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Organizational Barriers to Early Practical Training Among Undergraduate Medical and Health Sciences Students in Yemen

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Abstract

Background

Early practical training plays a key role in medical and health sciences education; however, students in low-resource and conflict-affected environments may encounter organizational barriers that hinder their access and successful integration into such training. The study aimed to assess the barriers of early practical training among undergraduate medical and health science students at the University of Science and Technology, Aden, Yemen.

Methods

A cross-sectional analytical study was carried out among 203 undergraduate students. The data collected included the students' sociodemographic and academic characteristics and their perceptions about the early practical training. The data were gathered using a structured self-administered questionnaire. Descriptive statistics and chi-square tests were performed to uncover the relationships between perceived barriers and students' attributes.

Results

Most participants were female (72.9%) and 20–25 years old (76.4%). The barriers students identified included the lack of clear information about the process of applying for practical training opportunities (85.7%), obstacles to readiness for the labor market (74.9%), regulations hindering early training (70.0%), inadequacy of the preparedness of medical institutions (68.0%), and difficulties with communication with medical institutions (65.0%). Most students recognized the benefits of early practical training, including the development of skills (95.1%) and self-confidence (95.1%). The significant association was found between the academic department and the absence of clear information about the process of applying for practical training opportunities ($p = 0.033$) and between the age group and the assessment of medical institutions' readiness ($p = 0.015$).

Conclusion

Organizational barriers to early practical training remain substantial, particularly regarding access to information, institutional preparedness, regulations, and communication with healthcare institutions. Strengthening university–healthcare institution partnerships, clarifying training procedures, and increasing institutional support may improve access to equitable and effective early practical training opportunities.

Introduction

Globally, medical education has increasingly shifted from traditional, fragmented preclinical teaching toward integrated curricula that emphasize early clinical and field-based experiences (1-3). early practical training (ECE) is grounded in experiential learning theory, including Kolb's model, which emphasizes learning through experience, reflection, conceptualization, and experimentation (4,5). Providing students with opportunities to engage with real or simulated clinical and field-based environments at an early stage can help bridge the gap between theoretical knowledge and clinical practice (6). Such experiences may contribute to the development of clinical reasoning, motivation, professional identity, communication skills, empathy, and an understanding of patient-centered care and social determinants of health (7,8).

Despite evidence supporting the contribution of early clinical and field-based education to competence, self-efficacy, and the application of theoretical knowledge, its implementation can be challenging in low- and middle-income countries (LMICs) (9,10). Compared with well-resourced settings, maintaining consistent access to appropriate clinical and field-based learning opportunities may be more difficult because of limited teaching resources, inadequate faculty supervision, curriculum overload, heavy clinical workloads, and insufficient institutional coordination (11-13). These challenges may restrict students' opportunities to translate classroom-based learning into practical experience.

At the institutional level, early practical training may also be limited by inadequate infrastructure, insufficient funding, ineffective organizational policies, and a shortage of trained supervisors and mentors (14,15). Curriculum-related constraints, such as the lack of integration between theory and practice and the needs of the health care system and communities, may also limit opportunities for experiential learning (16). In addition, shortages of suitable teaching hospitals, clinical spaces, and diagnostic resources can constrain the availability and quality of practical learning experiences (17). Thus, barriers to early practical training are likely to reflect not only individual-level challenges but also broader organizational and structural constraints within educational and healthcare systems.

These challenges may be particularly pronounced in conflict-affected and resource-constrained settings such as Yemen, where prolonged conflict and economic instability have placed substantial pressure on both healthcare and educational systems (18). Disruptions to healthcare services, limitations in educational infrastructure, and shortages of trained academic and clinical personnel may reduce the availability of appropriate environments for practical and field-based learning (17,18). Such constraints may affect the ability of medical and health sciences institutions to provide students with structured, supervised, and accessible early training opportunities. However, despite the growing international literature on early clinical and field-based education, there is limited empirical evidence examining the organizational and institutional barriers to early practical training among medical and health sciences students in Yemen, particularly in conflict-affected settings such as Aden.

Addressing this evidence gap is important for strengthening the quality of health professions education and supporting the development of a competent healthcare workforce in vulnerable health systems. Understanding students' perceptions of organizational and structural barriers can help educational

institutions identify modifiable constraints, improve coordination with healthcare facilities, optimize the use of limited training resources, and develop practical approaches to expanding equitable access to early field-based learning opportunities (19). Therefore, this study aimed to assess perceived organizational barriers to early practical training among undergraduate medical and health sciences students at the University of Science and Technology, Aden, Yemen.

Methodology

Study Design

This study employed an analytical cross-sectional survey design to assess perceived organizational barriers to early practical training among undergraduate medical and health sciences students. The cross-sectional design was used to examine the distribution of perceived barriers and their associations with selected sociodemographic and academic characteristics at a single point in time.

Study setting and duration

The study was conducted at the University of Science and Technology, Aden, Yemen. The university is a higher education institution operating in a low-resource and conflict-affected setting and includes several programs within the medical and health sciences. The study was conducted over a three-month period from November 2024 to January 2025. This period included the preparation and ethical approval of the study protocol, pilot testing of the questionnaire, participant recruitment, data collection, and data analysis.

Study population

The study population comprised undergraduate students enrolled in medical and health sciences programs at the University of Science and Technology, Aden, including students from Medicine, Pharmacy, and other health-related programs. Students from all eligible academic levels were considered for participation, including students in internships where applicable.

Sample Size

The required sample size was calculated using Cochran's formula for cross-sectional studies:

$n = Z^2 p (1-p) / e^2$

where *n* represents the required sample size, *Z* is the standard normal deviate corresponding to a 95% confidence level (1.96), *p* is the assumed prevalence of perceived barriers (0.50), and *e* is the margin of error (0.07). The use of *p* = 0.50 was based on the absence of a reliable local estimate and provides the maximum required sample size under this formula.)

The calculated minimum sample size was 196 participants. To account for potential non-response and incomplete questionnaires, recruitment was continued beyond the minimum calculated sample size, resulting in 203 participants with complete and eligible responses included in the final analysis.

Sampling and Participant Recruitment

A stratified random sampling technique was employed to recruit undergraduate students enrolled in the medical and health sciences programs at the University of Science and Technology, Aden. The eligible student population was first divided into strata according to academic department, namely Pharmacy, Medicine, and other medical and health sciences departments. The number of participants selected from each stratum was determined proportionally to the size of the corresponding department to ensure adequate representation of students from different academic disciplines.

Within each stratum, eligible students were selected using a random sampling procedure from the available student lists. Selected students were approached face-to-face at the university and invited to participate in the study. The study objectives, procedures, voluntary nature of participation, and confidentiality of the collected information were explained to all eligible students. Written informed consent was obtained before administration of the questionnaire.

Participants were eligible if they were undergraduate students enrolled in the selected medical and health sciences programs during the study period. Questionnaires with incomplete or unreliable responses were excluded from the final analysis.

Inclusion and Exclusion Criteria

The inclusion criteria comprised undergraduate students enrolled at the University of Science and Technology, Aden, in Medicine, Pharmacy, or other medical and health sciences programs. Students from eligible academic levels, including interns where applicable, were eligible to participate. Only students who voluntarily consented to participate were included.

The exclusion criteria comprised postgraduate students, students enrolled in non-medical programs such as engineering or business, participants who declined participation, and questionnaires that were incomplete or considered unreliable for analysis.

Study Instruments

Data were collected using a structured, self-administered questionnaire adapted from previously published instruments addressing barriers to medical education, research engagement, and practical or field-based training (21,22). The questionnaire was reviewed and adapted to reflect the local educational context and the objectives of the present study.

The study used a questionnaire consisting of three parts. The first part collected sociodemographic information, including participants' age, sex, place of residence, marital status, economic status, and

employment status. The second part collected academic characteristics, such as the students' academic departments and levels. The final section comprised ten questions (Q1-Q10) regarding perceived organizational barriers to early practical training. The ten questions addressed the following: the availability of training opportunities, communication with medical facilities, application procedure, regulations, institutional preparedness, and administrative support. Each item was measured using a five-point Likert scale (from 1 strongly disagree to 5 strongly agree).

The questionnaire was administered in Arabic; the original instrument was translated and adapted culturally prior to administration. Prior to the main data collection, the questionnaire was pilot tested among a group of undergraduate students who met the study's inclusion criteria but were excluded from the final analytical sample. Pilot testing evaluated the clarity and simplicity of the items as well as their general appropriateness and relevance. The results of the pilot testing were used to inform the necessary changes to the questionnaire, which were implemented before the main data collection commenced.

Definition and Measurement of Perceived Barriers

The identification of perceived barriers and influential factors related to early practical training was done using 10 statements. Each of the statements was evaluated using a five-point Likert scale. The statements were scored as Strongly Agree, Agree, Neutral, Disagree, and Strongly Disagree and were grouped into organizational, institutional, regulatory, informational, and training-related barriers.

The items were analyzed individually according to their contents. The statements indicating specific problems or obstacles in getting or using early practical training were regarded as barriers. For these items, agreement (Strongly Agree or Agree) was considered as a barrier, while disagreement (Neutral, Disagree, or Strongly Disagree) was considered the absence of a barrier.

Statements addressing the perceived benefits of early practical training, institutional support, or potential solutions were considered supportive or facilitating factors and were analyzed separately. For each item, frequencies and percentages were calculated for all five response categories. The proportion of students reporting agreement with each barrier statement was used to describe the relative prominence of the perceived barriers.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics software (version 25). Categorical variables were summarized using frequencies and percentages. Responses to the 10 perceived barrier and supportive/facilitating factor items were presented as frequencies and percentages for each Likert-scale response category.

For bivariate analysis, associations between participants' sociodemographic and academic characteristics and individual perceived barrier items were assessed using the Pearson chi-square test. When expected cell frequencies were small and the assumptions of the chi-square test were not met,

Fisher’s exact test or an appropriate exact test was used. All statistical tests were two-sided, and a *p*-value of <0.05 was considered statistically significant.

Results

The study included 203 students, predominantly aged 20–25 years (76.4%), female (72.9%), urban residents (90.1%), and single (86.7%). Most reported a medium economic level (78.8%) and were unemployed (83.3%). Pharmacy and other departments represented the largest academic groups, while third-year students (30.5%) were the most common Table 1.

Table 1
Sociodemographic and Academic Characteristics of the Study Participants (N = 203)

Variable	Category	Frequency (n)	Percentage (%)
Age Category	< 20	19	9.4
	20–25	155	76.4
	> 25	29	14.3
Gender	Male	55	27.1
	Female	148	72.9
Residence	City	183	90.1
	Village	20	9.9
Marital Status	Single	176	86.7
	Married	27	13.3
Economic Level	Low	31	15.3
	Medium	160	78.8
	High	12	5.9
Employment	Unemployed	169	83.3
	Employed	34	16.7
Academic Department	Pharmacy	74	36.5
	Medicine	54	26.6
	Other	75	36.9
Level of Study	First	11	5.4
	Second	40	19.7
	Third	62	30.5
	Fourth	57	28.1
	Fifth	12	5.9
	Sixth	1	0.5
	Others	20	9.9

The Table 2 indicate that lack of clear information on how to apply for practical training was the most commonly perceived barrier (85.7%), followed by obstacles affecting students' readiness for employment after graduation (74.9%). Additionally, 70.0% perceived current laws and regulations as

barriers, while 68.0% reported inadequate preparedness of nearby medical institutions for early-stage training. Difficulties communicating with medical institutions were reported by 65.0% of students.

Table 2
Perceived Organizational Barriers to Early Practical Training Among Undergraduate Students (N = 203)

Perceived organizational barrier	Strongly agree, n (%)	Agree, n (%)	Neutral, n (%)	Disagree, n (%)	Strongly disagree, n (%)	Agree/Strongly agree, n (%)
Difficulties in communicating with medical institutions to secure training opportunities	46 (22.7)	86 (42.4)	45 (22.2)	21 (10.3)	5 (2.5)	**132 (65.0)**
Current laws and regulations hinder students from obtaining early training opportunities	65 (32.0)	77 (37.9)	37 (18.2)	18 (8.9)	6 (3.0)	**142 (70.0)**
Lack of clear information on how to apply for practical training affects students' opportunities	86 (42.4)	88 (43.3)	13 (6.4)	12 (5.9)	4 (2.0)	**174 (85.7)**
Obstacles faced by students reduce their readiness to enter the labor market after graduation	71 (35.0)	81 (39.9)	26 (12.8)	17 (8.4)	8 (3.9)	**152 (74.9)**
Medical institutions in the students' area are not prepared to train students in the early stages	63 (31.0)	75 (36.9)	39 (19.2)	20 (9.9)	6 (3.0)	**138 (68.0)**

Note: *Agreement = Strongly agree + Agree.*

The Table 3 shows very high perceived benefits of early practical training. Most students agreed that it helps develop skills required for higher academic levels (95.1%) and enhances self-confidence (95.1%). Similarly, 94.6% considered institutional support essential, and 93.6% believed that feasible solutions could be implemented to facilitate early training. However, only 36.5% agreed that the current organizational environment provides sufficient practical training opportunities.

Table 3
Perceived Benefits and Institutional Facilitating Factors Related to Early Practical Training

Perceived benefit/facilitating factor	Strongly agree, n (%)	Agree, n (%)	Neutral, n (%)	Disagree, n (%)	Strongly disagree, n (%)	Agree/Strongly agree, n (%)
Early practical training helps develop the skills required for higher academic levels	152 (74.9)	41 (20.2)	9 (4.4)	0 (0.0)	1 (0.5)	**193 (95.1)**
Early training enhances self-confidence among students in medical fields	136 (67.0)	57 (28.1)	3 (1.5)	5 (2.5)	2 (1.0)	**193 (95.1)**
Support from the college and administration is essential to facilitate summer training opportunities before the advanced stage	133 (65.5)	59 (29.1)	5 (2.5)	3 (1.5)	3 (1.5)	**192 (94.6)**
Feasible solutions can be implemented to facilitate summer training opportunities before the advanced stage	115 (56.7)	75 (36.9)	9 (4.4)	1 (0.5)	3 (1.5)	**190 (93.6)**
The organizational environment within the college or university provides sufficient practical training opportunities before the advanced stage	12 (5.9)	62 (30.5)	55 (27.1)	45 (22.2)	29 (14.3)	**74 (36.5)**

Table 4 Most perceived barriers were not significantly associated with student characteristics. A significant association was observed between academic department and lack of clear information on how to apply for practical training ($p = 0.033$), with the highest prevalence among students from other departments (93.3%). Age group was significantly associated with perceived lack of preparedness of medical institutions ($p = 0.015$), with the highest prevalence among students aged < 20 years (73.7%) and the lowest among those > 25 years (44.8%). No other statistically significant associations were observed ($p > 0.05$).

Table 4
Association Between Student Characteristics and Perceived Organizational Barriers to Early Practical Training Among Undergraduate Students (N = 203)

Student characteristic	Category	Barrier, n (%)	No barrier, n (%)	p-value
Panel A. Lack of clear information on how to apply for practical training affects students' opportunities				
Age group (years)	< 20	17 (89.5)	2 (10.5)	1.000*
	20–25	132 (85.2)	23 (14.8)	
	> 25	25 (86.2)	4 (13.8)	
Gender	Male	48 (87.3)	7 (12.7)	0.699
	Female	126 (85.1)	22 (14.9)	
Residence	City	158 (86.3)	25 (13.7)	0.498*
	Village	16 (80.0)	4 (20.0)	
Marital status	Single	153 (86.9)	23 (13.1)	0.236*
	Married	21 (77.8)	6 (22.2)	
Economic status	Medium	137 (85.6)	23 (14.4)	0.865*
	Low	26 (83.9)	5 (16.1)	
	High	11 (91.7)	1 (8.3)	
Employment status	Unemployed	148 (87.6)	21 (12.4)	0.108*
	Employed	26 (76.5)	8 (23.5)	
Academic department	Pharmacy	58 (78.4)	16 (21.6)	**0.033**
	Medicine	46 (85.2)	8 (14.8)	
	Other	70 (93.3)	5 (6.7)	
Year of study	First	9 (81.8)	2 (18.2)	0.950*
	Second	35 (87.5)	5 (12.5)	
	Third	53 (85.5)	9 (14.5)	
	Fourth	49 (86.0)	8 (14.0)	
	Fifth	11 (91.7)	1 (8.3)	

Note: Values are presented as n (%). "Barrier" was defined as Strongly agree or Agree, whereas "No barrier" included Neutral, Disagree, or Strongly disagree. Percentages are calculated within each student-characteristic category. We used Pearson's chi-square test when expected cell frequencies were adequate; * Fisher's exact test when expected cell frequencies were sparse. We considered $p < 0.05$ statistically significant.

Student characteristic	Category	Barrier, n (%)	No barrier, n (%)	p-value
	Sixth	1 (100.0)	0 (0.0)	
	Others	16 (80.0)	4 (20.0)	
Panel B. The obstacles I face reduce my readiness to enter the labor market after graduation				
Age group (years)	< 20	14 (73.7)	5 (26.3)	0.697*
	20–25	118 (76.1)	37 (23.9)	
	> 25	20 (69.0)	9 (31.0)	
Gender	Male	45 (81.8)	10 (18.2)	0.165
	Female	107 (72.3)	41 (27.7)	
Residence	City	135 (73.8)	48 (26.2)	0.272
	Village	17 (85.0)	3 (15.0)	
Marital status	Single	134 (76.1)	42 (23.9)	0.291
	Married	18 (66.7)	9 (33.3)	
Economic status	Medium	117 (73.1)	43 (26.9)	0.460*
	Low	24 (77.4)	7 (22.6)	
	High	11 (91.7)	1 (8.3)	
Employment status	Unemployed	127 (75.1)	42 (24.9)	0.843
	Employed	25 (73.5)	9 (26.5)	
Academic department	Pharmacy	51 (68.9)	23 (31.1)	0.103
	Medicine	46 (85.2)	8 (14.8)	
	Other	55 (73.3)	20 (26.7)	
Year of study	First	8 (72.7)	3 (27.3)	0.683*
	Second	30 (75.0)	10 (25.0)	
	Third	50 (80.6)	12 (19.4)	
	Fourth	42 (73.7)	15 (26.3)	
	Fifth	9 (75.0)	3 (25.0)	

Note: Values are presented as n (%). “Barrier” was defined as Strongly agree or Agree, whereas “No barrier” included Neutral, Disagree, or Strongly disagree. Percentages are calculated within each student-characteristic category. We used Pearson’s chi-square test when expected cell frequencies were adequate; * Fisher’s exact test when expected cell frequencies were sparse. We considered $p < 0.05$ statistically significant.

Student characteristic	Category	Barrier, n (%)	No barrier, n (%)	p-value
	Sixth	1 (100.0)	0 (0.0)	
	Others	12 (60.0)	8 (40.0)	
Panel C. Current laws and regulations hinder students from obtaining early training opportunities				
Age group (years)	< 20	12 (63.2)	7 (36.8)	0.776
	20–25	110 (71.0)	45 (29.0)	
	> 25	20 (69.0)	9 (31.0)	
Gender	Male	38 (69.1)	17 (30.9)	0.871
	Female	104 (70.3)	44 (29.7)	
Residence	City	127 (69.4)	56 (30.6)	0.604
	Village	15 (75.0)	5 (25.0)	
Marital status	Single	123 (69.9)	53 (30.1)	0.959
	Married	19 (70.4)	8 (29.6)	
Economic status	Medium	111 (69.4)	49 (30.6)	0.841*
	Low	23 (74.2)	8 (25.8)	
	High	8 (66.7)	4 (33.3)	
Employment status	Unemployed	118 (69.8)	51 (30.2)	0.929
	Employed	24 (70.6)	10 (29.4)	
Academic department	Pharmacy	46 (62.2)	28 (37.8)	0.102
	Medicine	43 (79.6)	11 (20.4)	
	Other	53 (70.7)	22 (29.3)	
Year of study	First	6 (54.5)	5 (45.5)	0.657*
	Second	29 (72.5)	11 (27.5)	
	Third	45 (72.6)	17 (27.4)	
	Fourth	36 (63.2)	21 (36.8)	
	Fifth	9 (75.0)	3 (25.0)	

Note: Values are presented as n (%). “Barrier” was defined as Strongly agree or Agree, whereas “No barrier” included Neutral, Disagree, or Strongly disagree. Percentages are calculated within each student-characteristic category. We used Pearson’s chi-square test when expected cell frequencies were adequate; * Fisher’s exact test when expected cell frequencies were sparse. We considered $p < 0.05$ statistically significant.

Student characteristic	Category	Barrier, n (%)	No barrier, n (%)	p-value
	Sixth	1 (100.0)	0 (0.0)	
	Others	16 (80.0)	4 (20.0)	
Panel D. Medical institutions in my area are not prepared to train students in the early stages				
Age group (years)	< 20	14 (73.7)	5 (26.3)	**0.015**
	20–25	111 (71.6)	44 (28.4)	
	> 25	13 (44.8)	16 (55.2)	
Gender	Male	37 (67.3)	18 (32.7)	0.895
	Female	101 (68.2)	47 (31.8)	
Residence	City	123 (67.2)	60 (32.8)	0.479
	Village	15 (75.0)	5 (25.0)	
Marital status	Single	120 (68.2)	56 (31.8)	0.875
	Married	18 (66.7)	9 (33.3)	
Economic status	Medium	109 (68.1)	51 (31.9)	0.379*
	Low	19 (61.3)	12 (38.7)	
	High	10 (83.3)	2 (16.7)	
Employment status	Unemployed	116 (68.6)	53 (31.4)	0.654
	Employed	22 (64.7)	12 (35.3)	
Academic department	Pharmacy	44 (59.5)	30 (40.5)	0.054
	Medicine	43 (79.6)	11 (20.4)	
	Other	51 (68.0)	24 (32.0)	
Year of study	First	7 (63.6)	4 (36.4)	0.260*
	Second	30 (75.0)	10 (25.0)	
	Third	40 (64.5)	22 (35.5)	
	Fourth	42 (73.7)	15 (26.3)	
	Fifth	9 (75.0)	3 (25.0)	

Note: Values are presented as n (%). “Barrier” was defined as Strongly agree or Agree, whereas “No barrier” included Neutral, Disagree, or Strongly disagree. Percentages are calculated within each student-characteristic category. We used Pearson’s chi-square test when expected cell frequencies were adequate; * Fisher’s exact test when expected cell frequencies were sparse. We considered $p < 0.05$ statistically significant.

Student characteristic	Category	Barrier, n (%)	No barrier, n (%)	p-value
	Sixth	1 (100.0)	0 (0.0)	
	Others	9 (45.0)	11 (55.0)	
Panel E. Difficulties in communicating with medical institutions to secure training opportunities				
Age group (years)	< 20	12 (63.2)	7 (36.8)	0.913
	20–25	102 (65.8)	53 (34.2)	
	> 25	18 (62.1)	11 (37.9)	
Gender	Male	33 (60.0)	22 (40.0)	0.360
	Female	99 (66.9)	49 (33.1)	
Residence	City	119 (65.0)	64 (35.0)	0.998
	Village	13 (65.0)	7 (35.0)	
Marital status	Single	118 (67.0)	58 (33.0)	0.123
	Married	14 (51.9)	13 (48.1)	
Economic status	Medium	104 (65.0)	56 (35.0)	0.699*
	Low	19 (61.3)	12 (38.7)	
	High	9 (75.0)	3 (25.0)	
Employment status	Unemployed	110 (65.1)	59 (34.9)	0.966
	Employed	22 (64.7)	12 (35.3)	
Academic department	Pharmacy	41 (55.4)	33 (44.6)	0.073
	Medicine	40 (74.1)	14 (25.9)	
	Other	51 (68.0)	24 (32.0)	
Year of study	First	8 (72.7)	3 (27.3)	0.654*
	Second	24 (60.0)	16 (40.0)	
	Third	37 (59.7)	25 (40.3)	
	Fourth	42 (73.7)	15 (26.3)	
	Fifth	7 (58.3)	5 (41.7)	

Note: Values are presented as n (%). “Barrier” was defined as Strongly agree or Agree, whereas “No barrier” included Neutral, Disagree, or Strongly disagree. Percentages are calculated within each student-characteristic category. We used Pearson’s chi-square test when expected cell frequencies were adequate; * Fisher’s exact test when expected cell frequencies were sparse. We considered $p < 0.05$ statistically significant.

Student characteristic	Category	Barrier, n (%)	No barrier, n (%)	p-value
	Sixth	1 (100.0)	0 (0.0)	
	Others	13 (65.0)	7 (35.0)	

Note: Values are presented as n (%). “Barrier” was defined as Strongly agree or Agree, whereas “No barrier” included Neutral, Disagree, or Strongly disagree. Percentages are calculated within each student-characteristic category. We used Pearson’s chi-square test when expected cell frequencies were adequate; * Fisher’s exact test when expected cell frequencies were sparse. We considered $p < 0.05$ statistically significant.

Discussion

The present study identified substantial organisational barriers to early practical training among undergraduate medical and health sciences students at the University of Science and Technology, Aden, Yemen. At the same time, students strongly recognised the educational value of early practical exposure. Most participants agreed that early training helps develop skills required for higher academic levels (95.1%) and enhances self-confidence (95.1%). Similarly, 94.6% considered institutional support essential for facilitating training, and 93.6% believed that feasible solutions could be implemented. In contrast, only 36.5% agreed that the current organisational environment provides sufficient practical training opportunities. This contrast suggests that the challenge may lie less in students’ acceptance of early practical training and more in the organisational structures through which such experiences are provided.

Early practical exposure is consistent with educational approaches emphasising experiential learning and the integration of theoretical and clinical learning. Experiential learning allows students to learn through authentic practice-based experiences, while integrated and vertically integrated curricula aim to connect foundational knowledge with clinical contexts throughout medical education (1, 3, 5). Reviews of early practical training have similarly described potential benefits in professional development, communication, clinical reasoning, motivation, and understanding of the relevance of basic sciences to clinical practice (4). Evidence from a survey of medical schools in 30 European countries also indicates that early practical training is widely implemented, although more than half of responding schools reported barriers to implementing or expanding such programs (6). These findings provide a broader educational rationale for the strong student support for early practical training observed in the present study.

The most frequently perceived barrier was the lack of clear information on how to apply for practical training, reported by 85.7% of students. This finding points to an important administrative and coordination problem. Students may be uncertain about eligibility requirements, application procedures, available training sites, schedules, or responsible administrative contacts. Although the present study cannot establish the underlying causes of this perception, clearer and more standardized procedures could represent a feasible institutional intervention. A centralised training coordination system, designated coordinators, clearly communicated eligibility criteria, standardised application procedures,

and defined timelines may improve access to available opportunities. Such organisational mechanisms would also be consistent with the principles of integrated medical education, in which coordination across educational components and clinical settings is important for creating a coherent learning experience (1, 3).

Other frequently reported barriers included the perception that existing obstacles reduce readiness for the labour market (74.9%), that current laws and regulations hinder early training (70.0%), and that medical institutions are insufficiently prepared to train early-stage students (68.0%). Difficulties communicating with medical institutions were also reported by 65.0% of participants. These findings indicate that the barriers extend beyond students themselves and involve the relationship between universities and healthcare institutions. early practical training requires appropriate supervision, clear learning objectives, suitable learning activities, and coordination between academic and clinical environments (4, 5). In Ethiopia, students similarly identified weak linkages between academic and healthcare institutions and inadequate orientation regarding implementation as important barriers to early practical training, while the study also highlighted workload and institutional preparedness as challenges (23). In Qatar, students valued early practical training but reported unclear learning outcomes and limited faculty availability among important barriers to clinical learning (24). These findings support the interpretation that simply placing students in healthcare facilities may be insufficient unless the educational objectives, supervision, and institutional responsibilities are clearly established.

The regional evidence further suggests that these challenges are not unique to Yemen. In Qatar, early practical training was positively perceived by students, but implementation was accompanied by barriers related to learning objectives, faculty availability, and clinical learning (24). In Ethiopia, successful implementation was similarly linked to academic–healthcare institution relationships, staff preparation, curriculum integration, and clear educational objectives (23). Evidence from Yemen also demonstrates challenges in practical health-professions education. Among final-year pharmacy students from multiple Yemeni institutions, inadequate internship duration and limited access to patient medical records were among the major perceived barriers to pharmaceutical care provision (25). At a broader level, the experience of medical schools across 30 European countries indicates that even well-established educational systems encounter barriers when implementing or expanding early practical training (6). Therefore, the barriers observed in Aden may represent a combination of local organizational circumstances and broader challenges inherent in integrating early practical experiences into health-professions curricula.

The association analyses showed relatively limited variation according to student characteristics. Academic department was significantly associated with the perceived lack of clear information on how to apply for practical training ($p = 0.033$), with the highest proportion among students in the other departments group (93.3%), followed by medicine (85.2%) and pharmacy (78.4%). This finding should not be interpreted as evidence that one department generally experiences greater barriers. Differences in curriculum structure, departmental communication, or placement requirements may contribute to the observed variation, but these factors were not directly assessed. Age was also significantly associated

with perceived lack of preparedness of medical institutions (p = 0.015), with the highest proportion among students younger than 20 years (73.7%) and the lowest among those older than 25 years (44.8%). This association should be interpreted cautiously because previous clinical experience and other potentially relevant factors were not measured. No other statistically significant associations were observed across the examined student characteristics.

The high proportion of students who considered institutional support essential (94.6%) and believed that feasible solutions could be implemented (93.6%) has important implications for educational planning. Rather than requiring an entirely new educational model, improvement may begin with strengthening existing institutional coordination. Universities could establish formal partnerships with hospitals, clinics, laboratories, pharmacies, and other healthcare facilities; develop standardized placement procedures; and provide clear learning objectives appropriate for early-stage students. Such an approach would be consistent with the principles of vertical integration, whereby clinical relevance is introduced throughout the curriculum rather than being restricted to later stages of training (3). Evidence from early practical training programs also supports structured experiential learning rather than unstructured observation alone (4, 5).

Strengths and Limitations of Study

This study has several strengths, including the inclusion of students from multiple medical and health sciences departments and the use of stratified sampling by academic department. Another strength is that specific organizational barriers were examined individually rather than combining conceptually different statements into a single overall barrier score. However, several limitations should be considered. The cross-sectional design prevents causal inference, and the single-university setting limits generalizability to other institutions in Yemen. The questionnaire was adapted and culturally modified and pilot tested, but a validated multidimensional scale or internal consistency coefficient for the ten statements was not established; therefore, the analysis appropriately focused on individual items rather than an overall barrier score. Some subgroup categories were also relatively small, which may have limited the statistical power of certain comparisons. Finally, the study assessed students' perceptions without including the perspectives of academic administrators, healthcare institutions, or training supervisors.

Future research should use multicenter and mixed-methods approaches to explore the organizational processes underlying these barriers. Interviews with students, academic coordinators, and healthcare institutions could clarify why application procedures are perceived as unclear, which regulatory requirements create difficulties, and what factors determine the preparedness of training sites. Intervention studies could subsequently evaluate whether centralized placement coordination, formal university–healthcare partnerships, standardized application procedures, and structured learning objectives improve access to and quality of early practical training.

Overall, students strongly valued early practical training but perceived substantial organizational barriers to accessing it. The most prominent concerns involved unclear application procedures, perceived effects on employment readiness, regulatory barriers, training-site preparedness, and communication with healthcare institutions. The findings support strengthening institutional coordination, clarifying training pathways, and establishing structured partnerships between educational and healthcare institutions to facilitate meaningful early practical exposure in the Yemeni context.

Conclusion

This study identified important organizational barriers to early practical training, particularly unclear application procedures, regulatory constraints, limited institutional preparedness, and communication difficulties with healthcare institutions. Despite these barriers, students strongly recognized the benefits of early practical training and the importance of institutional support. Strengthening university–healthcare institution partnerships, improving access to information, and establishing clear and standardized training procedures may help provide more equitable and effective practical learning opportunities for undergraduate medical and health sciences students in Yemen.

Declarations

Ethical Considerations

The protocol of the study was reviewed and accepted by the Ethics Committee of the University of Science and Technology, Aden, Yemen, number (MEC /AD0151). The study was conducted in accordance with the principles of the Declaration of Helsinki. All the participants were informed of participation either in writing or electronically. Participants were clearly informed of their right to withdraw from the study at any time without any academic or personal consequences.

Consent for publication

Not applicable.

Availability of data and materials

All data generated during this study are included in this manuscript. Additional information can be made available upon reasonable request.

Conflict of interest

The authors declared no conflicts of interest.

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Authors' Contributions

F.M.S.M contributed to the study's conceptualisation and supervision. R.R.S.A contributed to the methodology design. R.R.M.S. was responsible for data collection. O.F.M.N. contributed to data analysis and interpretation of results. H.A.A.M. contributed to manuscript writing. All authors contributed to the study design, participated in the research process, reviewed the final manuscript, and approved it for publication.

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In writing this manuscript, the authors used Grammarly to assist with language editing, proofreading, and improving the clarity of the text. These tools were not used in the study design, data analysis, or interpretation of results. The authors carefully reviewed, verified, and approved all content and take full responsibility for the final manuscript.

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