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Readiness for digital case-based learning in Community Medicine: a multi- institutional cross-sectional needs assessment of undergraduate medical students in India

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Abstract

Background

Community Medicine asks medical students to reason from an individual case to action at family, community and programme level, but teaching in India still relies heavily on lectures and field visits. Digital case-based learning (DCBL) could give students repeated, structured practice in this kind of reasoning. Learner needs are rarely assessed before such modules are built. We assessed students' self-rated confidence in clinical reasoning, learning preferences, digital access, barriers and interest in DCBL, and identified factors associated with high interest.

Methods

We conducted a cross-sectional online survey between 10 July 2025 and 29 June 2026 among undergraduate medical students and interns at five medical colleges in four southern Indian states. The questionnaire combined 5-point ratings, multiple-response items and open questions. High interest (rating 4–5) was modelled using multivariable logistic regression, with an ordinal model as a sensitivity analysis. Free-text responses were analysed using content analysis.

Results

Of 906 responses, 860 were analysed. Of these, 28.0% rated their confidence in applying clinical reasoning to public-health problems as high; 53.4% chose the midpoint. Students learned best through clinical postings and field visits (64.7%), case-based learning (48.3%) and problem-based learning (43.6%); 30.0% chose classroom lectures. Most used a smartphone or tablet (91.9%). The commonest barriers were lack of motivation (35.1%), lack of internet access (34.5%) and limited time (31.9%). High interest in DCBL was reported by 47.4%, and 41.7% chose the midpoint. High interest was independently associated with higher confidence (adjusted odds ratio [aOR] 1.51, 95% CI 1.26–1.81) and higher engagement with current teaching (aOR 1.54, 1.29–1.83). It was less likely with lack of internet access (aOR 0.56, 0.41–0.76) and prior learning with digital cases (aOR 0.71, 0.53–0.95). Students valued realism, interactivity, visuals and anytime access, and most wanted cases on communicable diseases, outbreak investigation and maternal and child health.

Conclusions

Interest in DCBL was moderate rather than enthusiastic. It followed students' engagement and confidence rather than prior exposure. DCBL modules for Community Medicine should be realistic, decision-focused and interactive, work on mobile devices and low-bandwidth connections, and be linked

to field and classroom teaching. Their design should specifically reach disengaged and less confident learners.

Background

Community Medicine occupies a distinctive place in the Indian undergraduate medical curriculum. Students are expected not only to recognise disease in an individual, but also to reason about its determinants, its distribution in the community, and the programme, preventive and health-system responses it calls for. The competency-based undergraduate curriculum of the National Medical Commission (NMC) frames these as applied competencies to be demonstrated in individuals, families and communities [1]. Developing them requires repeated practice in reasoning from case information to decisions, which is the essence of clinical reasoning [2].

Case-based learning (CBL) is a long-established way of providing such practice. It anchors learning in authentic patient or community problems and integrates basic, clinical and social sciences around them. Learners generally value it, although evidence on its effect on learning outcomes is more mixed [3, 4]. Digital formats extend CBL in several ways. Virtual patients and other digital cases can be revisited, branched and paced by the learner. They also expose students to situations they may not meet during limited field postings [5, 6]. Systematic reviews show that virtual patient simulations improve skills, including clinical reasoning, at least as well as traditional teaching [6]. Blended learning improves knowledge outcomes compared with traditional teaching alone [7], and mobile learning applications can support both performance and engagement [8, 9]. Online CBL has also been proposed as a practical option for Indian medical colleges [10].

In Indian Community Medicine departments, recent innovations have aimed to replace passive, lecture-based teaching with more interactive formats. Examples include interactive classroom teaching, flipped classrooms, structured risk-assessment tasks within the Family Adoption Programme and participatory rural appraisal [11–14]. These initiatives respond to persistent concerns about low student interest and the difficulty of linking classroom theory to field practice. Experience during the COVID-19 pandemic showed that digital teaching in India is also constrained by connectivity, devices and learner motivation [15, 16].

Curriculum development models place a targeted needs assessment of learners before the design of educational strategies [17]. In practice, digital modules are often built around the content teachers want to cover, rather than around what learners currently find difficult, how they prefer to learn, what devices and connectivity they have, and what would make them use a module. No multi-institutional data describe the readiness of Indian undergraduate students for DCBL in Community Medicine.

This study was the learner needs assessment of a Foundation for Advancement of International Medical Education and Research (FAIMER) fellowship project, “Integrating Digital Case-Based Learning to Enhance Clinical Reasoning in Community Medicine”. A separate expert consensus study addressed the design of the modules, and a pilot evaluation of rule-based digital cases for antibiotic-stewardship

reasoning among MBBS learners found the format feasible and acceptable but showed only a small, case-specific gain in reasoning scores [18]. Our objectives were to describe, among undergraduate medical students: (1) self-rated confidence in applying clinical reasoning to public-health problems, engagement with current teaching and preferred learning methods; (2) device use, prior exposure to digital cases and barriers to digital learning; (3) interest in DCBL and the factors independently associated with high interest; and (4) students' views on what makes a digital Community Medicine case useful, which cases they want and how digital learning could be improved.

Methods

Study design and setting

We conducted a multi-institutional cross-sectional survey using an online, self-administered questionnaire. The study was led from the Department of Community Medicine, JSS Medical College, JSS Academy of Higher Education and Research, Mysuru, Karnataka. Responses were received from students at four other medical colleges: Dr. Moopen's Medical College, Wayanad (Kerala); Mount Zion Medical College, Adoor (Kerala); Arundathi Institute of Medical Sciences (Telangana); and Saveetha Medical College (Tamil Nadu). Data collection at each college was coordinated by Community Medicine faculty, including co-authors at JSS Medical College, Dr. Moopen's Medical College, Saveetha Medical College and Mount Zion Medical College. The report follows the Checklist for Reporting Results of Internet E-Surveys (CHERRIES) [19].

Participants and sampling

Eligible participants were undergraduate medical (MBBS) students in MBBS Phase 2, Phase 3 Part 1 or Phase 3 Part 2, and compulsory rotating medical interns, at the participating colleges. These are the stages at which Community Medicine is taught or applied under the current curriculum. Sampling was non-probabilistic. The questionnaire link was shared with student batches by Community Medicine faculty, and participation was voluntary. Because the item wording also allowed teachers to respond, a small number of faculty members and postgraduate students completed the form; they were excluded from this analysis. No sample size was calculated in advance. With 860 respondents, a proportion of 50% can be estimated with a 95% confidence interval half-width of about ± 3.3 percentage points.

Questionnaire

The questionnaire was developed by the investigators for this project, based on the objectives of the needs assessment. It contained 15 items in English. After identification items (name, roll number and college), it asked about:

- Year of study.

- Confidence in applying clinical reasoning skills to solve public-health problems, rated on a 5-point scale. The item was worded as “How confident/useful are you…”.
- Engagement with current Community Medicine teaching, rated on five verbal categories from “not engaging at all” to “very engaging”.
- The methods that help the respondent learn best (multiple responses allowed).
- Whether the respondent had ever learned using digital case scenarios, online or offline.
- Interest in learning Community Medicine through digital case scenarios, rated on a 5-point scale.
- Device(s) used for online academic learning (multiple responses).
- Challenges faced while using digital learning tools (multiple responses, including “others”).

Three open questions asked which Community Medicine cases students would like in a digital case-based format, what makes a digital Community Medicine case interesting and useful, and any suggestions for making digital learning in Community Medicine more effective. Confidence and interest were rated on numerical 1–5 scales. The full questionnaire is provided as Additional file 1.

Data collection

Data were collected using Google Forms between 6 June 2025 and 29 June 2026. Only responses received on or after 10 July 2025, the date of ethics approval, were included in this analysis. The college-name item was added to the form on 12 September 2025. All responses received before that date came from JSS Medical College, where data collection began, and were assigned to that institution.

Data management

Names, roll numbers and free-text college names were used only to identify duplicate submissions and to standardise institution names; they were then removed. Each record received a study identifier. When the same name and roll number appeared more than once at the same institution, the earliest submission was retained and later ones were excluded. Nine respondents ticked both “yes” and “no” for prior digital-case exposure; this item was treated as missing for them. Free-text answers consisting only of “nil”, “no”, “none” or punctuation were treated as non-substantive. All exclusions and recodes were documented in a data-management log, which is available from the corresponding author.

Statistical analysis

Categorical variables are presented as frequencies and percentages. Rating items are presented as full distributions, means with standard deviations and medians with interquartile ranges. For engagement, the five verbal categories were scored 1 (“not engaging at all”) to 5 (“very engaging”). We compared rating items across years of study and institutions using the Kruskal–Wallis test, and between students with and without prior digital-case exposure using the Mann–Whitney U test. Correlations between rating

items were estimated with Spearman's rho. Proportions with high interest were compared using the chi-square test.

The outcome of interest was high interest in DCBL, defined as a rating of 4 or 5. Explanatory variables were selected on conceptual grounds: clinical-reasoning confidence and engagement (each per 1-point increase), prior digital-case exposure, each of the five specified digital-learning challenges, and institution. Year of study was not entered because it was structurally confounded with institution: all MBBS Phase 2 respondents came from one college. We fitted multivariable binary logistic regression and report adjusted odds ratios (aORs) with 95% confidence intervals. Multicollinearity was checked using variance inflation factors.

As a sensitivity analysis, we fitted an ordinal (proportional-odds) logistic model to the full 1–5 interest scale. We examined the proportional-odds assumption by comparing odds ratios across separate binary splits of the outcome (≥ 2, ≥ 3 and ≥ 4). Because the assumption was not well supported for clinical-reasoning confidence, the binary model is presented as the main analysis. A second sensitivity analysis repeated the binary model among MBBS Phase 3 Part 1 students only, the largest and most homogeneous group. Analyses used complete cases. Statistical significance was set at $p < 0.05$. Analyses were performed in Python 3 using pandas, SciPy and statsmodels.

Use of generative artificial intelligence

Claude (Anthropic), a generative artificial intelligence tool, was used to assist with writing data-cleaning and statistical analysis code, applying the free-text coding frame and editing the language of the manuscript. The authors reviewed and verified all code, analytical outputs, coded data and text, made all analytical and interpretive decisions, and take full responsibility for the content of this article.

Analysis of free-text responses

Free-text responses were analysed using conventional (inductive) content analysis [20]. Categories were derived from repeated reading of the responses to each open question and organised into a codebook. Each substantive response could be assigned to more than one category, and category frequencies are reported as percentages of substantive responses. Categories were applied using keyword-assisted coding, and the coded responses were reviewed and the coding frame refined iteratively until categories were applied consistently. Illustrative responses are quoted verbatim with the respondent's study identifier.

Ethics

The study was approved by the Institutional Ethics Committee of JSS Medical College, Mysuru (approval no. JSSMC/IEC/972025/01 NCT/2024-25, dated 10 July 2025). This approval covered data collection at all participating colleges. The first section of the Google Form presented the study information and

sought informed consent before any questions were shown. Participation was voluntary, and responses were de-identified before analysis. The study was conducted in accordance with the Declaration of Helsinki.

Results

Participants

The form received 906 responses. We excluded 15 repeat submissions, 15 responses from faculty members or postgraduate students, and 16 responses received before the date of ethics approval, leaving 860 undergraduate students for analysis (Fig. 1). Most were in MBBS Phase 3 Part 1 (697; 81.0%); 115 (13.4%) were in Phase 2, 31 (3.6%) in Phase 3 Part 2 and 17 (2.0%) were interns. Respondents came mainly from JSS Medical College (391; 45.5%), Dr. Moopen's Medical College (304; 35.3%) and Mount Zion Medical College (138; 16.0%) (Table 1).

Table 1
Characteristics of the participants (n = 860)

Characteristic	n (%)
Year of study	
MBBS Phase 2	115 (13.4)
MBBS Phase 3 Part 1	697 (81.0)
MBBS Phase 3 Part 2	31 (3.6)
Compulsory rotating intern	17 (2.0)
Institution	
JSS Medical College, Mysuru, Karnataka[a]	391 (45.5)
Dr. Moopen's Medical College, Wayanad, Kerala	304 (35.3)
Mount Zion Medical College, Adoor, Kerala	138 (16.0)
Arundathi Institute of Medical Sciences, Telangana	15 (1.7)
Saveetha Medical College, Tamil Nadu	9 (1.0)
Not stated (invalid entry)	3 (0.3)
Previously learned with digital case scenarios	
Yes	516 (60.0)
No	335 (39.0)
Both options ticked (treated as missing)	9 (1.0)
Device(s) used for online academic learning[b]	
Tablet	548 (63.7)
Smartphone	465 (54.1)
Laptop	206 (24.0)
Desktop computer	21 (2.4)
Rarely uses digital devices for learning	31 (3.6)
Smartphone and/or tablet	790 (91.9)

[a] Includes 75 responses received before the college-name item was added to the form on 12 September 2025; all such responses came from JSS Medical College.

[b] Multiple responses allowed; percentages do not sum to 100.

Confidence, engagement and preferred ways of learning

Only 241 students (28.0%) rated their confidence in applying clinical reasoning to public-health problems as 4 or 5. Just over half (459; 53.4%) chose the midpoint, and 160 (18.6%) rated it 1 or 2 (Table 3; Fig. 2). Engagement with current teaching was more favourable: 469 (54.5%) found it somewhat or very engaging, 329 (38.3%) were neutral and 62 (7.2%) found it not very or not at all engaging.

Confidence differed by year of study ($H = 12.30$, $p = 0.006$). It was lowest among Phase 2 students (mean 2.91) and highest among interns (3.59). It also differed by institution ($H = 32.33$, $p < 0.001$). Confidence was higher among students who had previously learned with digital cases (mean 3.20 vs 3.01; $p = 0.002$). Engagement did not differ by year of study ($p = 0.99$), institution ($p = 0.91$) or prior exposure ($p = 0.11$).

Students most often said they learned best through clinical postings and field visits (556; 64.7%), case-based learning (415; 48.3%), problem-based learning (375; 43.6%) and group discussions (326; 37.9%). Fewer chose classroom lectures (258; 30.0%), online videos or modules (231; 26.9%) or PowerPoint presentations (226; 26.3%). The median number of methods selected was 3 (IQR 1–4) (Table 2).

Table 2
Preferred learning methods and challenges with digital learning tools (n = 860)

Item	n (%)
Methods that help students learn best[b]	
Clinical postings and field visits	556 (64.7)
Case-based learning	415 (48.3)
Problem-based learning	375 (43.6)
Group discussions	326 (37.9)
Classroom lectures	258 (30.0)
Online videos/modules	231 (26.9)
PowerPoint presentations	226 (26.3)
Other	11 (1.3)
Challenges faced while using digital learning tools[b]	
Lack of motivation	302 (35.1)
Lack of internet access	297 (34.5)
Limited time	274 (31.9)
Difficult interface or usability	143 (16.6)
Prefer traditional methods	125 (14.5)
Other (unspecified)	122 (14.2)
Two or more challenges reported	311 (36.2)

[b] Multiple responses allowed; percentages do not sum to 100.

Digital access, prior exposure and barriers

Almost all students used a smartphone or a tablet for online academic learning (790; 91.9%). Tablets (548; 63.7%) were reported more often than smartphones (465; 54.1%), and 206 (24.0%) used a laptop. Thirty-one (3.6%) rarely used digital devices for learning. Six in ten (516; 60.0%) had previously learned using digital case scenarios. The most frequently reported challenges were lack of motivation (302; 35.1%), lack of internet access (297; 34.5%) and limited time (274; 31.9%). Fewer reported a difficult interface (143; 16.6%) or a preference for traditional methods (125; 14.5%). Over a third (311; 36.2%) reported two or more challenges (Table 2). The proportion reporting lack of internet access ranged from 29.4% at JSS Medical College to 51.4% at Mount Zion Medical College.

Interest in digital case-based learning

Interest in learning through digital case scenarios was moderate (mean 3.49, SD 0.95). A total of 408 students (47.4%) reported high interest (rating 4 or 5), 359 (41.7%) chose the midpoint and 93 (10.8%) reported low interest (Table 3; Fig. 2).

Table 3
Responses to the three 5-point rating items (n = 860)

Item (rated 1–5)	1	2	3	4	5	Mean (SD)	Median (IQR)	Rating 4–5
Confidence/usefulness in applying clinical reasoning to public-health problems	21 (2.4)	139 (16.2)	459 (53.4)	190 (22.1)	51 (5.9)	3.13 (0.84)	3 (3–4)	241 (28.0)
Engagement with current Community Medicine teaching[c]	14 (1.6)	48 (5.6)	329 (38.3)	342 (39.8)	127 (14.8)	3.60 (0.86)	4 (3–4)	469 (54.5)
Interest in learning Community Medicine through digital case scenarios	28 (3.3)	65 (7.6)	359 (41.7)	276 (32.1)	132 (15.3)	3.49 (0.95)	3 (3–4)	408 (47.4)

Values are n (%) unless stated otherwise.

[c] Five verbal categories scored 1 = not engaging at all, 2 = not very engaging, 3 = neutral, 4 = somewhat engaging, 5 = very engaging.

IQR interquartile range, SD standard deviation

Interest correlated weakly and positively with confidence (rho = 0.20, $p < 0.001$) and engagement (rho = 0.21, $p < 0.001$). The proportion with high interest did not differ significantly by year of study ($\chi^2 = 4.95$, df = 3, $p = 0.175$). It did differ by institution ($\chi^2 = 15.86$, df = 3, $p = 0.001$): among the three largest colleges it was 54.4% at JSS Medical College, compared with 40.7% at Dr. Moopen's Medical College and 41.0% at Mount Zion Medical College. In unadjusted comparisons, high interest was slightly less common among students who had previously learned with digital cases (45.7% vs 50.1%; $\chi^2 = 1.41$, $p = 0.234$).

In the multivariable model (n = 851; 404 with high interest), high interest was independently associated with higher clinical-reasoning confidence (aOR 1.51, 95% CI 1.26–1.81 per point) and higher engagement with current teaching (aOR 1.54, 1.29–1.83 per point). It was inversely associated with reporting lack of internet access (aOR 0.56, 0.41–0.76), with prior digital-case exposure (aOR 0.71, 0.53–0.95) and with studying at Dr. Moopen's Medical College rather than JSS Medical College (aOR 0.62, 0.45–0.86) (Table 4; Fig. 3). Lack of motivation, limited time, a difficult interface and preferring traditional methods were not independently associated with high interest. The maximum variance inflation factor was 1.22.

Table 4
Factors associated with high interest (rating 4–5) in digital case-based learning (n = 851)

Variable	High interest, n/N (%)	Adjusted OR (95% CI)[d]	p	Ordinal model OR (95% CI)[e]
Clinical-reasoning confidence (per 1-point increase)		1.51 (1.26–1.81)	< 0.001	1.49 (1.27–1.76)
Engagement with current teaching (per 1-point increase)		1.54 (1.29–1.83)	< 0.001	1.48 (1.27–1.74)
Previously learned with digital case scenarios				
No	168/335 (50.1)	1 (reference)		1 (reference)
Yes	236/516 (45.7)	0.71 (0.53–0.95)	0.023	0.78 (0.60–1.01)
Challenge reported (yes vs no)				
Lack of internet access	114/294 (38.8) vs 290/557 (52.1)	0.56 (0.41–0.76)	< 0.001	0.75 (0.57–0.98)
Lack of motivation	133/298 (44.6) vs 271/553 (49.0)	0.80 (0.59–1.09)	0.156	0.72 (0.55–0.94)
Limited time	138/269 (51.3) vs 266/582 (45.7)	1.12 (0.82–1.53)	0.467	1.09 (0.83–1.43)
Difficult interface or usability	68/141 (48.2) vs 336/710 (47.3)	1.09 (0.74–1.60)	0.675	1.02 (0.73–1.43)
Prefers traditional methods	59/124 (47.6) vs 345/727 (47.5)	0.79 (0.53–1.20)	0.270	0.87 (0.60–1.25)
Institution				
JSS Medical College	211/388 (54.4)	1 (reference)		1 (reference)
Dr. Moopen's Medical College	123/302 (40.7)	0.62 (0.45–0.86)	0.004	0.61 (0.46–0.81)
Mount Zion Medical College	55/134 (41.0)	0.69 (0.45–1.07)	0.096	0.64 (0.44–0.94)
Other institutions or not stated[f]	15/27 (55.6)	0.92 (0.40–2.13)	0.845	0.80 (0.38–1.69)

For challenges, high interest is shown among students who reported the challenge vs those who did not.

[d] Multivariable binary logistic regression including all variables in the table; complete cases (nine respondents with an ambiguous answer on prior exposure excluded).

[e] Proportional-odds ordinal logistic regression on the full 1–5 interest scale with the same covariates (sensitivity analysis).

[f] Arundathi Institute of Medical Sciences (n = 15), Saveetha Medical College (n = 9) and institution not stated (n = 3) combined.

CI confidence interval, OR odds ratio

The ordinal model gave consistent results for confidence (OR 1.49), engagement (OR 1.48), lack of internet access (OR 0.75) and institution. In this model, lack of motivation was also inversely associated with interest (OR 0.72, 0.55–0.94). The association with prior exposure was weaker and not statistically significant (OR 0.78, 0.60–1.01). Odds ratios for confidence differed across cut-points of the outcome: 0.88 for ≥ 2, 1.21 for ≥ 3 and 1.51 for ≥ 4. This indicates that confidence distinguished highly interested students from the rest more than it distinguished low from moderate interest. Restricting the binary model to Phase 3 Part 1 students (n = 692) gave similar estimates: confidence aOR 1.40 (1.13–1.72), engagement 1.52 (1.25–1.85), lack of internet access 0.54 (0.38–0.77) and prior exposure 0.68 (0.49–0.94).

Students' views on digital cases

Most students answered the questions on desired cases (791; 92.0%) and on what makes a digital case useful (756; 87.9%). Fewer offered substantive suggestions (368; 42.8%) (Table 5).

The cases students most wanted were communicable and infectious diseases (25.8% of substantive responses), real-life and common community problems (16.3%), outbreak and epidemic investigation (14.5%) and maternal and child health, including immunisation (10.4%). Non-communicable and lifestyle diseases (7.3%), epidemiology and screening (6.4%), national health programmes (6.1%) and nutrition (4.0%) were mentioned less often. A smaller group asked for rare cases or cases they would not otherwise encounter (3.5%).

Students said a digital case was interesting and useful when it was realistic and relevant to real life (21.3%), interactive (19.8%), easy to understand and remember (17.9%), visual or multimedia-rich (15.9%), accessible at any time and at their own pace (13.8%) and required them to apply theory and make decisions (13.4%). One student described the ideal case as one that "feels like a real life public health situation where u must make a decision" (P2-462). A few students were sceptical of digital formats or preferred traditional teaching (0.5%).

Suggestions centred on more interactivity (24.7%); videos, images and animations (21.7%); more, and more varied, case scenarios (19.6%); real-life, local and current cases (18.2%); quizzes, multiple-choice questions and game elements (17.4%); and faculty facilitation, discussion and feedback (13.6%). Some students asked that digital cases be blended with field visits and clinical postings (5.7%) or that traditional methods be retained alongside them (2.2%).

Table 5
Content analysis of free-text responses

Category	n (%)[g]	Illustrative response (respondent ID)
A. Cases students would like to see in digital format (substantive responses, n = 791)		
Communicable/infectious diseases	204 (25.8)	
Real-life / common community cases	129 (16.3)	
Outbreak/epidemic investigation	115 (14.5)	
Maternal & child health / immunisation	82 (10.4)	
Any / all types (non-specific)	68 (8.6)	
Non-communicable/lifestyle diseases	58 (7.3)	
Public health problems & prevention (general)	51 (6.4)	
Epidemiology, screening & biostatistics	51 (6.4)	
National health programmes & policy	48 (6.1)	
Nutrition	32 (4.0)	
Rare or unusual cases	28 (3.5)	
B. What makes a digital Community Medicine case interesting and useful (substantive responses, n = 756)		
Realism and real-life relevance	161 (21.3)	“When it feels like a real life public health situation where u must make a decision” (P2-462)
Interactivity	150 (19.8)	“Making the session interactive by making the students capable of diagnosing the case by themselves.” (P2-583)
Ease of understanding and retention	135 (17.9)	“It is more interesting and holds the attention longer than traditional classes” (P2-484)

Category	n (%)[g]	Illustrative response (respondent ID)
A. Cases students would like to see in digital format (substantive responses, n = 791)		
Visuals and multimedia	120 (15.9)	“More engaging and videos help understand better” (P2-050)
Accessibility, flexibility and self-pacing	104 (13.8)	“easy access to the cases anytime” (P2-057)
Application of theory and clinical reasoning	101 (13.4)	“When we learn something and are immediately able to apply it” (P2-271)
Clarity, structure and brevity	43 (5.7)	
Quizzes, questions and feedback	36 (4.8)	“interactive, realistic, and provides clear explanations with immediate feedback” (P2-809)
Discussion and facilitation	34 (4.5)	
Exposure to rare or unseen cases	21 (2.8)	“It is able to show us cases that are rare and we can dissect it further.” (P2-265)
Sceptical of digital / prefers traditional	4 (0.5)	
C. Suggestions for making digital learning more effective (substantive responses, n = 368)		
More interactivity	91 (24.7)	“Use short videos, quizzes, and simple interactive tools” (P2-090)
Videos, images and animations	80 (21.7)	“Animated videos should be included. / Shorter length videos.” (P2-878)
More, and more varied, case scenarios	72 (19.6)	
Real-life, local and practical cases	67 (18.2)	“Tie lessons to current public health issues or outbreaks” (P2-079)
Quizzes, MCQs and gamification	64 (17.4)	“Online Quiz formats that have previously been implemented in classes (like Kahoot) to help recap what has been learned” (P2-465)
Faculty facilitation and discussion	50 (13.6)	“Provide personalized feedback after each case and include references for further reading.” (P2-899)
Usability, interface and internet access	34 (9.2)	“Include more real life cases, short videos and mobile - friendly content” (P2-876)

Category	n (%)[g]	Illustrative response (respondent ID)
A. Cases students would like to see in digital format (substantive responses, n = 791)		
Short, concise content (microlearning)	30 (8.2)	
Simulation, virtual patients and branching cases	23 (6.2)	“short quizzes, outbreak investigation simulations, and data interpretation tasks” (P2-397)
Blend with field visits and clinical postings	21 (5.7)	“field visit, involving medical students in medical camps to get more exposure” (P2-641)
Keep traditional methods alongside digital	8 (2.2)	“Both digital and traditional should go hand in hand” (P2-150)

[g] Percentage of substantive responses to each question; a response could be coded to more than one category. Categories mentioned in fewer than 4% of responses are shown only where discussed in the text. Quotations are verbatim; “/” marks a line break in the original.

Discussion

This multi-institutional needs assessment of 860 undergraduate students gives a measured picture of readiness for DCBL in Community Medicine. Self-rated confidence in applying clinical reasoning to public-health problems was modest. Students preferred active, authentic methods (field visits, case-based and problem-based learning) over lectures. Almost all had a mobile device, but a third faced connectivity problems and a third reported lack of motivation. Interest in DCBL was moderate: under half were highly interested and two in five chose the midpoint. High interest followed students’ engagement and confidence, was lower where internet access was a problem, and was not higher among students who had already used digital cases.

Clinical-reasoning confidence and preferred ways of learning

Over half of the students placed themselves at the midpoint of the confidence scale, and fewer than three in ten rated their confidence as high. Self-ratings are an imperfect guide to actual competence [21]. Even so, the finding is consistent with the long-recognised difficulty of transferring Community Medicine theory into reasoning about real families and communities [11, 12]. The preference for clinical postings, field visits and case-based learning shows that students value learning anchored in real problems. They do not reject the subject itself. Digital cases should therefore extend field teaching rather than replace it, as some students explicitly asked. A digital case can prepare students for a field visit, let them rehearse decisions they rarely get to make in the field, and structure reflection afterwards.

A moderate and conditional interest

Interest in DCBL was moderate. The large group choosing the midpoint suggests that many students had no clear picture of what a well-designed digital case would offer. Their judgement may instead have been shaped by generic online content. Two findings support this interpretation. First, interest was associated with engagement and confidence. Students already engaged with Community Medicine, and more confident in it, were more interested in a new way of learning it. This creates a real risk that DCBL will mainly benefit students who are already doing well. The engagement and confidence findings, together with lack of motivation as the most common barrier, suggest that modules should be designed to reach disengaged learners. Short cases, early success, immediate feedback and explicit links to examinations and field work may help.

Second, students who had previously learned with digital cases were somewhat less likely to report high interest. This association was modest, was significant only in the binary model, and should be interpreted cautiously. A plausible explanation is that students' previous "digital cases" were static presentations or text documents rather than interactive, decision-based cases, and that this experience tempered their expectations. Our exposure item did not capture the quality or format of previous experience. For module developers, the implication is that the format alone will not create interest. The quality of the case, and the reasoning it demands, are likely to matter more. Our earlier single-session evaluation of rule-based digital cases points the same way: usability was acceptable, but the overall change in reasoning scores was small [18]. The literature on virtual patients similarly emphasises design features such as branching decisions, feedback and integration into the curriculum, rather than digitisation as such [5, 6].

Connectivity and institutional context

Lack of internet access was the barrier most consistently associated with lower interest. It affected half of the respondents at one college. This echoes Indian experience of online teaching during the COVID-19 pandemic [15, 16]. It means that DCBL modules should work on low-bandwidth connections and on mobile devices, preferably with offline access. Colleges should not assume that institutional Wi-Fi or student data plans are adequate. The predominance of tablets among respondents at some colleges suggests that institutional device provision may already be in place and could be used for DCBL. Interest also varied between institutions after adjustment. This points to local factors that our data could not measure, such as teaching culture, previous exposure to well-designed cases and infrastructure. It argues for a short local readiness check before modules are introduced at a new site.

Implications for the design of digital Community Medicine cases

Students' free-text responses translate readily into design requirements. They asked for cases that feel real and require decisions, are interactive and visual, are short, can be accessed at any time, and include quizzes and feedback, with faculty facilitation and discussion. These features match those associated

with effective case-based and virtual-patient learning [3, 6, 7]. The topics they asked for are core Community Medicine competencies: communicable diseases, outbreak investigation, and maternal and child health including immunisation [1]. Outbreak investigation stands out as a topic that students rarely experience directly but that lends itself to a staged, branching digital case. Students also asked for local and current cases, which supports building cases around Indian national health programmes and the epidemiology of the students' own region rather than adapting generic international material. Mobile learning evidence supports delivering such cases on the devices students already use [8, 9].

Strengths and limitations

The strengths of this study are its size, its inclusion of five colleges in four states, the combination of rated and open-ended items, and the transparent handling of duplicates, exclusions and modelling choices. There are several limitations. Sampling was non-probabilistic and the number of students who received the link is not known, so a response rate cannot be calculated and responders may differ from non-responders. All measures were single self-reported items from a questionnaire developed for this project, whose validity was not formally tested in this study. The confidence item combined "confident" and "useful" in its wording, which may have been interpreted in different ways. Year of study was confounded with institution, so we could not separate their effects. Responses received before the college item was added were assigned to JSS Medical College on the basis of where data collection was then taking place. Most respondents were in MBBS Phase 3 Part 1, and two colleges contributed few responses, which limits comparisons across years and sites. The free-text analysis was descriptive; categories were derived inductively and applied with keyword support, without independent double coding. Finally, the cross-sectional design does not allow causal interpretation of the associations observed.

Conclusions

Undergraduate students in this multi-institutional sample reported modest confidence in applying clinical reasoning to public-health problems. They preferred active, authentic ways of learning, and their interest in DCBL was moderate rather than enthusiastic. Interest was greater among more engaged and more confident students, and lower where internet access was a problem. Community Medicine departments developing DCBL should build realistic, decision-focused, interactive cases on core community problems. These should be delivered in mobile-friendly, low-bandwidth formats, linked to field and classroom teaching, and designed deliberately to engage less motivated and less confident students. Evaluation of such modules should measure reasoning outcomes, not only acceptability.

Abbreviations

aOR
adjusted odds ratio
CBL

case-based learning
CBME
competency-based medical education
CHERRIES
Checklist for Reporting Results of Internet E-Surveys
CI
confidence interval
DCBL
digital case-based learning
FAIMER
Foundation for Advancement of International Medical Education and Research
IQR
interquartile range
MBBS
Bachelor of Medicine and Bachelor of Surgery
NMC
National Medical Commission
OR
odds ratio
SD
standard deviation

Declarations

Ethics approval and consent to participate

The study was approved by the Institutional Ethics Committee of JSS Medical College, Mysuru (JSSMC/IEC/972025/01 NCT/2024-25, dated 10 July 2025) and was conducted in accordance with the Declaration of Helsinki. The approval covered all participating colleges. Informed consent was obtained from all participants electronically, on the first page of the online form, before any questions were shown.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

S.K.D. conceived and designed the study, developed the questionnaire, coordinated data collection, analysed the data and drafted the manuscript. S.D. supervised the study as the FAIMER project guide and critically revised the manuscript for important intellectual content. A.M. coordinated data collection at Dr. Moopen's Medical College and critically revised the manuscript. R.M. coordinated data collection at Saveetha Medical College and Mount Zion Medical College and critically revised the manuscript. G.H.P. curated and analysed the data and critically revised the manuscript. All authors read and approved the final manuscript.

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Data Availability

The de-identified dataset analysed during the current study is available from the corresponding author on reasonable request.

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Figures

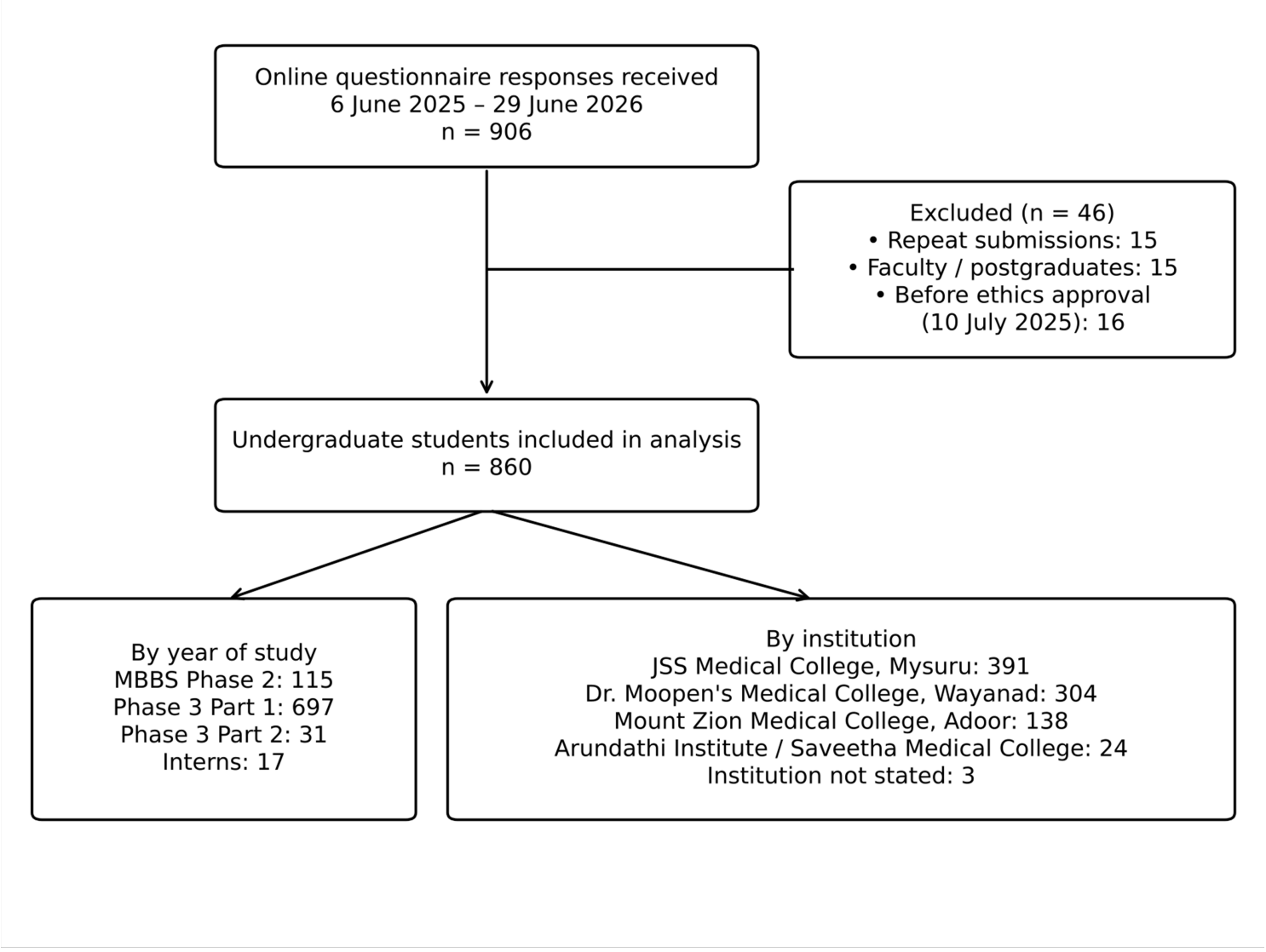


Figure 1

Flow of survey responses and composition of the analysed sample

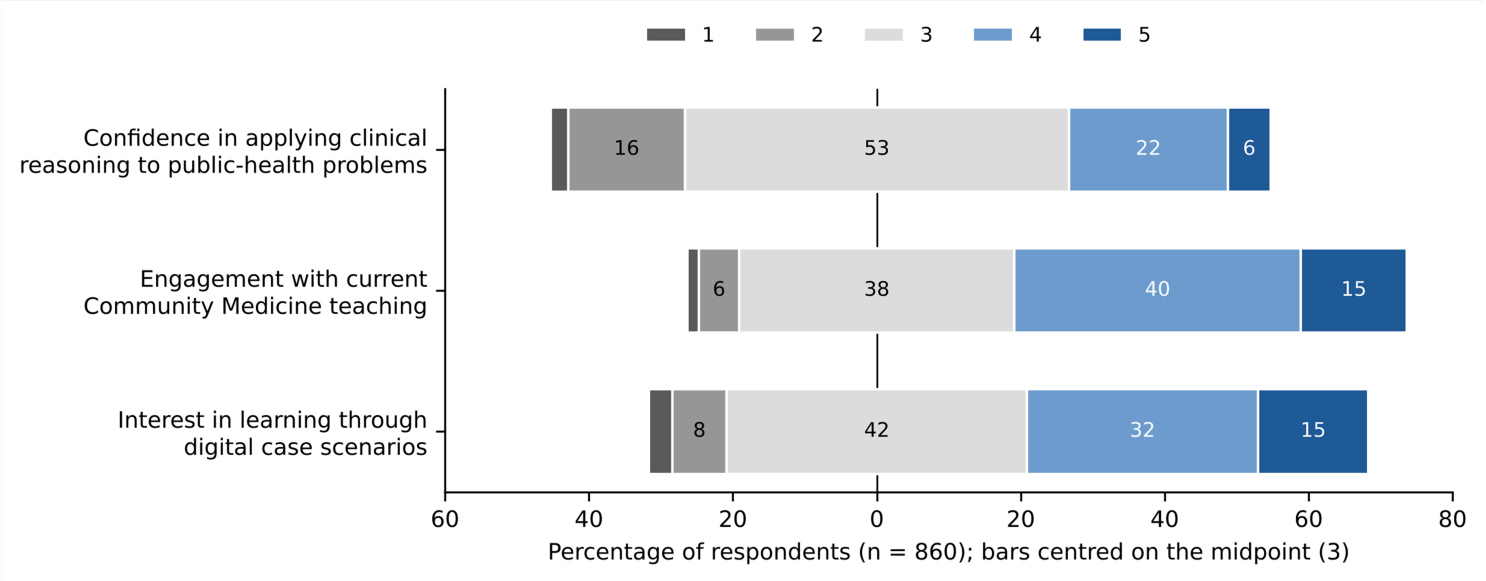


Figure 2

Distribution of responses to the three 5-point rating items (n = 860). Bars are centred on the midpoint (3); numbers inside bars are percentages

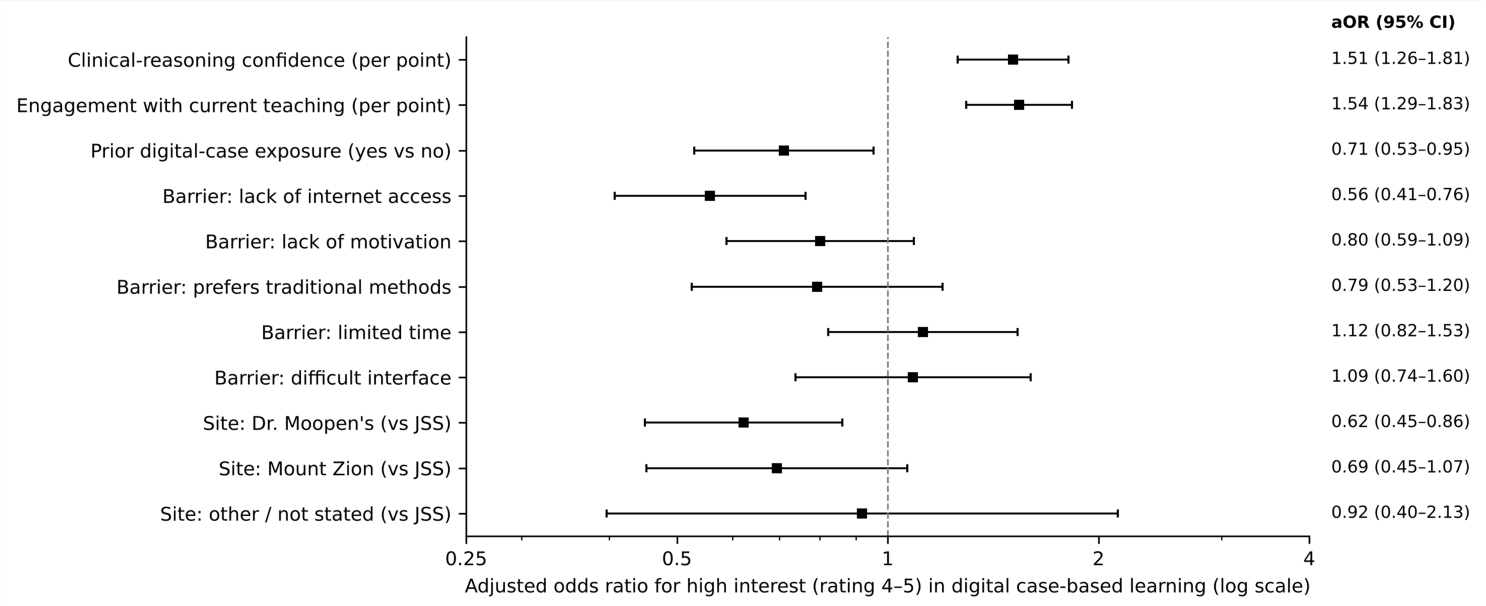


Figure 3

Adjusted odds ratios for high interest (rating 4–5) in digital case-based learning (multivariable logistic regression, n = 851). Horizontal lines show 95% confidence intervals; the x-axis is on a log scale

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Additionalfile1Questionnaire1.docx
- CHERRIESChecklist.docx