendations to improve the Mentoring Program: Recommendations on MP improvement showed consensus around optional participation and diverged on preclinical implementation and mentors' working conditions. To accommodate students' needs, they also highlighted the possibility of declining a mentor assignment. Medical students considered preclinical implementation to ease the adjustment to university demands and new language. Mentors stressed the need for investment in training and structural support.

Quantitative Results

Of the 162 students invited to participate, 119 completed the survey, corresponding to a response rate of 73.5%. The final sample represented 52.4% of the total eligible population (119/227). Non-participation resulted from lack of prior consent to contact for research purposes, non-response to the survey invitation, or incomplete questionnaires (Supplementary Material 4). To determine representativeness, the sociodemographic characteristics of the final sample were compared with the eligible population. The results suggest that the sample was representative, as no significant differences were observed in gender, current academic year or campus (all $p > 0.05$), except for age (23 [22-24] vs 24 [23-26], $p < 0.001$)

(Supplementary Material 8). The age difference, while statistically significant, was small in absolute terms (one year difference in median) and is unlikely to introduce meaningful selection bias.

Descriptive analysis

From the medical students included, 68 (57.1%) were classified as satisfied and 51 (42.9%) as dissatisfied with the MP. Overall, no statistically significant differences were observed between dissatisfied and satisfied students across the analysed sociodemographic variables. The survey response data are presented in Table 2.

Bivariate and Multivariate analysis

Perceived Need and satisfaction with information received for the Mentoring Program: Spearman correlation showed a moderate positive association between perceived need and satisfaction with received information, justifying separate regression models for each variable ($\rho=0.308$; $p<0.001$). Both were significant in bivariate analysis ($p<0.001$) and remained independent predictors after full adjustment (Fig 2). Students who perceived a need for the MP were nearly eight times more likely to be satisfied (OR=7.76; 95% CI: 3.08–19.58), and those satisfied with information received were approximately thirty times more likely to report overall satisfaction (OR=29.92; 95% CI: 8.85–101.2).

Impact of the Mentoring Program: Spearman correlation showed moderate-to-strong positive associations between perceived impacts, justifying separate regression models for each impact ($\rho=0.74-0.76$; $p<0.001$). All three impacts – academic, psychosocial and professional – were significant in bivariate analysis ($p<0.001$) and remained independent predictors after full adjustment (Fig. 2). Significantly higher odds of overall satisfaction were found among those students reporting high academic impact (OR=27.23; 95% CI: 9.44–78.51, high psychosocial impact (OR=32.51; 95% CI: 11.19–94.41), and those reporting high professional impact (OR=35.67; 95% CI: 11.69–108.87).

Table 2. Survey responses of students matched by global satisfaction with the Mentoring Program.

	Final Sample n=119 n=68	Dissatisfied n=51	Satisfied	p- value
Section 1: Sociodemographic				
Age, years	23 (22 – 24)	23 (23 – 24)	23 (22 – 24)	0.761
Gender				
Female	96 (80.7%)	43 (84.3%)	53 (77.9%)	0.384
Male	23 (19.3%)	8 (15.7%)	15 (22.1%)	
Current year				
fourth	32 (26.9%)	10 (19.6%)	22 (32.4%)	0.300
fifth	34 (28.6%)	16 (31.4%)	18 (26.5%)	
sixth	53 (44.5%)	25 (49%)	28 (41.2%)	
Campus				
Vic	66 (55.5%)	29 (56.9%)	37 (54.4%)	0.790
Manresa	53 (44.5%)	22 (43.1%)	31 (45.6%)	
Section 2: Mentor support				
Received information				
Dissatisfied	69 (58%)	47 (92.2%)	22 (32.4%)	<0.001
Satisfied	50 (42%)	4 (7.8%)	46 (67.6%)	
Regular contact				
No	33 (27.7%)	26 (51%)	7 (10.3%)	<0.001
Yes	86 (72.3%)	25 (49%)	61 (89.7%)	
Contact type				
Individual	78 (95.1%)	22 (91.7%)	56 (96.6%)	<0.001
Group	4 (4.9%)	2 (8.3%)	2 (3.5%)	
On-line	45 (62.5%)	11 (57.9%)	34 (64.2%)	
In person	27 (37.5%)	8 (42.1%)	19 (35.9%)	0.114
Perceived need				
No	42 (35.3%)	29 (56.9%)	13 (19.1%)	<0.001
Yes	77 (64.7%)	22 (43.1%)	55 (80.9%)	
Sufficient resources				

No	70 (58.8%)	42 (82.4%)	28 (41.2%)	
Yes	49 (41.2%)	9 (17.6%)	40 (58.8%)	<0.001
Section 3: Relationship with Mentor				
Satisfaction				
Dissatisfied	44 (37%)	38 (74.5%)	6 (8.8%)	
Satisfied	75 (63%)	13 (25.5%)	62 (91.2%)	<0.001
Considered Mentor Change	16 (13.4%)	14 (27.5%)	2 (2.9%)	<0.001
Section 4: Perception of Impact				
Academic Impact				
Low	50 (42%)	40 (78.4%)	10 (14.7%)	
High	69 (58%)	11 (21.6%)	58 (85.3%)	<0.001
Psychosocial Impact				
Low	54 (45.4%)	43 (84.3%)	11 (16.2%)	
High	65 (54.6%)	8 (15.7%)	57 (83.8%)	<0.001
Professional Impact				
Low	43 (36.1%)	38 (74.5%)	5 (7.4%)	
High	76 (63.9%)	13 (25.5%)	63 (92.6%)	<0.001
Section 5: Overall Satisfaction				
Dissatisfied	51 (42.9%)			
Satisfied	68 (57.1%)			

Note: Data are presented as absolute frequencies and valid percentages for categorical variables, and as medians and interquartile ranges for numerical variables. Categorical variables were compared using the chi-square test, and numerical variables were compared using the Mann–Whitney U test. Contact type applies only to participants who reported having regular contact (n=86); slightly different denominators reflect missing values on specific contact type items.

Mentor–Student Relationship: Regular contact and individual contact were the only variables that were significant in bivariate analysis ($p<0.001$) and remained independent predictors after full adjustment (Fig. 2). Regular contact was associated with approximately nine times higher odds of relationship satisfaction (OR=9.36; 95% CI: 3.58–24.47), and individual contact with approximately eight times higher odds (OR=8.1; 95% CI: 3.25–20.2). Practicum assessment showed a significant negative association in bivariate analysis, which lost significance in multivariate analysis (OR=0.37; 95% CI: 0.14–1.01; $p=0.051$),

with the current academic year identified as an interaction variable. Although the current academic year was not independently associated with relationship satisfaction in bivariate analysis ($p=0.239$), its inclusion altered the relationship between practicum assessment and satisfaction, suggesting an interaction effect rather than direct association. No association was observed between mentor gender and satisfaction ($p=0.583$).

Compiled medical students' recommendations: Medical students' recommendations were collected from Section 6 of the survey and analysed thematically, available in Table Supplementary Material 9. Recommendations largely converged with those identified in the focus group. The survey provided Supplementary themes that were not previously identified.

Students explicitly called for clearer structural guidelines for mentor responsibilities and predefined contact points integrated into the academic calendar. The absence of allocated time and physical space for meetings was identified as a practical barrier to regular interaction. Students expressed concern about inequity in practicum assessment, calling for a separate evaluation figure from the mentor to reduce subjectivity. Further themes emerged, such as the value of mentors sharing their experience, and the importance of greater institutional investment by FM UVic-UCC to ensure program quality and consistency. Students also expressed a need for deeper support across academic, psychosocial, and professional areas.

Integration of results in Theory of Change

To understand how mentoring generated perceived benefits, an initial ToC was developed and progressively refined throughout the study. The final ToC provided an explanatory model linking mentoring interventions, contextual conditions, relational processes, and perceived outcomes. (Fig. 3). Qualitative findings informed the identification of key pathways and conditions, while quantitative analyses supported the association between perceived impacts, overall MP satisfaction and relationship satisfaction.

Taken together, the integrated findings suggest that mentoring effectiveness is not explained by program participation alone, but by the activation of several interacting mechanisms. Awareness of available support, perceived relevance to student needs, regular individualised contact and psychologically safe relationships emerged as key conditions through which mentoring was perceived to generate academic, psychosocial and professional benefits.

Mechanisms of mentoring engagement: Qualitative findings identified awareness of mentor functions and available support as a key condition for mentoring engagement. Students frequently reported insufficient understanding of the MP and its potential benefits.

This was triangulated by the independent association between satisfaction with information received and overall MP satisfaction (I3 and A3, Fig. 3). Perceived need emerged as an important mechanism influencing engagement with mentoring, varying across student profiles –qualitative data distinguished

between independent and dependent students– and this variability was confirmed with an independent association with overall satisfaction (I2 and A1, Fig. 3).

Qualitative data indicated positive perceptions across academic, psychosocial, and professional supports, with varying intensity. Although professional support was reported as less valuable in the medical students' focus group, survey data revealed a higher proportion of perceived impact compared to psychosocial impact (63.9% vs 54.6%). All three impacts were independently associated with overall satisfaction (I6-I8, Fig. 3), confirming convergence between both data (R1-R2, Fig. 3).

Overall satisfaction (57% satisfied) was primarily linked to perceived impact, and was also related to relationship satisfaction in both qualitative and quantitative data, with no significant association with sociodemographic factors (A2, I1, I9, Fig. 3).

Relationship conditions associated with mentoring effectiveness: Qualitative findings described two trajectories: positive, characterised by trust, continuity and regular contact; and negative, marked by communication gaps, limited contact, low mentor commitment and null student participation (A4, Fig. 3). The first mentor-student contact was identified as a critical leverage point in this trajectory to establish a foundation for continuity. This was triangulated quantitatively: regular contact and individual contact were independently associated with relationship satisfaction (I4-I5, Fig. 3). Null findings for group, in-person, and online contact formats complement the qualitative emphasis on the personalised nature of the relationship.

Qualitative data also identified practicum assessment as a source of tension, associated with a role shift toward academic gatekeeping and anxiety. Quantitatively, there was a negative association with relationship satisfaction in bivariate analysis (OR=0.23; $p<0.031$), which did not reach statistical significance in multivariate analysis (OR=0.37; $p=0.051$), with the current year identified as an interaction variable. Given the negative direction, borderline statistical significance, and qualitative corroboration, it was included in the model. Some students with negative satisfaction with the mentoring relationship even considered mentor change (I10-11, Fig. 3). Supplementary qualitative findings concerned perceptions of insufficient mentor training, limited structural support, and unfavourable working conditions.

Discussion

This study aimed not only to evaluate a mentoring program, but to understand how mentoring generates value within undergraduate medical education. By integrating qualitative and quantitative findings within a ToC framework, the study identified a set of interconnected mechanisms that appear to explain successful mentoring outcomes. Four findings may be particularly relevant to other institutional contexts, pending replication: (1) awareness of available mentoring support is a prerequisite for engagement; (2) perceived need shapes participation and perceived value; (3) regular individualised contact was the strongest predictor for relationship quality; and (4) psychological safety may be compromised when supportive and evaluative roles are combined.

While these findings are broadly consistent with previous mentoring literature, existing evidence remains heterogeneous, with reported benefits varying according to program structure, institutional context, mentoring objectives and evaluation methods (11,13). Together, our findings suggest that mentoring effectiveness depends less on program availability itself than on the activation of specific relational and organisational mechanisms.

Mechanisms of mentoring engagement: The finding that satisfaction with information received constituted one of the strongest independent predictors of overall MP satisfaction suggests that inadequate communication appears to be a primary structural barrier to engagement. Our findings extend this observation as students who are not adequately informed about the MP are unlikely to perceive its relevance, form a sense of need, or derive satisfaction from it.

The heterogeneity in perceived need across different student profiles raises a broader question about the design of universally applied mentoring models. Students' recommendations to make participation optional reflect a desire to optimise the fit between individual need and program engagement. Mentors similarly attributed variability in need to academic year progression, observing that students become more autonomous as they gain familiarity with their environment. Importantly, while students framed optionality as personal autonomy, mentors framed it as a matter of resource efficiency, suggesting a flexible model based on needs. While universal assignment ensures equitable access, targeted or more flexible models may be more efficient in resource-limited contexts. This observation aligns with previous literature highlighting the diversity of mentoring needs, goals, and program structures across learners and educational settings (11–13).

The multidimensional role of mentoring in medical education is confirmed in our study with significant and independent associations of impacts with overall satisfaction. These are consistent with previous studies that demonstrated that mentoring programs provide gains across several domains at the same time (12,16,17). Despite this, in our study, the comparable association magnitude across the three impacts should not be interpreted as reflecting equivalent importance, given their strong intercorrelation; instead, it should be interpreted as changes in the MP across multiple simultaneous pathways.

The absence of statistically significant sociodemographic predictors of overall satisfaction suggests that the MP has the potential to benefit students equitably, provided that relational and structural conditions are met. Improving mentoring outcomes therefore would not require differential targeting by demographic group, but rather the guarantee of a consistent relationship with the mentor. However, previous studies have reported variability in students' mentoring experiences and perceived benefits, suggesting that individual characteristics and contextual factors may shape how mentoring is experienced (11,15,17). Further research should include these factors to assess their influence on MP satisfaction.

Relationship conditions associated with mentoring effectiveness: Regular and individual contact were the strongest predictors of relationship satisfaction, whereas group format and meeting modality showed no significant associations. This finding suggests that the value of mentoring depends less on

contact volume than on the quality of personalised interactions. Consistent with previous studies, one-to-one relationships appear to facilitate trust and continuity over time (11,31). The importance of continuity, trust, accessibility, and individualisation identified in previous literature supports our observation that regular individualised contact may represent a key mechanism through which mentoring generates perceived benefits. These findings suggest that relationship quality, rather than programme participation alone, may be central to mentoring effectiveness (31). The qualitative identification of the first mentor–student contact as a critical moment further suggests that early relationship development may shape subsequent mentoring trajectories and expectations (11,31).

The borderline negative association between practicum assessment and relationship satisfaction would have important implications for program design. Both students and mentors described how evaluative responsibilities may shift the mentor’s role from a supportive figure to an academic gatekeeper, generating tension, anxiety, and potential mistrust. Although this association did not reach statistical significance after adjustment, its direction was consistent with the qualitative accounts of role tension described by both students and mentors, offering complementary (though not confirmatory) support for the hypothesis that combining supportive and evaluative functions may compromise relationship quality. This observation is consistent with literature emphasising trust, relational safety, and role clarity as key conditions for effective mentoring relationships (31,32). Separating these roles, or clearly delimiting evaluative responsibilities, could therefore help preserve the trust required for effective mentoring relationships.

Mentor perspectives also add an important corrective to student-centred interpretations of relationship failure. Where students described relationship deterioration primarily as a consequence of mentor disengagement, mentors described a reciprocal dynamic in which student passivity contributed to their own withdrawal. This bidirectionality is consequential for program design: interventions aimed solely at improving mentor commitment –through selection, training, or incentives– may be insufficient if student engagement is not also structurally supported. Predefined contact points, minimum participation requirements, and onboarding that builds students' confidence in using the program may address both sides of this dynamic (11,31). Participants also highlighted mentor training, protected time, and institutional support as factors that may influence mentoring quality, suggesting that effective mentoring depends not only on relational processes but also on enabling organisational conditions, consistent with previous recommendations for institutionally supported mentoring programmes (11).

The absence of a significant association between mentor gender and relationship satisfaction, corroborated qualitatively, suggests that relational quality may depend more on responsiveness, trust, and engagement than on demographic matching, consistent with literature emphasising the central role of relationship quality in mentoring effectiveness (11,31). This finding may simplify mentor assignment processes without necessarily compromising mentoring outcomes.

Participants’ recommendations for mentoring program design: Participants identified four priorities for strengthening mentoring effectiveness. First, clearer structural guidelines defining mentor

responsibilities, minimum contact requirements, and predefined meeting points integrated into the academic calendar should be implemented. Both students and mentors described uncertainty regarding the scope of mentoring, while previous studies support the value of structured and longitudinal mentoring frameworks in enhancing consistency and learner confidence (11,31). Second, more rigorous mentor selection and ongoing mentor training are warranted, as relationship quality depends heavily on mentor engagement and preparedness (11,16,31). Third, the dual supportive–evaluative role of mentors generated concern among participants, reinforcing the need to clearly separate or delimit assessment responsibilities to preserve trust within the mentoring relationship (31,32). Fourth, the current universal assignment model may benefit from greater flexibility, allowing different levels of participation according to students’ evolving needs and stages of training (11,13). Finally, earlier preclinical implementation, potentially complemented by peer mentoring, may facilitate academic, social, and professional adjustment during the transition into medical school (2,3).

Limitations and strengths: This study has several limitations that should inform interpretation. The survey instrument was developed from qualitative findings and an initial ToC workshop rather than externally validated scales, which limits psychometric comparability with other programs; future studies should prioritise validated tools to enable cross-institutional benchmarking. The single institutional setting limits the ability to determine whether the mechanisms identified operate similarly across other educational contexts. Replication in public, larger, or non-Mediterranean medical faculties is needed to examine the transferability of the proposed ToC model. Finally, the absence of a mentor survey limits the ability to test mentor-side outcomes statistically; a parallel quantitative instrument for mentors would substantially strengthen future evaluations of dual-perspective programs.

Meaningful methodological strengths counterbalance these limitations. The mixed-methods design enabled triangulation of qualitative and quantitative evidence, providing a richer understanding of mentoring processes than either approach alone. Grounding the survey in prior qualitative findings and the ToC workshop enhanced its content validity despite the absence of formal external validation. The integration of both student and mentor perspectives addresses a gap that most existing studies leave unexamined (12,16). Rather than solely evaluating a local program, the study generated a ToC model that offers a transferable framework for understanding how mentoring may produce academic, psychosocial and professional benefits across medical education settings. Finally, this study contributes to an underrepresented literature, as most existing evidence on medical mentoring derives from non-Mediterranean contexts, making this one of the few evaluations conducted within the Spanish university system. For future research, studies should employ externally validated instruments, include mentor quantitative surveys, examine social support networks as moderating variables, and test these mechanisms in diverse medical education settings to further understand how mentoring contributes to student development and well-being.

Implications beyond the study setting: The findings suggest that MP should focus not only on providing mentoring opportunities but also on activating the mechanisms that appear to make mentoring effective. Institutions should ensure that students understand the purpose and scope of mentoring,

establish structured opportunities for regular individualised contact, and carefully manage the overlap between supportive and evaluative mentor roles. The Theory of Change developed in this study offers a practical framework for designing and evaluating mentoring systems by focusing on four core elements: awareness of available support, alignment with students' perceived needs, psychologically safe relationships, and regular individualised contact (Fig. 3). Rather than replicating specific program structures, institutions may benefit from examining whether these underlying mechanisms are successfully activated within their own contexts.

Conclusions

Taken together, these findings reframe mentoring evaluation: rather than focusing solely on program availability or participation rates, medical schools should examine whether the mechanisms that drive mentoring effectiveness identified here—awareness, perceived relevance, regular contact, and role clarity — are being activated within their own institutional context. Academic, psychosocial and professional benefits appeared to emerge through these relational pathways rather than through program participation alone. In contrast, the combination of supportive and evaluative mentor roles may hinder the development of trust required for mentoring to achieve its intended effects. The Theory of Change developed in this study provides a transferable framework for understanding, evaluating, and strengthening mentoring programs across educational contexts.

Abbreviations

Faculty of Medicine at the University of Vic–Central University of Catalonia (FM UVic-UCC); Mentoring Program (MP); Student Support Program (SSP); and Theory of Change framework (ToC).

Declarations

Ethics approval and consent to participate: This study was approved by the UVic-UCC Research Ethics Committee (Reference 370/2025). All participants were informed about the study's objectives, procedures, and implications, and provided written consent before participation. The study complied with the Declaration of Helsinki, General Data Protection Regulation 2016/679 and Spain's Organic Law 3/2018 on Personal Data Protection and Digital Rights. All data were anonymised. Written informed consent was obtained from all participants before their inclusion in the study. Participation was voluntary and participants were informed of their right to withdraw at any time without consequences. A gender-sensitive perspective was incorporated in its design and analysis, ensuring that potential gender-related differences were systematically addressed.

Consent for publication: Not applicable.

Availability of data and materials: Anonymised quantitative data are stored on the FM UVic-UCC OneDrive institutional platform and are available from the corresponding author upon reasonable

request. The qualitative data of this study are not publicly available since the data containing information that could compromise research participants' privacy and consent.

Competing interests: The authors declare no competing interests.

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Clinical trial registration/number: not applicable.

Human ethics and consent to participate: approved by the UVic-UCC Research Ethics Committee (Reference No. 370/2025). Written informed consent was obtained from all participants prior to participation.

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Figures

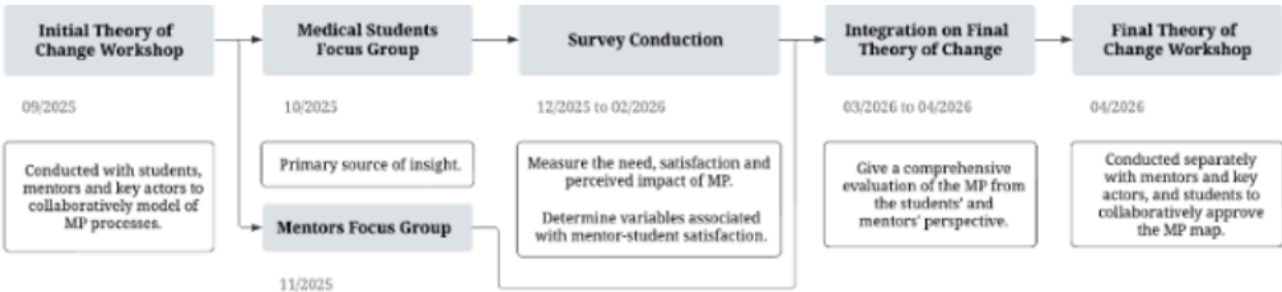


Figure 1

The design and methods timeline followed in this study.

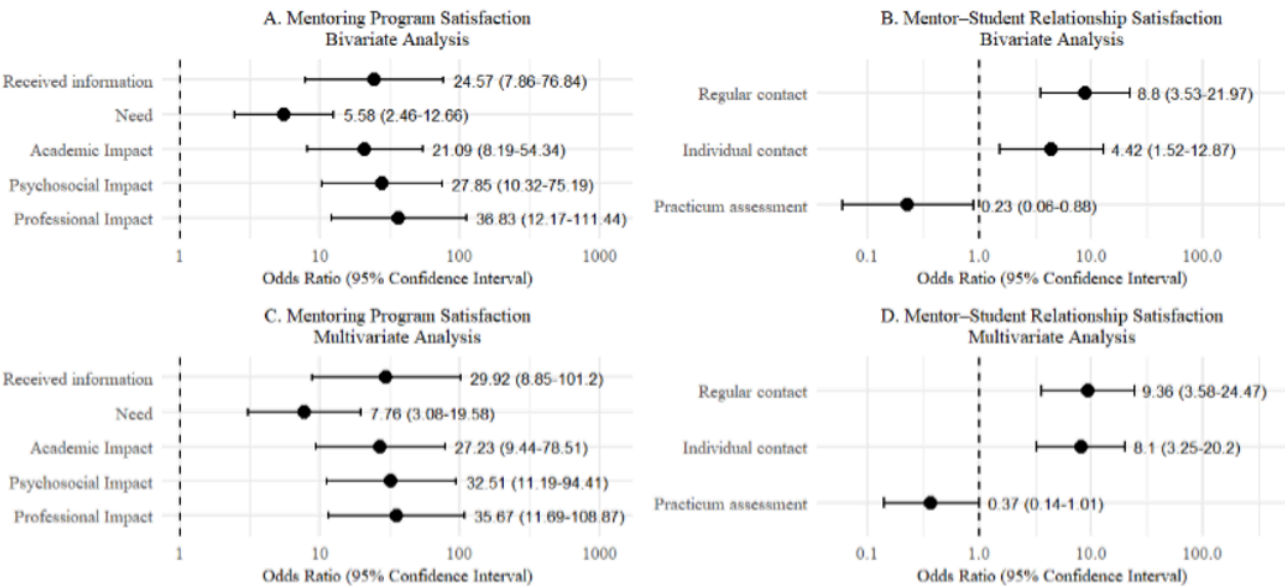


Figure 2

Logistic Regression models for Mentoring Program and Mentor-Student relationship satisfaction.

A-B display bivariate analysis, and C-D display multivariate analysis. Forest plots display odds ratios (points) with 95% confidence intervals (horizontal lines) on a log scale. Values to the right of the vertical dotted line indicate positive associations. All models used binary logistic regression with Likert items dichotomized as satisfied/high (scores 4-5) and dissatisfied/low (scores 0-3).

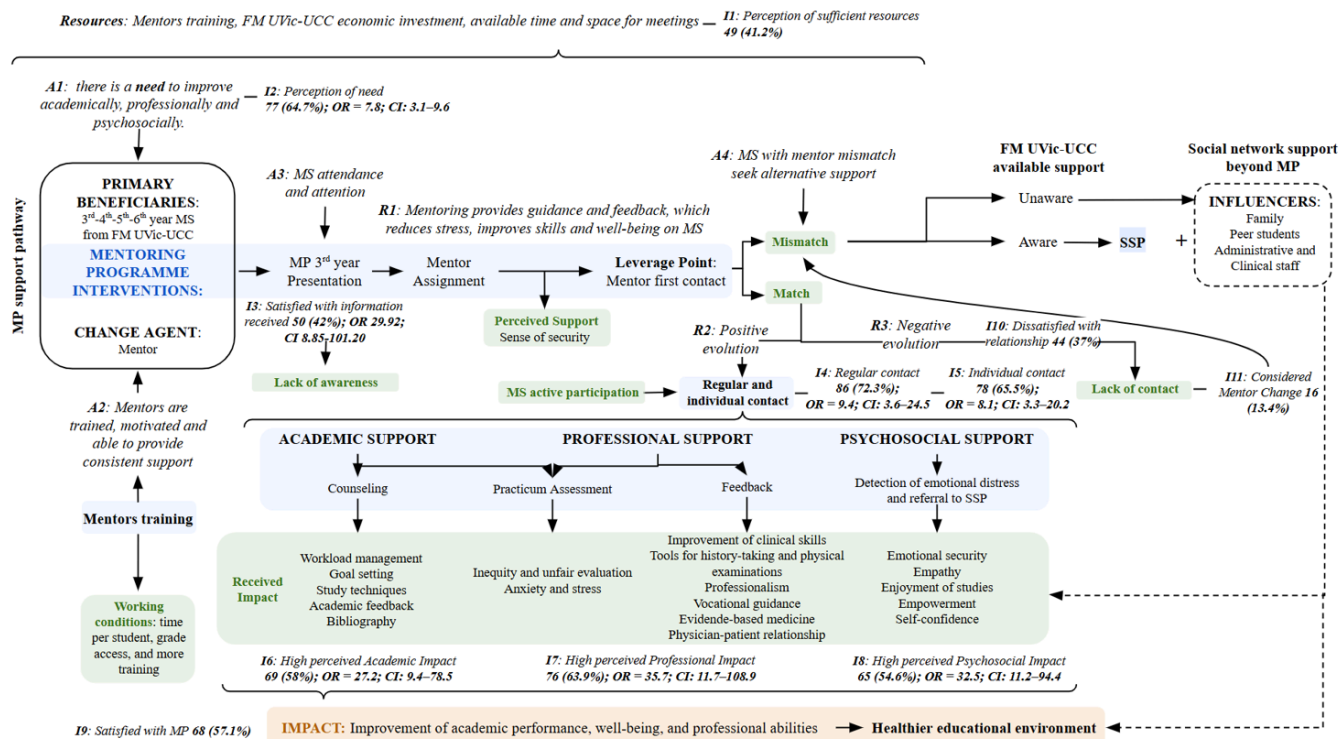


Figure 3

Mentoring Program Theory of Change final model

Legend: Blue, interventions; green, outcomes; orange, impact, Rn°, rationale; An°, assumptions; In°, Indicators; MP, Mentoring Program; SSP, Student Support Program; MS, Medical Students. **Data** are presented as absolute frequencies and valid percentages for qualitative variables. Multivariate logistic regression values are presented with odds ratios for MP satisfaction and relationship satisfaction, all with 95% CI.

Supplementary Files

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