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Original Research Article

Effectiveness of using medical health records as an educational tool in teaching integrated laboratory medicine in phase-II MBBS students

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ABSTRACT

Background: Undergraduate medical students develop technical proficiency in laboratory medicine but frequently lack understanding of clinical significance. This knowledge gap impairs their integrated approach to data interpretation and makes analytical exercises challenging, highlighting the need for improved teaching methodologies.
Methods: A comparative study of 106 medical students randomly divided into control and intervention groups was conducted. The intervention group received instruction using duplicated medical health records, while the control group was taught using traditional case-based learning. Academic performance was assessed through standardized scoring with statistical analysis. A Likert scale questionnaire evaluated intervention group participants' perceptions.
Results: No significant difference was found between mean academic scores of control and intervention groups ($p=0.567$). However, qualitative assessment showed overwhelmingly positive reception, with 98.6% of intervention group students expressing favorable attitudes toward medical health records as effective educational resources for integrated laboratory medicine.
Conclusions: Medical health records represent a valuable educational resource for teaching integrated laboratory medicine to undergraduate medical students. However, their effectiveness in improving academic performance remains uncertain. Further studies with larger sample sizes and longer follow-up periods are recommended to strengthen understanding of this educational approach's potential benefits.

Keywords: Educational tool, Integrated laboratory medicine, Medical health records

INTRODUCTION

Appropriate knowledge and use of laboratory testing is essential for achieving safe and effective patient care. Despite the critical importance of laboratory medicine in clinical practice, there has been insufficient attention given to appropriate medical student education in this area, resulting in a decline in practicing physicians' ability to order and interpret laboratory tests appropriately.[1]

The Centers for Disease Control and Prevention emphasized in May 2009 that "appropriate use of laboratory testing is essential for achieving safe, effective and efficient patient care.[2] However, medical education in laboratory medicine has been found to be inadequate, with insufficient time allocated and inappropriate teaching methods employed in undergraduate medical curricula.[3]

Healthcare providers with inadequate knowledge of laboratory tests are more prone to inappropriate test ordering and misinterpretation of results, leading to poor case management, increased healthcare costs and adverse patient outcomes.[4] Research demonstrates that while medical students may successfully answer theoretical questions about diagnostic tests after reading relevant literature, they often fail to accurately apply these

principles when confronted with actual clinical scenarios.[5] This gap between theoretical knowledge and practical application highlights the need for more effective teaching methodologies. Methods for integrating laboratory medicine principles throughout all stages of the four-year medical curriculum are critical to maximize the benefits of integrated learning.[6]

Medical health records, defined by Huffman as "a compilation of pertinent facts of a patient's life and health history, including past and present illness and treatment, written by health professionals contributing to that patient's care," represent a valuable educational resource.[7]

These records can serve as effective tools for helping medical students become knowledgeable and comfortable with medical documentation systems and their direct integration into clinical practice.[8] Teaching laboratory medicine within pathology presents unique challenges, requiring an interdisciplinary approach. Previous studies have employed case presentations and special study modules to enhance relevant basic science learning at the undergraduate level.[9] However, there remains a need for innovative educational approaches that bridge the gap between technical proficiency and clinical application.

This study aims to assess the effectiveness of using medical health records as an educational tool for phase-II medical students to develop an integrative approach to laboratory medicine. The objective is to enhance higher-order cognitive skills through data integration and clinical reasoning, ultimately enabling students to arrive at accurate diagnoses through systematic interpretation of laboratory findings.

METHODS

Study design and setting

This educational interventional study was conducted between April and September 2022 at the Department of Pathology of a Malabar Medical College Hospital and Research Centre in Northern Kerala.

Study population and sample size

The target population consisted of Phase II MBBS students attending clinical pathology postings. A total of 106 students participated in this study, organized into six batches for clinical postings. Each batch was equally divided into control and intervention groups by Pathology department faculties. Students with odd roll numbers were assigned to the control group, while those with even roll numbers formed the intervention group.

Inclusion criteria

All students who provided written informed consent were included in the study.

Exclusion criteria

All those students who did not attend all the sessions and who failed to attend the assessment at the end of the session.

Study procedure and intervention design

Students were assigned to clinical pathology postings for one month each. The posting was structured as follows.

Days 1-25

Regular clinical pathology teaching through lectures and demonstrations.

Days 26-30

Revision classes designated for the intervention.

Group allocation and teaching methods

Control group

Students received instruction through traditional case-based learning discussions. Cases included only relevant laboratory data for interpretation and discussion.

Intervention group

Students learned through duplicated medical health records-based integrated laboratory medicine approach. Duplicated medical health records (with patient personal details removed) were utilized, containing comprehensive clinical information including case history, laboratory data, sonological reports and ECG records. Various medical conditions were represented in the health records.

Implementation process

Following approval from the Institutional Research Committee and Institutional Ethics Committee, the study was explained to students in detail and written informed consent was obtained. Six intervention cycles were conducted by the same faculty member teaching both groups to ensure consistency. The teaching module was developed in consultation with pathology department faculty members.

Students in both groups were allocated cases for interpretation, which were subsequently discussed in detail during successive sessions. Medical health records covered various clinical conditions to provide comprehensive learning exposure.

Assessment and data collection

Both groups were assessed using problem-based multiple-choice questions (MCQs) at the end of each posting. Ten

MCQs were administered and evaluated by independent faculty members to minimize bias. Scores obtained by students in both control and intervention groups were systematically recorded.

Statistical analysis

All academic performance data were entered into SPSS software for analysis. Descriptive statistics including means and standard deviations were calculated for scores obtained by both groups.

Perception assessment

A structured questionnaire utilizing a five-point Likert scale (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree) was administered to assess student perceptions of the teaching methodology.

Ethical considerations

To address ethical concerns and ensure fairness, duplicated medical health records were provided to the control group for discussion after the formal assessment was completed. This approach ensured that all participants had access to the same educational resources while maintaining the integrity of the comparative study design.

The study received approval from both the Institutional Research Committee and Institutional Ethics Committee prior to implementation (MMCH&RC/IEC/2022 dated 28/3/22). Written informed consent was obtained from all participants and confidentiality was maintained throughout the study period.

RESULTS

Out of the total of 106 students who participated in the project, 68 were females and 38 were males as shown in the Figure 1, between the age group of 20-23 years as seen in Figure 1. After the teaching learning process by using duplicated medical health records which included various medical conditions as depicted in Table 1, the assessment was conducted as MCQ. After the analysis it was found that there was no significant difference in the marks scored between the test and control group as the p value thus obtained after comparison was not significant as depicted in Table 2. A questionnaire was also given to the participants in the test group to know about their perception regarding the new teaching learning tool as following.

Laboratory medicine classes are more interesting with integrated teaching. Using medical health records is useful method of teaching integrated laboratory medicine. Helps in enhancing a better understanding of subject. Makes the student interested in interpretation of laboratory data interpretation. Helps in correlating clinical history with laboratory data in a better manner. Useful in understanding the concepts and usefulness of various tests in diagnosis. Helpful in performing better in exams. Overall effectiveness and benefit of the new teaching method. These aspects were rated on Likert scale and the observations were tabulated as shown in Figure 2.

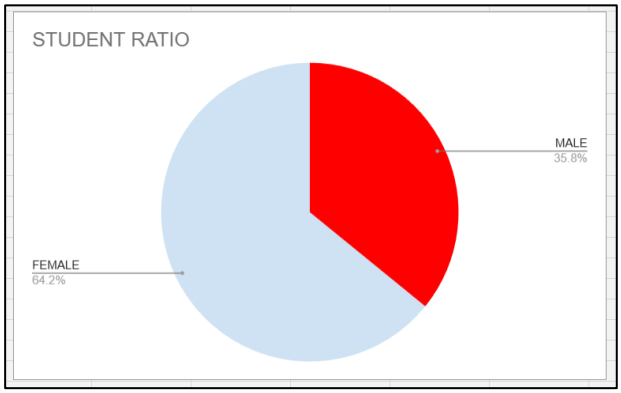

Figure 1: Ratio of students involved in the control and intervention group.

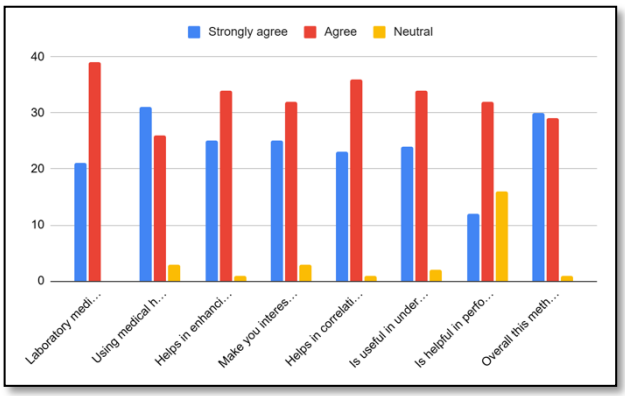

Figure 2: Perceptions of students to new teaching methodology.

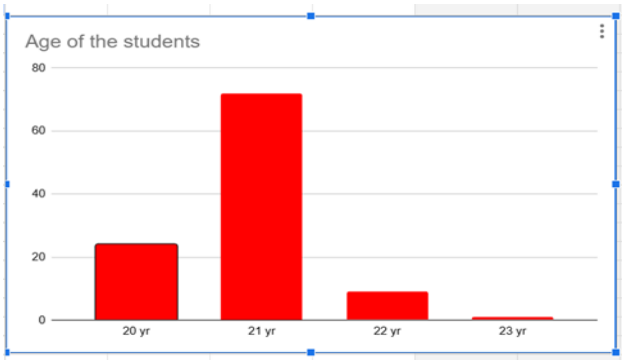

Figure 3: Age distribution of students involved in the control and intervention group.

Perceptions of the student about the new teaching tool showed that 96.2% students agreed that laboratory medicine classes are more interesting with integrated learning. 94.3% participants agreed that medical health records were a useful method of teaching integrated laboratory medicine while 5.6% were neutral about this

new intervention. 98.1% agreed that this method of teaching with medical health records used as an educational tool helps in better understanding and makes interpretation of the laboratory tests more interesting. By using medical health records, 98.1% participants stated that it helps in better correlation with clinical history and laboratory tests ordered while 1.8% had neutral opinion about it. 96.2% participants also agreed it helps in better understanding of various laboratory diagnostic tests.

Only 81.1% agreed that this method of teaching using health records helped them in performing better in exams whereas 18.8% maintained a neutral opinion about the same, which was further supported by the evidence that there was no significant difference in marks scored between both groups. 98.1%agreed that this method of teaching using medical health records was effective and beneficial.

Table 1: Medical health records used during the clinical laboratory postings for the test group.

S. no.	Medical health records	Numbers
1.	Nephrotic syndrome	1
2.	Nephritic syndrome	1
3.	Iron deficiency anemia	2
4.	Megaloblastic anemia	2
5.	Acute Lymphoblastic Leukemia	1
6.	Multiple myeloma	1
7.	Acute myeloid leukemia	1
8	Thalassemia	1

Table 2: Scores obtained by test group and control group.

Groups	Mean	Standard deviation	Standard error of mean	t value	p value
Intervention	5.65	1.471	0.19	0.575	0.567
Control	5.8	1.388	0.179		

DISCUSSION

Pathology education has traditionally been confined to general and systemic pathology, emphasizing disease mechanisms while neglecting clinical pathology and laboratory medicine as essential components of undergraduate medical education.

With the implementation of competency-based medical education, medical schools have transitioned toward integrating basic sciences with clinical medicine, presenting topics within integrated frameworks to enhance clinical relevance and application. This study represents an attempt to bridge the gap between theoretical knowledge and practical application of laboratory medicine in undergraduate education by utilizing duplicated medical health records as educational tools for teaching integrated laboratory medicine. Due to strict institutional confidentiality and liability protocols, original medical records were inaccessible; therefore, duplicated medical health records with anonymized patient information were developed for educational purposes.

Learning outcomes

The findings demonstrate strong student acceptance of the integrated teaching approach. In our study, 96.2% of participants agreed that laboratory medicine classes became more engaging when presented in an integrated format, which aligns closely with the findings of Azer et al, where 91.5% of students found integrated teaching interesting.[9] The novel nature of this teaching methodology contributed to enthusiastic student reception.

Regarding clinical correlation skills, 98.1% of participants in our study reported improved ability to correlate clinical findings with ordered laboratory tests and better understanding of test utility. This finding is consistent with Zhou et al who reported that 92.13% of students demonstrated enhanced clinical correlation abilities following similar interventions.[10] This improvement in clinical reasoning represents a significant educational outcome, as it addresses the fundamental challenge of connecting theoretical knowledge with practical clinical application.

Academic performance considerations

Interestingly, 18.8% of participants expressed concerns that this teaching method might not effectively improve examination performance. This perception is supported by literature suggesting that while medical health records serve as valuable teaching tools, direct evidence for improved examination scores remains limited. As noted by Borycki et al the primary benefit lies in increased clinical exposure and enhanced understanding of healthcare applications rather than immediate academic performance gains.[11] This finding can be attributed to the fact that problem-based questions constitute only 15% of total examination marks in the current assessment structure.

Despite concerns about examination performance, 98.1% of participants agreed that medical health records represent an effective and beneficial method for learning laboratory medicine, consistent with findings reported by Smith et al.[12] This overwhelming positive response indicates that students recognize the intrinsic educational value of this approach beyond immediate academic gains.

Strengths

The primary strength of this study lies in its integration within regular laboratory medicine classes, eliminating time constraints and ensuring realistic implementation

conditions. The novel teaching approach generated positive and enthusiastic student attitudes, as participants gained unprecedented access to medical records, providing authentic clinical learning experiences that enhanced engagement and motivation.

Limitations

Several limitations warrant consideration in interpreting these findings. The relatively small sample size limits generalizability of results to broader populations. The assessment methodology, utilizing problem-based multiple-choice questions, evaluates only short-term knowledge retention without measuring long-term learning outcomes or knowledge application in clinical settings. Student motivation may have been compromised as participants understood that assessment results would not contribute to their formal second-year evaluations, potentially affecting the validity of performance measures. The absence of pre-intervention testing represents a methodological limitation, as baseline knowledge assessment would have provided more robust comparative data for evaluating educational effectiveness. Practical limitations included the cumbersome nature of paper-based medical records, which proved challenging to maintain and distribute effectively. Electronic health records would represent a more efficient and sustainable alternative for future implementations.

CONCLUSION

The need for optimal education regarding laboratory medicine has been emphasized due to dramatic growth in laboratory testing which was further reinforced by National Medical Council by adding laboratory medicine as an elective posting in rotatory internship. Accessing medical records helps medical students acquire several fundamental skills for their future practice.

The current evidence, though promising in terms of student acceptance, remains insufficient to definitively establish medical health records as superior to traditional teaching approaches for improving academic performance. Further comprehensive studies with larger sample sizes, longer follow-up periods and using different assessment methods including clinical reasoning evaluations, practical skill assessments are essential to strengthen our understanding of this educational approach's true potential and its role in preparing competent clinicians capable of integrating laboratory data into holistic patient care.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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