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# Medical Student Perceptions of the Learning Environment: Learning Communities Are Associated With a More Positive Learning Environment in a Multi-Institutional Medical School Study

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## Abstract

### Purpose

Many medical schools have implemented learning communities (LCs) to improve the learning environment (LE) for students. The authors conducted this study to determine whether a relationship exists between medical student perceptions of the LE and presence of LCs during the preclerkship years.

### Method

Students from 24 schools participating in the American Medical Association Learning Environment Study completed the 17-item Medical Student Learning Environment Survey (MSLES) at the end

of their first and second years of medical school between 2011 and 2013. Mean total MSLES scores and individual item scores at the end of the first and second years in schools with and without LCs were compared with *t* tests, and effect sizes were calculated. Mixed-effects longitudinal models were used to control for student demographics and random school and student effects on the relationship between LC status and MSLES score.

### Results

A total of 4,980 students (81% of 6,148 matriculants) from 18 schools with LCs

and 6 without LCs participated. Mean [SD] MSLES scores were significantly higher in LC schools compared with non-LC schools at the end of year one (3.72 [0.44] versus 3.57 [0.43],  $P < .001$ ) and year two (3.69 [0.49] versus 3.42 [0.54],  $P < .001$ ). The effect size increased from 0.35 (small) at the end of year one to 0.53 (medium) at the end of year two.

### Conclusions

This large multi-institutional cohort study found that LCs at medical schools were associated with more positive perceptions of the LE by preclerkship students.

Learning communities (LCs) are a common educational framework in colleges and universities, used in over 800 institutions in the United States as of 2009.<sup>1</sup> At the collegiate level, LCs have been identified as one of five high-impact practices associated with student-centered outcomes, including improved retention and academic success.<sup>2</sup> Although a small number of U.S. medical schools had LCs in the 1970s and 1980s, they have been widely implemented in undergraduate medical education (UME) within the last decade.<sup>3</sup>

LCs are referred to in the literature as “colleges, societies, CELLS, and houses” and defined as “intentionally developed longitudinal groups that aim to enhance students’ medical school experience and maximize learning.”<sup>3,4</sup> The number of Association of American Medical

Colleges institutions that reported having LCs increased nearly threefold, from 18 to 66, over the five years from 2007 to 2012.<sup>3,4</sup> In 2013, the Liaison Committee on Medical Education (LCME) added an item to Part II of the Annual Medical School Questionnaire asking if students were organized into colleges or mentorship groups at any time during their education.<sup>5</sup> For the 2012–2013 academic year, the number of schools that reported organizing students into colleges or mentorship groups was 93 of 136 (68.4%). For the 2013–2014 academic year, the number grew to 102 of 140 schools (72.9%).<sup>6</sup> Despite the rapid increase in number of institutions using LCs in UME, the literature supporting the use of LCs in medical school is sparse.

Several institutions have conducted pre- and post-LC implementation analyses that associated LCs with positive outcomes including students’ increased comfort in clinical skills,<sup>7</sup> Clinical Performance Examination scores,<sup>8</sup> and performance on clinical rotations,<sup>9</sup> as well as connections between students, involvement in leadership and service activities, student access to faculty, and positive perceptions of the learning environment (LE).<sup>10</sup> The

American Medical Association (AMA)-sponsored Learning Environment Study (LES)<sup>11</sup> includes two institutions that have published descriptions of their LCs: University of Arizona College of Medicine–Tucson<sup>12</sup> and Stanford University School of Medicine.<sup>13</sup> At those institutions, LCs are used to teach clinical skills and promote student wellness.<sup>12,13</sup> Career advising and social gatherings are other common areas of focus for LCs.<sup>3,14,15</sup>

LCs have been implemented in an attempt to improve the LE for UME students.<sup>10</sup> The LE encompasses the broad, complex, social, psychological, and educational factors, including physical spaces, that create the overall educational climate.<sup>16,17</sup> This involves both the formal and hidden curriculum.<sup>18,19</sup> Although undesirable changes such as decreased empathy,<sup>20–24</sup> burnout,<sup>25–30</sup> and depression<sup>31–33</sup> are well documented during UME, it is not known which factors mitigate them and how they relate to differences in student perceptions of the LE.

We have not identified any multi-institutional studies that examined the relationship between LCs and medical student perceptions of the LE. We conducted our study to determine whether

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medical student perceptions of the LE during the preclerkship years were different between schools with and without LCs. We hypothesized that students at schools with LCs would have more positive perceptions of the LE compared with those at schools without LCs.

## Method

The LES is an AMA-sponsored longitudinal study of two student cohorts, matriculating in 2010 and 2011, at 28 LCME-accredited U.S. and Canadian allopathic medical schools who self-selected to be part of a study on the LE in UME. The study has been previously described in detail by Skochelak et al.<sup>11</sup> To summarize, we examined data from the preclerkship years, which were collected from the fall semester of 2010 through the spring semester of 2012 for the first cohort, and from the fall semester of 2011 through the spring semester of 2013 for the second cohort. Approval for LES collaboration was obtained from the University of Michigan Medical School institutional review board (IRB); each participating medical school received local IRB approval.

Schools with LCs were identified through a separate 2014 AMA survey of LES schools that included the question “Does your institution currently have LCs (e.g., societies, colleges, docent teams, houses, mentorship groups, tracks, cohorts)?” Results were confirmed with data from the Learning Communities Institute’s national survey, administered from 2011 to 2012.<sup>3</sup> Two authors (S.S., L.D.) used additional descriptors including open-ended responses provided on these surveys to achieve consensus on the presence of an LC in each school. We determined class size from the LCME Part II survey and Association of Faculties of Medicine Canada enrollment data.

At matriculation, for the LES we collected student demographic information: gender, marital status, time between college and medical school, location growing up (rural, town, suburb, or city), previous health work, and presence of a physician in the immediate family. We also asked students to select “all that apply” of several race and ethnicity categories. Students who selected only “non-Hispanic white” were categorized as white; students who selected “Native American,” “Alaska Native/Eskimo/Inuit,”

“African American/African descent/Black,” or “Hispanic/Latino/Chicano,” with or without other categories, were categorized as underrepresented in medicine (UIM); students who selected “Asian American/Asian descent/Pacific Islander” and no other UIM category were categorized as Asian; all other students were categorized as “other” and treated as having missing race–ethnicity data and included in analyses.

The LE was measured through student self-reports using the 17-item Medical Student Learning Environment Survey (MSLES), a validated shorter version of the original 50-item MSLES survey.<sup>10,16</sup> The 17-item MSLES includes items that measure students’ perceptions of the LE across several areas including student relationships to one another, willingness to assist each other, finding time for family and friends, or allowing interests outside of medicine. It assesses their perception of academics such as competition for grades, exam fairness, and the relationship between basic science and clinical material. It also examines their relationships with faculty, staff, and administration at the medical school. The MSLES was included in a battery of instruments administered at the end of the spring semester of the first year and at the end of the semester immediately preceding the start of the clerkship year.<sup>11</sup> We analyzed data from 22 U.S. schools (33 campuses) and 2 Canadian schools (2 campuses). We excluded 4 of the original 28 LES schools that did not collect MSLES data during the specified study period. Of these 4 schools, 1 had an LC. These missing schools were similar to those included in our analysis; class sizes ranged from 38 to 206, 1 was private, and 3 were public institutions. Schools were included in the analysis if they administered the MSLES tool at least once to students in their first and second years of medical school.

Each MSLES item was rated on a five-point Likert scale where 1 = “never,” 2 = “rarely,” 3 = “sometimes,” 4 = “often,” and 5 = “very often.” Negatively worded items were reverse coded to improve interpretation; a higher overall MSLES score indicated a more positively perceived LE. The overall MSLES score is an average of scores on all 17 items. Students were included in the analysis if they completed at least 1 MSLES item at

least once in the first two years of medical school. Students who completed some, but not all, of the 17 items were included in the item-level analysis of that time point, but excluded from the total MSLES score analyses.

We conducted chi-square and Student *t* tests of differences for student demographic characteristics between LC schools and non-LC schools at matriculation. We examined the difference in MSLES scores for LC and non-LC schools at the end of the first and second years of medical school for each MSLES item using *t* tests and Cohen *d* effect sizes. We defined effect sizes as small (0.20–0.49), medium (0.50–0.79), and large (> 0.80).<sup>34</sup> We examined the relationship between overall MSLES score and presence of an LC during the preclinical years with a mixed-effects generalized linear model, while controlling for demographics and random school and student effects. This model allowed for student and school dropout over time by using maximum likelihood to estimate the variance between students and schools; accounting for variance related to known and unknown aspects of the schools that might be related to the LE; and examination of the presence of an LC and student characteristics. We performed this model first on all available data, and then, as confirmation, we repeated the analyses for students who responded at both time points. We performed all analyses using SAS Enterprise Guide, Version 6.1 (SAS International Inc., Cary, North Carolina).

## Results

Eighteen schools (19 campuses) had LCs, and 6 schools (16 campuses) did not. The average class size at matriculation was 159 students for the 18 LC schools (range of 40–234) and 204 for the 6 non-LC schools (range of 65–356). Of the 6,148 students enrolled at matriculation, 4,980 (81.0%) completed at least one MSLES item, and 4,934 (80.3%) completed the entire MSLES at least once. Students at LC and non-LC schools differed demographically, except for gender (Table 1). Standardized Cronbach alpha for the MSLES responses was 0.86, suggesting high internal reliability for these data. Item-to-total correlations ranged from 0.44 to 0.62.

Table 1

**Participation in the Medical Student Learning Environment Survey and Demographic Traits at 24 U.S. and Canadian Medical Schools, According to Learning Community (LC) Status, for Classes Matriculating in 2010 and 2011, as Reported on the Learning Environment Study Matriculation Questionnaire<sup>a</sup>**

Characteristic	LC schools	Non-LC schools	P value <sup>b</sup>
<b>Participation</b>			
Students, c no. (%)			n/a
M1	3,152 (83.1)	990 (83.5)	
M2	2,518 (66.3)	615 (51.9)	
Both M1 and M2	1,875 (49.4)	420 (35.4)	
M1 or M2, no.	3,795	1,185	
Schools, no.	18	6	n/a
Campuses, no.	19	16	n/a
<b>Demographic traits, no. (%)</b>			
Gender			
Female	1,473 (38.8)	428 (36.1)	.28
Male	1,479 (39.0)	467 (39.4)	
Race/ethnicity <sup>d</sup>			
Asian	634 (16.7)	160 (13.5)	
UIM	360 (9.5)	149 (12.6)	< .001
White	1,772 (46.7)	495 (41.8)	
Physician in family			
Yes	858 (22.6)	229 (19.3)	.03
No	2,080 (54.8)	671 (56.6)	
Previous health work			
Yes	1,554 (40.9)	433 (36.5)	.001
No	1,301 (34.3)	463 (39.1)	
Location growing up			
City	471 (12.4)	164 (13.8)	
Rural	224 (5.9)	115 (9.7)	< .001
Suburb	1,676 (44.2)	433 (36.5)	
Town	581 (15.3)	187 (15.8)	
Marital status			
Living with partner	104 (2.7)	32 (2.7)	
Divorced	41 (1.1)	12 (1.0)	.04
Married	202 (5.3)	90 (7.6)	
Single	2,605 (68.6)	766 (64.6)	
Time between end of college and start of medical school			
0–6 months	1,086 (28.6)	413 (34.9)	
7–12 months	289 (7.6)	94 (7.9)	
13–24 months	710 (18.7)	176 (14.9)	< .001
25–36 months	375 (9.9)	92 (7.8)	
37+ months	485 (12.8)	126 (10.6)	

Abbreviations: M1 indicates students at the end of the spring semester of the first year of medical school; M2, students at the end of the semester immediately preceding the start of the clerkship year (which was at the end of the spring semester of the second year in 23 schools and at the end of the fall semester of the second year in 1 school); UIM, underrepresented in medicine.

<sup>a</sup>Sums of percentages in rows of demographics do not equal 100% because demographic information was only asked at matriculation, while participation on Medical Student Learning Environment Survey was at the end of the first year and the end of the semester immediately preceding the start of the clerkship year.

<sup>b</sup>Chi-square tests for difference between learning community and non-learning-community schools.

<sup>c</sup>Number of students who completed at least one entire (i.e., all 17 items) Medical Student Learning Environment Survey at the end of the first year or at the end of the semester immediately preceding start of the clerkship year.

<sup>d</sup>See Method for race/ethnicity categorization.

At the end of the first year of medical school, students at LC schools reported statistically significantly higher mean (SD) total MSLES scores, 3.72 (0.44), than those at non-LC schools, 3.57 (0.43), a difference of 0.15 points ( $P < .001$ ) with a small effect size (0.35) (Table 2). By the end of the second year, the difference in total MSLES scores between students in LC schools, 3.69 (0.49), and those in non-LC schools, 3.42 (0.54), increased to 0.27 points ( $P < .001$ ) with a medium effect size (0.53). LC schools also had statistically significantly higher scores than non-LC schools on 13 of the 17 individual MSLES items at the end of the first year of medical school and in 16 of 17 items at the end of the second year (Table 2). The three items that had medium effect sizes for the differences between LC and non-LC schools (Table 2) were “The environment allows for interests outside of medicine,” “Students gather together for informal activities,” and “Competition for grades is intense.”

To address the demographic differences between LC and non-LC schools, we controlled for student demographic characteristics and random school and student effects in the mixed-effects model (Table 3). We found that students at LC schools had total MSLES scores 0.19 points higher (3.66 versus 3.47,  $P < .001$ ) than non-LC schools at the end of the first year and 0.28 points higher (3.64 versus 3.36,  $P < .001$ ) at the end of the second year when controlling for demographic and school effects. Student perceptions of the LE, as measured by total MSLES scores, declined significantly between the ends of the first and second years at non-LC schools, by 0.11 ( $P < .001$ ), but were not significantly changed for the LC schools between the ends of the first and second years ( $P = .09$ ). We also found significant demographic differences in perceptions of the LE as expressed in student MSLES scores (Table 3). We repeated these analyses for students who completed MSLES at both time points and found similar results (data not shown).

## Discussion

To our knowledge, this is the first multi-institutional study demonstrating that medical schools with LCs were associated with significantly more positive student

Table 2

**MSLES Total Scores and Scores for Each of 17 Individual Survey Items at the End of the First and Second Years of Medical School, According to Learning Community (LC) Status, From 4,980 Students at 24 U.S. and Canadian Medical Schools Participating in the Learning Environment Study, 2011–2013<sup>a,b</sup>**

Survey item	Year	LC school, mean (SD)	Non-LC school, mean (SD)	Difference (effect size)	P value <sup>c</sup>
Total MSLES	M1	3.72 (0.44)	3.57 (0.43)	-0.15 (0.35)	< .001
	M2	3.69 (0.49)	3.42 (0.54)	-0.27 (0.53)	< .001
The environment of the school allows for interests outside of medicine	M1	3.82 (0.87)	3.39 (0.89)	0.43 (0.50)	< .001
	M2	3.58 (0.95)	3.09 (0.96)	0.49 (0.52)	< .001
Students gather together for informal activities	M1	4.09 (0.80)	3.91 (0.78)	0.18 (0.23)	< .001
	M2	3.99 (0.81)	3.58 (0.85)	0.41 (0.51)	< .001
Competition for grades is intense <sup>d</sup>	M1	3.68 (0.99)	3.34 (1.00)	0.34 (0.34)	< .001
	M2	3.82 (0.93)	3.32 (1.08)	0.50 (0.52)	< .001
Students hesitate to express their opinions and ideas to faculty <sup>d</sup>	M1	3.71 (0.79)	3.58 (0.81)	0.13 (0.17)	< .001
	M2	3.74 (0.91)	3.55 (1.02)	0.19 (0.19)	< .001
The relationship between basic science and clinical material is unclear <sup>d</sup>	M1	3.57 (0.77)	3.38 (0.81)	0.19 (0.25)	< .001
	M2	3.56 (0.81)	3.32 (0.88)	0.24 (0.28)	< .001
Exams provide a fair measure of student achievement	M1	3.59 (0.80)	3.55 (0.72)	0.04 (0.05)	.17
	M2	3.52 (0.82)	3.31 (0.86)	0.21 (0.25)	< .001
Students' complaints are responded to with meaningful action	M1	3.71 (0.88)	3.41 (0.88)	0.30 (0.34)	< .001
	M2	3.65 (0.92)	3.29 (1.00)	0.36 (0.39)	< .001
Exams emphasize understanding of concepts	M1	3.59 (0.80)	3.57 (0.76)	0.02 (0.03)	.43
	M2	3.53 (0.84)	3.36 (0.82)	0.17 (0.21)	< .001
Upper-level students provide informal guidance to lower-level students	M1	3.63 (1.00)	3.53 (1.05)	0.10 (0.10)	.01
	M2	3.75 (1.00)	3.75 (0.99)	0.00 (0.00)	.98
Students have difficulty finding time for family and friends <sup>d</sup>	M1	3.12 (0.91)	2.90 (0.84)	0.22 (0.25)	< .001
	M2	3.14 (0.88)	2.85 (0.88)	0.29 (0.34)	< .001
Students in school get to know each other well	M1	4.03 (0.75)	4.00 (0.80)	0.03 (0.04)	.29
	M2	4.05 (0.79)	3.76 (0.91)	0.29 (0.35)	< .001
Students in school are distant from each other <sup>d</sup>	M1	3.71 (0.71)	3.65 (0.76)	0.06 (0.09)	.01
	M2	3.69 (0.75)	3.50 (0.82)	0.19 (0.24)	< .001
Faculty are reserved and distant with students <sup>d</sup>	M1	3.78 (0.71)	3.78 (0.71)	0.00 (0.00)	.97
	M2	3.79 (0.73)	3.58 (0.87)	0.21 (0.28)	< .001
Courses emphasize the interdependence of facts, concepts, and principles	M1	3.74 (0.75)	3.58 (0.75)	0.16 (0.22)	< .001
	M2	3.66 (0.80)	3.42 (0.87)	0.24 (0.29)	< .001
Students spend time assisting each other	M1	3.99 (0.76)	3.83 (0.77)	0.16 (0.22)	< .001
	M2	3.89 (0.79)	3.61 (0.83)	0.28 (0.35)	< .001
Students are reluctant to share with each other problems they are having <sup>d</sup>	M1	3.57 (0.81)	3.42 (0.82)	0.15 (0.18)	< .001
	M2	3.53 (0.86)	3.28 (0.91)	0.25 (0.28)	< .001
Faculty, administrators, and staff give personal help to students having academic difficulty	M1	3.88 (0.85)	3.82 (0.83)	0.06 (0.07)	.05
	M2	3.84 (0.88)	3.64 (0.93)	0.20 (0.23)	< .001

Abbreviations: MSLES indicates Medical Student Learning Environment Survey; UIM, underrepresented in medicine; M1, the end of the spring semester of the first year of medical school; M2, the end of the semester immediately preceding the start of the clerkship year (which was at the end of the spring semester of the second year in 23 schools and at the end of the fall semester of the second year in 1 school).

<sup>a</sup>First-year medical students (M1) completed MSLES survey at the end of their first year of medical school, and second-year medical students (M2) completed their surveys at the end of the semester immediately preceding the start of their clerkships (which was the end of the spring semester of the second year of medical school in 23 of 24 schools and at the end of the fall semester of the second year in 1 school).

<sup>b</sup>Likert scale anchors: 1 = never, 2 = rarely, 3 = sometimes, 4 = often, and 5 = very often.

<sup>c</sup>Results from Student *t* test.

<sup>d</sup>Item was reverse coded.

perceptions of their schools' LE compared with schools without LCs. These observed differences at the end of both years one and two were statistically significant and meaningful as supported by the observed effect sizes. These findings are consistent with those of previous studies at single medical schools<sup>10</sup> and at the collegiate level,<sup>35</sup> which may have broad implications, as many medical schools are using or exploring the use of LCs.

Our study found that student perceptions of the LE from the first to second year decreased at non-LC schools, but showed no significant differences at schools with LCs. We speculate that teaching medical students within LCs may be a protective factor against some typical challenges of the preclerkship years. The end of the second year of medical school is traditionally a difficult time for students, who may be concerned about the high-stakes United States Medical Licensing Exam (USMLE) Step 1. One study correlated higher LE scores with better USMLE scores, even when controlling for baseline academic performance.<sup>36</sup>

Students at schools with LCs rated their LE more positively than schools without LCs at the end of the first year, and the difference increased significantly by the end of the second year, with a greater difference in total MSLES scores, individual item scores, and effect sizes. As represented by differences in individual item scores of the MSLES tool between LC and non-LC schools, compared with non-LC schools, the LEs of the LC schools in our study were most notably different in three elements: less competition for grades, increased informal gatherings, and allowing interests outside of medicine. By integrating academic and social activities, LCs may enhance academic outcomes as knowledge is socially and actively constructed.<sup>2,35,37</sup>

Our findings are also consistent with a prior multischool study reporting that decreasing competition for grades using a pass–fail grading system was associated with decreased levels of stress, burnout, exhaustion, depersonalization, and thoughts of dropping out of medical school.<sup>38</sup> Although not specifically measuring perceptions of the LE, one single-institution study reported that changing to a less competitive

Table 3

**Results of Longitudinal Mixed-Effects Generalized Linear Model for MSLES Scores for 4,980 Medical Students at 24 U.S. and Canadian Medical Schools Participating in the Learning Environment Study, 2011–2013**

MSLES point estimates	Point estimate for MSLES, <sup>a,b</sup> mean (95% CI)	P value <sup>c</sup> (M1 vs. M2)
<b>LC school</b>		
M1	3.66 (3.62, 3.71)	.09
M2	3.64 (3.60, 3.68)	
<b>Non-LC school</b>		
M1	3.47 (3.42, 3.52)	< .001
M2	3.36 (3.31, 3.41)	
Model estimates	Effect estimate (95% CI)	P value <sup>d</sup>
<b>LC vs. non-LC at end of M1</b>	0.19 (0.16, 0.23)	< .001
<b>Time (slope for year) for non-LC schools</b>	−0.11 (−0.15, −0.07)	< .001 <sup>e</sup>
<b>Time (slope for year) for LC schools</b>	−0.02 (−0.06, 0.02)	< .001 <sup>f</sup>
<b>Gender (female vs. male)</b>	0.05 (0.02, 0.08)	< .001
<b>Race/ethnicity<sup>g</sup></b>		
Asian vs. white	−0.09 (−0.13, −0.06)	< .001
UIM vs. white	−0.02 (−0.06, 0.02)	.27
<b>Previous health work (vs. none)</b>	−0.02 (−0.05, 0.01)	.16
<b>Physician in immediate family (vs. none)</b>	0.00 (−0.04, 0.03)	.77
<b>Location growing up</b>		
City vs. town	−0.04 (−0.09, 0.00)	.08
Rural vs. town	0.00 (−0.06, 0.06)	.99
Suburb vs. town	0.01 (−0.02, 0.05)	.54
<b>Marital status</b>		
Living with partner vs. single	−0.09 (−0.16, −0.01)	.03
Divorced vs. single	−0.08 (−0.19, 0.04)	.20
Married vs. single	0.02 (−0.03, 0.08)	.37
<b>Time between end of college and start of medical school</b>		
7–12 months vs. 0–6 months	−0.05 (−0.10, 0.00)	.04
13–24 months vs. 0–6 months	−0.02 (−0.06, 0.02)	.30
25–36 months vs. 0–6 months	−0.02 (−0.07, 0.02)	.31
37+ months vs. 0–6 months	−0.12 (−0.16, −0.08)	< .001

Abbreviations; MSLES, Medical Student Learning Environment Survey; M1, the end of the spring semester of the first year of medical school; M2, the end of the semester immediately preceding the start of the clerkship year (which was at the end of the spring semester of the second year in 23 schools and at the end of the fall semester of the second year in 1 school); LC, learning community; non-LC, non-learning-community; UIM, underrepresented in medicine.

<sup>a</sup>Likert scale anchors: 1 = never, 2 = rarely, 3 = sometimes, 4 = often, and 5 = very often.

<sup>b</sup>Point estimate signifies the adjusted difference in results when controlling for all above characteristics, and random school and student effects on average MSLES score.

<sup>c</sup>Adjusted differences between M1 and M2.

<sup>d</sup>Significance in mixed-effects regression model including random school and student factors.

<sup>e</sup>P value represents that the slope for non-LC schools is significantly different from 0.

<sup>f</sup>P value represents that the slope for LC schools is significantly different from the slope for non-LC schools. Estimate is presented as slope for LC schools, rather than the difference in slopes, for ease of interpretation.

<sup>g</sup>See Method for race–ethnicity categorizations.

grading system resulted in an increased overall sense of student well-being and satisfaction in personal lives without any decrease in academic performance on courses, USMLE Step 1 or Step 2 (Clinical Knowledge) examinations, or residency

matching.<sup>39</sup> A recent multi-institutional study demonstrated a positive association between the educational environment and medical student quality-of-life scores.<sup>40</sup> If less intense grade competition and encouragement of interests outside of

medicine decrease stress in the preclinical environment without sacrificing educational outcomes, this may lay the foundation for long-term work–life integration necessary in medical careers.<sup>41</sup>

The initial lack of difference between LC and non-LC student perceptions of faculty being reserved and distant may reflect a general perception of faculty members rather than LC mentors specifically. The majority of faculty members may interact with students in a more traditional manner—for instance, during lectures for entire medical school classes. However, the difference noted at the end of the second year may suggest that LC students and faculty remain more consistently engaged.

Many medical schools have implemented longitudinal clerkships to try to formally combat the fragmentation of medical education during the first clinical year of training—that is, during the core clerkships.<sup>42</sup> However, LCs purposefully go beyond delivering formal curricular elements over time. One common LC format pairs a small number of medical students with a carefully selected mentor who knows students, curricula, and institutional resources well, and the students and their mentor maintain this relationship throughout medical school. This continuous relationship may benefit students by providing more personalized experiences during their time in medical school compared with schools without such an LC format.<sup>7,8,13</sup> LC mentors are often the first point of contact for student issues and can help guide students to appropriate resources.<sup>3,8</sup> Finally, by providing a space for structured reflection with mentors and classmates, LCs often represent a school's attempt to address the hidden curriculum, provide humanistic role models, and positively influence the overall LE.<sup>3,13,14</sup>

“Upper-level students provide informal guidance to lower-level students” is the sole MSLES item that did not differ significantly between schools with and without LCs by the end of the second year. Many LCs purposefully attempt to create vertical communication among the classes,<sup>3,10</sup> which is perhaps most feasible when second-year students mentor first-year students. Although some institutions have LCs that meet regularly during clinical training,<sup>3,8,43</sup> other schools may find it challenging to meaningfully integrate LCs into the clinical years.

The mixed-effects regression model found differences in perceptions of the LE as expressed in MSLES scores: Asians, males, students living with partners at home, and those who had greater time between college graduation and medical school rated the LE more negatively than other students. These findings suggest a need to determine whether LCs may benefit certain categories of students more than others on the basis of demographic factors or other traits.

This study has several limitations. LCs are heterogeneous in multiple aspects, such as LC size, goals and objectives, ratio of students to faculty, and curricular or extracurricular activities. We made no attempt to analyze data on the basis of these aspects of the LC. However, we verified the presence or absence of LCs and confirmed that LC-designated schools met established LC definitions.<sup>3,4</sup> This was an observational study and not a randomized study. Reported differences may not be the effect of LCs as these schools may differ from non-LC schools in other aspects, such as admissions, prevailing philosophy of faculty, curricula, grading, support structures, or other unknown features. Student MSLES responses were self-reported, one-time perceptions at the end of the first and second years of medical school, which may not reflect their perceptions of the LE throughout the academic years. However, both LC and non-LC schools are relatively equally affected by end-of-year academic stressors. Participants may differ from nonparticipants in unknown ways. The response rate at the end of second year was lower than the rate at matriculation and the end of the first year. We speculate that the end of year two is generally a challenging time to engage students in surveys for reasons such as preparing for their clerkship and/or studying for USMLE Step 1. Nonetheless, this is currently the largest dataset available to study the relationship between LCs and the LE. Although there could be student selection bias for schools with or without LCs, the differences in MSLES scores were likely not due to demographic characteristics because an earlier study of the LES found that the influence of student demographics on total MSLES score was small in comparison with the influence of the LE.<sup>11</sup>

Future directions include following cohorts longitudinally to assess whether differences in perceptions of the LE

between LC and non-LC schools are maintained during the clinical years. Characteristics of LCs such as funding, amount of time dedicated to LCs, and curricular versus extracurricular functions could be explored to identify factors that affect the LE. Future research would aim to categorize different types of LCs, exploring specific benefits and outcomes for different structures, and examining how different grading policies may be related to LC experiences.

Our large multi-institutional cohort study found that the presence of LCs in medical school was associated with more positive perceptions of the LE by first- and second-year students. Although the observed association was significant with small and medium effect sizes, aspects of LCs that may result in such positive perceptions remain uncertain and deserve further study. Nonetheless, it seems reasonable to believe that assigning students to a longitudinal small group of classmates and a faculty mentor can provide a structural change to LEs of medical schools that may promote social and humanizing influences within the LEs of the challenging preclerkship years.

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