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Research Article

Keywords: medical students, student support programs, early identification, learning and personal needs, academic performance

Posted Date: October 12th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10910470/v1>

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Additional Declarations: No competing interests reported.

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ABSTRACT

Introduction: Medical students frequently experience academic, personal, and social difficulties that may affect learning, wellbeing, and professional development. Although support initiatives are increasingly implemented, students are often classified based only on academic risk indicators, and limited evidence exists regarding how students' needs evolve over time. Our institution implemented a Student Support Program (SSP) integrating academic and non-academic information to identify students' needs and provide tailored support. This study examined changes in students' learning and personal needs after their participation in the program and explored changes in academic performance.

Methods: An observational cohort study was conducted within the Student Support Program among undergraduate medical students (September 2022 to June 2024). Students were classified into four levels of increasing learning and personal need complexity (N1-N4) and support intensity (S1-S4). Changes in need complexity from baseline (T1) to one-year follow-up (T2) were the primary outcome; changes in annual grade averages were secondary outcomes.

Results: Among 559 recruited students, 329 had paired T1-T2 data. More than half of the students initially classified as moderate or high needs (N3-N4) were reclassified as N1 at follow-up, and N4 prevalence decreased from 19.1% to 9.4%. Students classified as N3 at baseline showed the highest academic performance improvement ($\Delta=0.35$; $p<0.001$).

Conclusions: The longitudinal SSP framework identified, targeted and monitored students' needs over one year and revealed a substantial proportion of medical students with moderate or high learning and personal needs extending beyond academic difficulties alone. Improvements in students' need profiles within the SSP reinforce the integration of academic and non-academic factors to properly support medical students throughout their training.

Abbreviations: Learning and Personal Needs (LPN); Student Support Program (SSP).

INTRODUCTION

Medical students frequently encounter academic, personal, psychological, and social challenges throughout their training. These difficulties are shaped by the interaction of academic demands, personal circumstances, learning environments, and professional transitions, and may influence learning, wellbeing, professional identity formation, and progression through the curriculum (1–3). The transition towards competency-based medical education has reinforced the need to support students not only as learners but also as developing professionals whose needs evolve over time (4,5).

In response to these challenges, medical schools have implemented a wide range of support initiatives, including academic advising, mentoring programs, wellbeing interventions, peer-support initiatives, and mental health services (6–8). Evidence suggests that these interventions may contribute positively to students' academic adaptation, professional development, wellbeing, sense of belonging, and access to support resources (9–11). Mentoring, in particular, has been associated with professional identity formation, self-regulated learning, psychosocial support, and career development (11–13).

However, most published interventions focus on specific domains of support, such as wellbeing, mentoring, or academic performance, and are frequently evaluated as isolated initiatives rather than as components of integrated institutional systems (7,8). Furthermore, traditional approaches for identifying students in need of support often rely primarily on academic indicators, despite evidence that academic performance alone may fail to identify students experiencing important personal, psychological, or contextual difficulties (14–16). Emerging evidence suggests that students' needs are multidimensional and may change substantially throughout different stages of medical training (14,17,18). Consequently, there is growing interest in proactive and longitudinal approaches that integrate academic and non-academic information to facilitate the early identification of vulnerable students and provide support that adapts to their evolving circumstances (6,14,16). However, evidence on institutional support systems that systematically integrate academic, personal, and professional dimensions while monitoring students' changing needs throughout the entirety of the medical curriculum remains limited (7,8).

To address this gap, our medical school implemented a Student Support Program (SSP), a longitudinal institutional support system that integrates monitoring, personal follow-up, and access to support resources throughout undergraduate medical education. The program was designed to identify emerging needs early, facilitate appropriate interventions, and support students' academic, personal, and professional development. This study evaluated longitudinal changes in students' learning and personal needs during participation in the SSP and explored accompanying changes in academic performance. Specifically, it examined how students' needs evolved over time when assessed through a multidimensional framework integrating academic and non-academic information.

METHODS

STUDY SETTING

The study was conducted at the Faculty of Medicine of the Universitat de Vic—Universitat Central de Catalunya, a six-year undergraduate medical program based on a competency-oriented curriculum. The program combines a progressive sequence of subjects, case-based learning, simulation activities, clinical skills training, and progressively increasing clinical placements.

STUDENT SUPPORT PROGRAM

The Student Support Program (SSP) is a longitudinal institutional support system developed in 2021 to facilitate the early identification, monitoring, and management of students' learning and personal needs throughout undergraduate medical education. The SSP is coordinated by two faculty members specifically trained in student support and operates using multiple sources of information collected during routine educational activities (19). These include academic records, self-referrals, meetings with students, mentoring reports, observations reported by faculty members, concerns communicated by administrative staff, and academic progress reviews. Information from these sources is integrated to obtain a broader understanding of each student's academic, personal, and professional circumstances. Students can access the SSP either through self-referral (via email or online request) or proactive contact initiated by SSP coordinators when concerns arise regarding academic progression, learning difficulties, wellbeing, personal circumstances, professional behaviour, or other factors potentially affecting their educational development. Following an individual assessment, support needs are reviewed by one of the SSP coordinators and an appropriate support plan is proposed. All the students receive routine monitoring through the SSP; active participation in additional support activities within the support plan remains voluntary. The SSP integrates several complementary components within a single support framework. These include group-based activities focused on learning strategies, examination preparation, wellbeing, and adaptation to different stages of training; individual tutoring sessions delivered by SSP coordinators; a structured mentoring program; and referral to specialised institutional or external support services when required. The structured mentoring program is a core component of the SSP. From the third year onwards, all students are assigned a trained faculty mentor through a random allocation process. Mentors support a maximum of five students each and hold a minimum of three formal meetings per academic year, with additional meetings available whenever necessary. Mentors are clinicians who receive specific preparation in student guidance, feedback, early identification of support needs, and referral pathways. The mentoring program may also be offered earlier (first and second year) when students present circumstances requiring additional longitudinal support.

The SSP was designed as a flexible and needs-based support system rather than a set of predefined intervention pathways. Consequently, students can access different support components according to their needs, and support intensity is adapted throughout follow-up.

STUDY DESIGN AND PARTICIPANTS

This observational longitudinal cohort study was conducted alongside the routine operation of the SSP at the Faculty of Medicine of the Universitat de Vic–Universitat Central de Catalunya in Spain. Medical students from all years of the undergraduate medical program who were enrolled between September 2022 and June 2024 were invited to participate through presentations delivered by SSP coordinators at the beginning of each academic year. Students who provided written informed consent were enrolled in the study. No additional exclusions criteria were applied.

The study examined changes in students' learning and personal needs between two consecutive academic years. Baseline assessments were conducted during the 2022–2023 academic year (T1; baseline assessment), and follow-up assessments were performed during the subsequent academic year 2023–2024 (T2; follow-up assessment). Academic performance data from the previous academic year (T0; 2021–2022 academic year) were available for a subgroup of students and were used in exploratory analyses of academic progression.

Participation in both the study and SSP activities was voluntary. Students could discontinue participation at any time without affecting their access to academic support services.

LEARNING AND PERSONAL NEEDS AND SUPPORT CLASSIFICATION

Students' Learning and Personal Needs (LPN) were assessed using a structured multidimensional framework developed within the SSP to identify the complexity of students' support needs. The framework integrates information collected through routine SSP activities, including academic records, self-referrals, individual interviews, mentoring reports, faculty observations, and follow-up reviews. Academic factors considered in the assessment included academic performance, failed courses, learning difficulties, study strategies, and academic trajectory. Non-academic factors included psychological and emotional difficulties, health conditions, adverse personal circumstances, social or environmental challenges, neurodevelopmental conditions, learning disorders, and concerns related to professional behaviour. LPN classification was based on the overall integration of these sources of information rather than on any single criterion. Using this multidimensional assessment, students were classified into one of four levels of increasing need complexity (N1-N4):

N1 (No identified support needs): students without identified academic or personal circumstances requiring additional SSP support.

N2 (Learning optimisation needs): students with satisfactory academic progression who voluntarily sought advice to optimise learning strategies, study methods, examination techniques, personal development, or professional growth, without relevant academic difficulties or significant personal circumstances affecting learning.

N3 (Moderate support needs): students presenting academic difficulties associated with a low risk of academic failure. Classification considered factors such as the number and complexity of failed assessments, previous academic trajectory, and other contextual circumstances potentially affecting academic progression.

N4 (High-complexity support needs): students presenting a high risk of academic failure due to either academic factors, non-academic factors, or both. These included substantial academic difficulties, health conditions, psycho-emotional difficulties, adverse personal circumstances, social or environmental challenges, learning disorders, limiting neurodevelopmental conditions, or concerns regarding professional behaviour requiring intensive monitoring and support.

LPN classifications were performed by the two SSP coordinators using the same assessment framework and information from multiple sources. Complex cases were reviewed during regular team meetings to promote consistency in classification decisions. Formal inter-rater reliability was not assessed because the classification was partly based on consensus.

Support intensity (S1-S4) was classified according to the highest level of intervention received during the study period: S1, routine monitoring and academic guidance; S2, participation in structured group-based activities focused on learning strategies, examination preparation, wellbeing, or educational transitions; S3, individual tutoring provided by SSP coordinators; and S4, referral to specialised institutional or external support services. For each student, the highest support level was selected to represent the maximum support intensity reached during follow-up. As students could receive multiple forms of support simultaneously and support pathways could change over time, support levels were considered indicators of the maximum intervention intensity rather than mutually exclusive categories.

STUDY VARIABLES AND OUTCOMES

Sociodemographic variables included age, gender, and academic year at enrolment. Gender was self-reported on the consent form (woman, man, or non-binary). Age and academic year were obtained from institutional records. Academic performance was measured as the annual institutional grade average (0-10 scale), calculated as the mean final grade obtained across all subjects completed during a given academic year. Academic performance data were collected for the academic years corresponding to T1 (2022-2023), T2 (2023-2024), and T0 (2021-2022) when available. LPN classification and SSP support intensity were recorded at each assessment point. LPN classification reflected the overall complexity of students' support needs (N1-N4), whereas support intensity reflected the highest level of support received during the study period (S1-S4).

The primary outcome was the change of LPN between T1 and T2, assessed through changes in students' LPN classification across the four predefined categories (N1-N4).

Secondary outcomes included changes in academic performance between T1, T2, and T0 when available, measured through annual grade averages. Exploratory analyses additionally examined patterns of academic evolution according to baseline LPN category and support intensity level.

STATISTICAL ANALYSIS

Descriptive statistics included frequencies, percentages, medians, and interquartile ranges (IQR). Paired comparisons between T1 and T2 were performed using the Wilcoxon signed-rank test due to non-normal distribution of the paired data. Median differences (Δ) and Wilcoxon effect sizes (r) with

95% confidence intervals were calculated. Effect sizes were interpreted as (r): 0.10–0.29, small effect; 0.30–0.49, moderate effect; 0.50–0.69, large effect; ≥ 0.70 , very large effect. P values were adjusted using the Benjamini–Yekutieli method, and statistical significance was set at $p < 0.05$. Analyses were performed using R version 4.5.1 (20).

ETHICAL CONSIDERATIONS

This study was approved by the UVic-UCC Research Ethics Committee (Reference No. 221/2022). Written informed consent was obtained from all participants prior to enrolment. The study was conducted in accordance with the Declaration of Helsinki. All data were anonymised and processed in accordance with the General Data Protection Regulation (EU) 2016/679 and applicable Spanish data protection legislation.

RESULTS

STUDY COHORT CHARACTERISTICS

Of the 559 medical students who consented to participate, 329 had paired T1-T2 data on learning and personal needs and annual average grades, comprising the Study Cohort (T1-T2; n=329), and were included in the longitudinal analyses. Loss to follow-up was primarily attributable to graduation or unavailable follow-up assessments (Supplementary Figure 1). Among these participants, academic performance data from T0 (2021-2022 academic year) were additionally available for 263 students, who comprised the Three-Year Academic Evolution Subcohort (T0-T1-T2; n=263) and were used in exploratory analyses of academic progression. The characteristics of the Study Cohort are summarised in Table 1. Students from all years of the medical curriculum were represented, although sixth-year students contributed limited paired T1-T2 data because most had graduated before follow-up assessment.

	Total N=329	Women N=258 (78.4%)	Men N=71 (21.6%)
Age (years)	21.0 [20.0;22.0]	21.0 [20.0;22.0]	22.0 [20.0;23.0]
Course at T1			
1 st	69 (21%)	57 (22.1%)	12 (16.9%)
2 nd	51 (15.5%)	34 (13.2%)	17 (23.9%)
3 rd	72 (21.9%)	60 (23.3%)	12 (16.9%)
4 th	71 (21.6%)	57 (22.1%)	14 (19.7%)
5 th	65 (19.8%)	49 (19%)	16 (22.5%)
6 th	1 (0.3%)	1 (0.39%)	0 (0%)
Average grade per academic year			
T0; N=263	7.07 [6.32;7.66]	7.08 [6.41;7.65]	6.86 [5.98;7.72]
T1; N=329	7.44 [6.69;7.87]	7.45 [6.78;7.85]	7.33 [6.52;7.93]
T2; N=329	7.57 [6.95;8.04]	7.57 [6.97;8.03]	7.54 [6.85;8.16]
Learning and personal needs at T1			
N1	192 (58.4%)	154 (59.7%)	38 (53.5%)
N2	24 (7.3%)	18 (7.0%)	6 (8.5%)
N3	50 (15.2%)	37 (14.3%)	13 (18.3%)
N4	63 (19.1%)	49 (19%)	14 (19.7%)
Support at T1			
S1	214 (65%)	163 (63.2%)	51 (71.8%)
S2	17 (5.2%)	14 (5.4%)	3 (4.2%)
S3	80 (24.3%)	68 (26.4%)	12 (16.9%)
S4	18 (5.5%)	13 (5.04%)	5 (7.04%)
Learning and personal needs at T2			
N1	222 (67.5%)	175 (67.8%)	47 (66.2%)
N2	33 (10%)	26 (10.1%)	7 (9.9%)
N3	43 (13.1%)	29 (11.2%)	14 (19.7%)
N4	31 (9.4%)	28 (10.9%)	3 (4.2%)

Table 1. Characteristics of the Study Cohort (T1-T2; n=329). T0, 2021-2022 academic year; T1, baseline assessment (2022-2023 academic year); T2, follow-up assessment (2023-2024 academic year). N1-N4 and S1-S4 refer to the highest levels observed for LPN and the SSP support received by each participant, respectively, during the corresponding period. Data are presented as absolute frequencies and valid percentages for qualitative variables, as medians and interquartile ranges for numerical variables.

LEARNING AND PERSONAL NEEDS EVOLUTION

The evolution of LPN between baseline (T1) and follow-up (T2) during participation in the SSP is presented in Table 2. At baseline, 34.3% of students were classified as having moderate or high levels of need (N3-N4). This proportion decreased to 22.5% at follow-up, representing an absolute reduction of 11.8 percentage points. The prevalence of N4 decreased from 19.1% to 9.4%, while the proportion of students classified as N1 increased from 58.4% (n=192) to 67.5% (n=222). Improvement in LPN classification was observed across all baseline categories. Among students initially classified as N3 or N4, 58 of 113 (51.3%) were classified as N1 at follow-up. The largest improvement was observed among students classified as N3 at baseline, of whom 74.0% transitioned to N1 after one year. Conversely, approximately one-third of students initially classified as N4 remained in the same category at follow-up.

Learning and personal needs at T1	N	Learning and personal needs at T2			
		N1	N2	N3	N4
N1	192	157 (81.8%)	19 (9.9%)	12 (6.3%)	4 (2.1%)
N2	24	9 (37.5%)	11 (45.8%)	1 (4.2%)	3 (12.5%)
N3	50	37 (74.0%)	1 (2.0%)	9 (18.0%)	3 (6.0%)
N4	63	19 (30.2%)	2 (3.2%)	21 (33.3%)	21 (33.3%)
Total	329	222 (67.5%)	33 (10.0%)	43 (13.1%)	31 (9.4%)

Table 2. Evolution of learning and personal needs between T1 and T2. Values are presented as absolute frequencies and row percentages. T1 corresponds to the baseline assessment (2022-2023 academic year) and T2 to the follow-up assessment (2023-2024 academic year). LPN, Learning and Personal Needs. N1, no identified support needs; N2, learning optimisation needs; N3, moderate support needs; N4, high-complexity support needs. Percentages in each row indicate the proportion of students within each baseline LPN category who were classified into each LPN category at follow-up

Descriptive analyses according to support intensity indicated improvements in LPN classifications across all support levels (Table 3). Among students receiving more intensive support (S3-S4), 16 of 53 students (30.2%) initially classified as N4 were reclassified as N1 at follow-up, while 36 of 53 (67.9%) were reclassified to lower-need categories (N1-N3).

Learning and Personal Needs at T1	Learning and Personal Needs at T2			
	N1	N2	N3	N4

Support					
S1	N1 (n=179)	147 (82.1%)	17 (9.5%)	12 (6.7%)	3 (1.7%)
	N3 (n=25)	21 (84%)	0 (0%)	3 (12%)	1 (4%)
	N4 (n=10)	3 (30%)	1 (10%)	2 (20%)	4 (40%)
S2	N1 (n=13)	10 (76.9%)	2 (15.4%)	0 (0%)	1 (7.7%)
	N3 (n=4)	3 (75%)	0 (0%)	1 (25%)	0 (0%)
S3	N2 (n=24)	9 (37.5%)	11 (45.8%)	1 (4%)	3 (12.5%)
	N3 (n=21)	13 (61.9%)	1 (4.8%)	5 (23.8%)	2 (9.5%)
	N4 (n=35)	11 (31.4%)	1 (2.9%)	13 (37.1%)	10 (28.6%)
S4	N4 (n=18)	5 (27.8%)	0 (0%)	6 (33.3%)	7 (38.9%)
Total (n=329)		222 (67.5%)	31 (9.4%)	45 (13.7%)	31 (9.4%)

Table 3. Evolution of learning and personal needs according to baseline need category and maximum support intensity (T1-T2). Values are presented as absolute frequencies and row percentages. T1, baseline assessment (2022-2023 academic year); T2, follow-up assessment (2023-2024 academic year). Support levels (S1-S4) refer to the highest level of Student Support Program support received during follow-up. Percentages indicate the proportion of students within each baseline Learning and Personal Needs category at T1 who were classified into each LPN category at follow-up (T2). N1, no identified support needs; N2, learning optimisation needs; N3, moderate support needs; N4, high-complexity support needs; S1, routine monitoring and academic guidance; S2, participation in structured group-based activities; S3, individual tutoring; S4, referral to specialised institutional or external support services.

ACADEMIC PERFORMANCE EVOLUTION

As a secondary outcome, annual average grades were analysed to explore whether changes in LPN were accompanied by changes in academic performance. The academic outcomes at T1 and T2 of the Study Cohort (T1-T2; n=329) were examined according to baseline LPN category and support intensity to describe patterns of academic evolution across different levels of need and support within the SSP framework (Table 4).

	N	T1 Median	T2 Median	Median Δ	95% CI	r	p
Learning and personal needs at T1							
N1	192	7.7 [7.28 - 8.05]	7.8 [7.42 - 8.22]	0.13	(0.07-0.18)	0.26	<0.001
N2	24	7.68 [7.28 - 8.2]	8.02 [7.54 - 8.32]	0.21	(0.06-0.39)	0.57	0.011
N3	50	6.66 [6.28 - 6.89]	7.01 [6.71 - 7.46]	0.35	(0.19-0.51)	0.6	<0.001
N4	63	6.09 [5.42 - 6.97]	6.57 [5.56 - 7.06]	0.21	(0.07-0.37)	0.39	0.003
Total	329	7.44 [6.69 - 7.87]	7.57 [6.95 - 8.04]	0.18	(0.13-0.23)	0.35	<0.001
Support at T1							
S1	214	7.62 [7.06 - 7.98]	7.72 [7.29 - 8.15]	0.13	(0.08-0.19)	0.26	<0.001
S2	17	7.17 [6.79 - 7.85]	7.62 [7.19 - 7.94]	0.27	(0.01-0.5)	0.54	0.041
S3	80	6.64 [5.91 - 7.3]	6.96 [6.26 - 7.58]	0.28	(0.17-0.41)	0.57	<0.001
S4	18	7.2 [6.58 - 7.51]	7.35 [6.34 - 7.69]	0.19	(0.03-0.37)	0.48	0.057
Total	329	7.44 [6.69 - 7.87]	7.57 [6.95 - 8.04]	0.18	(0.13-0.23)	0.35	<0.001

Table 4. Evolution of annual average grades according to baseline learning and personal needs category and support intensity (T1-T2). N1-N4 and S1-S4 refer to the highest levels observed at T1 (baseline assessment; 2022-2023 academic year) for LPN and the SSP, respectively. Data are presented as medians and interquartile ranges; r, effect size; Δ, median difference; p, p-value.

Median annual average grades increased in the Study Cohort (T1-T2; n=329) (Median Δ=0.18; 95% CI 0.13-0.23; r=0.35). By LPN subgroups, the largest increase was observed among students with suboptimal performance at T1 (N3: Δ=0.35; 95% CI 0.19-0.51; r=0.6), followed by those seeking

performance improvement (N2: $\Delta=0.21$; 95% CI 0.06-0.39; $r=0.57$), and those at highest risk (N4: $\Delta=0.21$; 95% CI 0.07-0.37; $r=0.39$). Median annual average grades increased from T1 to T2 across all support categories (S1–S4), although the change did not reach statistical significance in the small S4 subgroup ($n=18$; $p=0.057$). The largest increase was observed among students receiving individual tutoring (S3; $\Delta=0.28$; 95% CI 0.17-0.41; $r=0.57$), whereas the smallest increase was observed among students receiving routine monitoring and general academic guidance (S1; $\Delta=0.13$; 95% CI 0.08-0.19; $r=0.26$) (Table 4). Because support categories represented levels of support intensity within an integrated and non-exclusive support system, these analyses should be interpreted descriptively rather than as comparisons of intervention effectiveness.

We additionally explored academic changes in the Three-Year Academic Evolution Subcohort (T0-T1-T2; $n = 263$). Improvements in average grades were already apparent for the intervention year (T0-T1 comparison). The largest grade increases were again observed among students receiving individual tutoring (S3; $\Delta = 0.65$; 95% CI 0.43-0.87; $r = 0.69$) and those referred to specialised support services (S4; $\Delta = 0.50$; 95% CI 0.02-0.97; $r = 0.54$) (Table 5).

Support at T1	N	T0 Median	T1 Median	T2 Median	Median Δ (T0-T1)	95% CI	r	p	Median Δ (T0-T2)	95% CI	r	p	Median Δ (T1-T2)	95% CI	r	p
S1	188	7.15 [6.64 - 7.7]	7.58 [7.16 - 8.01]	7.78 [7.34 - 8.17]	0.43	0.36-0.5	0.69	<0.001	0.12	0.07-0.18	0.3	<0.001	0.57	0.48-0.65	0.72	<0.001
S2	9	7.4 [6.9 - 7.76]	7.59 [7.17 - 7.87]	7.83 [7.59 - 8.14]	0.26	-0.15-0.73	0.38	0.301	0.36	-0.13-0.59	0.49	0.164	0.53	0.13-1.12	0.81	0.012
S3	51	6.26 [5.37 - 7.28]	6.86 [6.26 - 7.62]	7.02 [6.62 - 7.88]	0.65	0.43-0.87	0.69	<0.001	0.12	-0.01-0.23	0.25	0.076	0.72	0.53-0.94	0.81	<0.001
S4	15	6.75 [5.8 - 7.16]	7.31 [6.85 - 7.49]	7.38 [6.65 - 7.67]	0.5	0.02-0.97	0.54	0.038	0.19	0.01-0.36	0.54	0.038	0.6	0.19-1.11	0.76	0.002
Total	263	7.07 [6.32 - 7.66]	7.56 [6.96 - 7.93]	7.71 [7.11 - 8.13]	0.46	0.39-0.53	0.67	<0.001	0.13	0.08-0.18	0.31	<0.001	0.59	0.52-0.66	0.74	<0.001

Table 5. Evolution of annual average grades in the Three-Year Academic Evolution Subcohort (T0-T1-T2; $n=263$). T0, 2021-2022 academic year; T1, baseline assessment (2022-2023 academic year); T2, follow-up assessment (2023-2024 academic year). Data are presented as medians and interquartile ranges; r, effect size; Δ , median difference; p, p-value. S1-S4 refer to the highest level of SSP support received by each participant during T1 (baseline assessment; 2022-2023 academic year).

DISCUSSION

This study examined the longitudinal evolution of medical students' learning and personal needs within an institutional support system that integrates academic and non-academic sources of information. Three main findings emerged. First, approximately one-third of students presented moderate or high levels of need at baseline, indicating that a substantial proportion of students required support beyond routine academic guidance. Second, the proportion of students with higher levels of need decreased during follow-up, with more than half of students initially classified as N3 or N4 transitioning to lower levels of need. Third, improvements in academic performance were observed alongside improvements in LPN. Together, these findings support the value of longitudinal and multidimensional approaches for identifying and monitoring students' support needs throughout medical training.

One of the most relevant findings was that approximately one-third of students presented moderate or high levels of need at baseline, despite many of them remaining academically successful. This observation reinforces the limitations of relying exclusively on academic outcomes to identify students requiring support and prevention. Previous studies have shown that students experiencing academic, psychological, social, or personal difficulties may remain undetected when identification systems rely primarily on grades or progression indicators (14,15,21). High levels of psychological distress, burnout, and wellbeing difficulties have been documented in medical students who continue to progress academically, further highlighting the limitations of academic indicators as sole markers of vulnerability (1,2,22). Furthermore, contemporary models of student support increasingly recognise vulnerability as a multidimensional construct shaped by the interaction of academic, personal, and contextual factors rather than by academic performance alone (3). The multidimensional framework used in this study therefore provided information that would not have been captured through academic performance indicators alone.

A second important finding was the favourable evolution of LPN classifications during participation in the SSP. More than half of students initially classified as N3 or N4 transitioned to lower levels of need, and approximately half were classified as N1 at follow-up. Although the observational design prevents attribution of these changes directly to the SSP, the findings suggest that students' support needs may evolve favourably within a longitudinal support framework that incorporates continuous monitoring and access to tailored support resources (7,23). Educational transitions are known to modify students' support needs and adaptation challenges throughout training (17,18), which further supports the value of longitudinal approaches capable of identifying evolving needs over time.

Women participated more frequently in individual support activities despite presenting similar distributions of LPN, a finding that is consistent with previous studies suggesting that help-seeking behaviours and patterns of engagement with support services may vary across student groups (24). Differences in engagement with support services may also be influenced by stigma, accessibility, perceived confidentiality, and attitudes towards seeking help (25,26). In addition, institutional initiatives may improve the utilisation of support resources only when barriers to help-seeking are actively addressed (27). More broadly, diversity, inclusion, social context, and individual experiences should be

considered when designing institutional support systems, as these factors may influence both the expression of support needs and access to available resources (28,29). From this perspective, effective support systems may require not only mechanisms for identifying needs but also strategies that facilitate equitable access and engagement across different student groups.

Improvements in academic performance were also observed across all LPN and support categories. Because academic outcomes constituted a secondary outcome and no comparison group was available, these findings should be interpreted cautiously. Nevertheless, the concurrent improvement in LPN classifications and academic performance is compatible with evidence suggesting that academic achievement is influenced by a broad range of psychological, behavioural, and contextual factors beyond knowledge acquisition alone (30). Self-regulated learning, motivation, learning strategies, wellbeing, and adaptation to the learning environment have all been associated with academic performance among medical students (31–35). From this perspective, academic performance may be understood as one component of a broader educational experience rather than as an isolated marker of student success.

Importantly, the main contribution of this study is not the evidence of intervention effectiveness but the evidence regarding the longitudinal evolution of students' learning and personal needs within an integrated institutional support system. While previous studies have highlighted the educational value of mentoring, wellbeing initiatives, and institutional support structures (36–38), and recent evidence has reinforced the importance of institutional approaches to student wellbeing and support (39), relatively little is known about how students' support needs change over time when academic and non-academic dimensions are considered simultaneously. The present findings therefore contribute to the growing literature on student support systems by providing empirical evidence on the longitudinal evolution of students' learning and personal needs within a multidimensional institutional framework spanning the medical curriculum.

These findings have several implications for medical education. First, they reinforce the need for systems capable of identifying support needs before academic difficulties become evident. Second, they support the use of multidimensional approaches that integrate academic and non-academic information when monitoring student progress. Third, the favourable evolution of LPN classifications observed over time is consistent with the potential value of longitudinal monitoring approaches that allow support strategies to be adapted to students' changing circumstances. Finally, the N1-N4 and S1-S4 framework may provide a practical model for institutions seeking to move beyond binary classifications based exclusively on academic risk and towards more individualised and needs-based support systems (14,15,21).

Future research should examine the transferability of this framework across institutions and educational contexts, explore factors influencing engagement with support resources, and further investigate how students' learning and personal needs evolve throughout medical training. Qualitative approaches may contribute a deeper understanding of students' experiences and barriers to support utilisation, while multicentre studies could provide evidence regarding the generalisability and sustainability of longitudinal support systems.

STRENGTHS AND LIMITATIONS

This study has several strengths. It evaluates a longitudinal support program operating across all years of the curriculum and incorporates a multidimensional assessment framework that integrates academic and non-academic information. In addition, participation rates were high, with a substantial proportion of the medical student population consenting to participate. The analysis therefore extends beyond traditional grade-based evaluation and provides insight into the evolution of support needs over time.

Several limitations should also be acknowledged. The study was conducted at a single institution, which may limit generalisability. Although participation rates were high, information regarding non-participating students was not available; therefore, some degree of selection bias cannot be entirely excluded. In addition, the observational design precludes causal inference. Because interventions were integrated, non-exclusive, and voluntarily accessed, the independent contribution of individual components cannot be determined. Consequently, analyses based on support levels should be interpreted as descriptions of different levels of support intensity rather than comparisons of intervention effectiveness. Finally, factors such as external support, informal support networks, or individual socioeconomic circumstances were not systematically measured and may have influenced outcomes.

CONCLUSIONS

This study contributes to the growing literature on needs-based support systems in medical education by providing evidence on the longitudinal evolution of students' learning and personal needs within an integrated institutional support system. A substantial proportion of students presented moderate or high levels of need that extended beyond academic performance alone. During participation in the Student Support Program, these needs showed a favourable evolution over time, while academic performance also improved. Although causality cannot be established, the findings are consistent with the potential value of longitudinal support systems that integrate academic and non-academic information to identify, monitor, and respond to students' changing support needs throughout the medical curriculum.

STATEMENTS AND DECLARATIONS

COMPETING INTERESTS

The authors declare no competing interests.

FUNDING

This work was supported by the Medical Education Chair scholarship program of the Faculty of Medicine of the Universitat de Vic–Universitat Central de Catalunya (UVic-UCC).

DATA AVAILABILITY

The datasets generated and/or analysed during the current study are available from the corresponding author on reasonable request.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by the UVic-UCC Research Ethics Committee (Reference No. 221/2022). Written informed consent was obtained from all participants prior to enrolment. The study was conducted in accordance with the Declaration of Helsinki.

CONSENT FOR PUBLICATION

Not applicable.

CLINICAL TRIAL REGISTRATION

Not applicable.

AUTHOR CONTRIBUTIONS

Irene Veganzones Guanyabens: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Writing – original draft, Writing – review & editing.

Gemma Molist Ferrer: Methodology, Investigation, Data curation, Formal analysis, Writing – review & editing.

Jana Carvajal Camprubí: Writing – original draft, Writing – review & editing.

Cristina Cruz Zambrano: Conceptualization, Methodology, Supervision, Investigation, Data curation, Formal analysis, Writing – original draft, Writing – review & editing.

Ramon Pujol-Farriols: Conceptualization, Writing – review & editing.

Laura Coll-Planas: Writing – review & editing. All authors read and approved the final manuscript.

ACKNOWLEDGMENTS

The authors are grateful to the medical students who participated in this study and to the teaching and administrative staff of the Faculty of Medicine of the University of Vic–Central University of Catalonia for their support. The authors also thank Professor Cees van der Vleuten for his valuable advice and feedback during the development and revision of this work.

DECLARATION OF AI USE

Microsoft Copilot (GPT-5) was used solely to assist with bibliographic research, including the development of search and selection strategies and the management of bibliographical citations. All outputs were reviewed and verified by the authors. The authors take full responsibility for the content, interpretation, and final version of the manuscript (40).

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SUPPLEMENTARY MATERIAL

Supplementary Figure 1. Participant flow and derivation of the analytical cohorts.

