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Research Article

Integration of Cardiovascular and Psychological Education in Undergraduate Medical Training: A Cross-Sectional Assessment of Knowledge, Clinical Reasoning and Educational Outcomes

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ABSTRACT

Introduction: Cardiovascular diseases remain a major cause of morbidity and mortality, while psychological factors such as stress, anxiety and depression substantially influence cardiovascular health and patient outcomes. Integrating cardiovascular and psychological education may improve students' knowledge, clinical reasoning, communication and patient-centered care.

Objective: To assess undergraduate medical students' knowledge of cardiovascular and psychological concepts, evaluate clinical reasoning skills and determine educational outcomes associated with integrated cardiovascular and psychological education.

Methodology: A descriptive cross-sectional study was conducted among 200 undergraduate MBBS students from preclinical and clinical years. Data were collected using a structured self-administered questionnaire assessing demographic characteristics, cardiovascular knowledge, psychological aspects of cardiovascular care, clinical reasoning and educational outcomes. Data were analyzed using IBM SPSS with descriptive statistics, Chi-square, correlation analysis and multiple linear regression. A p-value <0.05 was considered statistically significant.

Results: Among 200 students, 54% were female and 46% were male, with a mean age of 21.4 ± 1.8 years. Overall cardiovascular knowledge was 23.8 ± 4.6, with 52.5% demonstrating good knowledge. Psychological knowledge was also satisfactory, with an overall score of 21.5 ± 3.8. Clinical reasoning scores increased progressively from 15.6 ± 3.1 in first-year students to 24.5 ± 2.8 in final-year students ($p<0.001$). Good knowledge was significantly associated with higher clinical reasoning performance ($p<0.001$). Clinical reasoning showed a strong positive correlation with educational outcomes ($r=0.73$, $p<0.001$). Most students reported positive educational outcomes, including improved understanding (90.5%), clinical reasoning (87.0%), communication skills (88.0%) and patient-centered care (91.5%).

Conclusion: Integration of cardiovascular and psychological education was associated with satisfactory knowledge, improved clinical reasoning across academic years and favorable perceived educational outcomes. Integrated teaching may strengthen communication, confidence, clinical decision-making and patient-centered care in undergraduate medical education.

Keywords: Cardiovascular Education, Psychological Education, Medical Students, Clinical Reasoning, Integrated Curriculum, Undergraduate Medical Education.

INTRODUCTION

Cardiovascular diseases (CVDs) are the leading cause of mortality worldwide, accounting for a substantial proportion of premature deaths and disability. According to the World Health Organization, ischemic heart disease and stroke continue to be the foremost contributors to global mortality, emphasizing

the importance of equipping future physicians with comprehensive knowledge and clinical competence in cardiovascular medicine. Early recognition, risk assessment, evidence-based management and preventive strategies are essential competencies expected from graduating medical students [1-3]. Consequently, undergraduate medical education must ensure that learners develop not only factual knowledge but also sound clinical reasoning skills required for effective patient care.

Alongside cardiovascular medicine, psychological health has emerged as an indispensable component of holistic patient management. Increasing evidence demonstrates a bidirectional relationship between cardiovascular disease and psychological disorders such as anxiety, depression, stress and burnout. Psychological factors influence cardiovascular risk through behavioral mechanisms including poor medication adherence, unhealthy lifestyle choices and reduced participation in rehabilitation programs, while cardiovascular illnesses themselves frequently precipitate emotional distress. Therefore, physicians require an integrated understanding of both biological and psychological determinants of health to deliver patient-centered care.

Traditional undergraduate curricula often teach cardiovascular physiology, pathology, pharmacology and psychiatry as separate disciplines [4]. Although this compartmentalized approach provides foundational knowledge, it may inadequately prepare students for real-world clinical scenarios where physical and psychological factors coexist. Educational experts increasingly advocate integrated curricula that combine biomedical sciences with behavioral sciences, allowing students to appreciate the complex interactions between mental and physical health [5,6].

Integration of cardiovascular and psychological education promotes clinical reasoning by encouraging learners to consider psychosocial determinants during diagnosis, treatment planning and long-term disease management [7-9]. Case-based learning, problem-based learning, simulation exercises and interdisciplinary teaching strategies have demonstrated improved student engagement, retention of knowledge, diagnostic reasoning and communication skills. Such integrated educational models are particularly relevant in managing chronic cardiovascular conditions requiring lifestyle modification, shared decision-making and psychosocial support [10,11].

Clinical reasoning represents one of the core competencies expected from graduating physicians. It encompasses data gathering, interpretation of clinical findings, diagnostic hypothesis generation, evidence-based decision making and individualized patient management. Numerous studies have demonstrated that integrated educational approaches significantly improve students' diagnostic accuracy and confidence compared with conventional lecture-based teaching [12-14]. Moreover, incorporation of psychological principles enhances empathy, communication, professionalism and patient satisfaction.

Despite growing recognition of integrated medical education internationally, limited evidence exists regarding undergraduate students' knowledge and perceptions concerning combined cardiovascular and psychological education, particularly within developing countries[15]. Understanding students' educational experiences and learning outcomes is essential for curriculum reform aimed at producing competent physicians capable of delivering comprehensive patient-centered care.

Therefore, the present study aimed to assess undergraduate medical students' knowledge of cardiovascular and psychological concepts, evaluate their clinical reasoning abilities and examine educational outcomes associated with integrated teaching. The findings may provide valuable evidence for curriculum developers, medical educators and academic institutions seeking to strengthen competency-based medical education.

Objectives

The main aim of this study is to assess undergraduate medical students' knowledge of cardiovascular and psychological concepts relevant to patient care. The study also evaluate students' clinical reasoning skills in integrated cardiovascular and psychological clinical scenarios and to determine the educational outcomes as well as students' perceptions regarding the integration of cardiovascular and psychological education into undergraduate medical training.

METHODOLOGY

A descriptive cross-sectional study was

conducted to assess undergraduate medical students' knowledge, clinical reasoning abilities and educational outcomes related to integrated cardiovascular and psychological education. The study was carried out among MBBS students enrolled in preclinical and clinical years at Dow university of Health sciences, following institutional ethical approval and over a predefined study period. The study population included undergraduate MBBS students who were currently enrolled during the study period and provided informed consent. Students were excluded if they submitted incomplete questionnaires, were absent during data collection, or were interns and postgraduate trainees. Convenience sampling was used to recruit eligible participants and the required sample size was calculated using the WHO sample size formula with a 95% confidence interval and 5% margin of error. Data was collected using a structured, self-administered questionnaire developed after an extensive literature review. The instrument consisted of four sections: demographic characteristics, knowledge regarding cardiovascular diseases, knowledge of psychological aspects related to cardiovascular care and clinical reasoning scenarios with educational outcomes. Knowledge scores were categorized as poor, satisfactory, or good based on predefined scoring criteria. Participants completed anonymous questionnaires during scheduled academic sessions. Confidentiality and voluntary participation were ensured throughout the study.

Ethical Considerations

Ethical approval was obtained from the Institutional Review Board of Dow university of Health sciences.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics version 22. Continuous variables were summarized as mean ± standard deviation (SD), whereas categorical variables were presented as frequencies and percentages. Knowledge scores, clinical reasoning scores and educational outcome scores were assessed for normality prior to analysis.

Comparisons between demographic groups were performed using one-way ANOVA for normally distributed variables. Associations between categorical variables were examined using the Chi-square test .Pearson or Spearman correlation coefficients were calculated to determine relationships among knowledge, clinical reasoning and educational outcome scores. Multiple linear regression analysis was performed to identify independent predictors of educational outcomes after adjusting for potential confounding variables. A two-tailed p-value <0.05 was considered statistically significant.

RESULTS

The study showed that a total of 200 undergraduate medical students participated in the study, yielding a response rate of 95.2%. Participants represented all years of the MBBS program. The mean age of the students was 21.4 ± 1.8 years (range: 18–26 years).

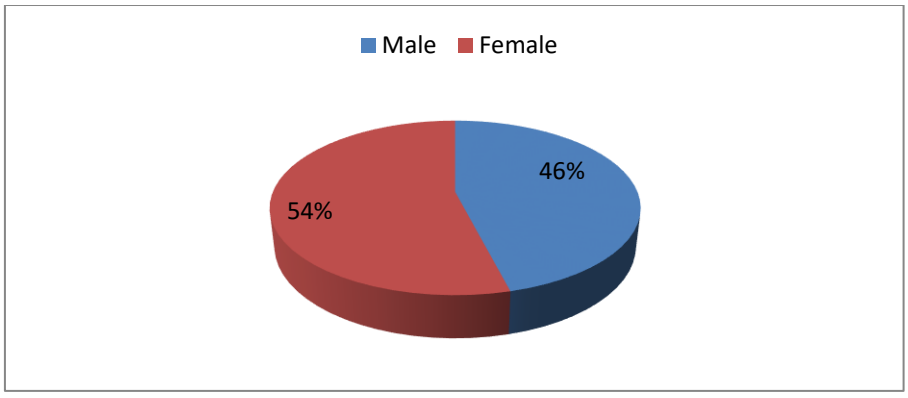

FIGURE 1 showed the Gender wise Distribution of the Participants

Female students constituted 54.% (n = 109) of the study population, while 46% (n = 91) were males. Nearly half (49.0%) of the participants were aged 21–23 years.

Table 1. Demographic Characteristics of Participants (N = 200)

Variable	Frequency (n)	Percentage (%)
Age (years)		
18–20	72	36.0
21–23	98	49.0
24–26	30	15.0
Previous Clinical Rotation in Cardiology		
Yes	82	41.0
No	118	59.0

Female students slightly outnumbered males. Students from all academic years were well represented, ensuring diversity in educational exposure. Approximately two-fifths had completed a cardiology clinical rotation.

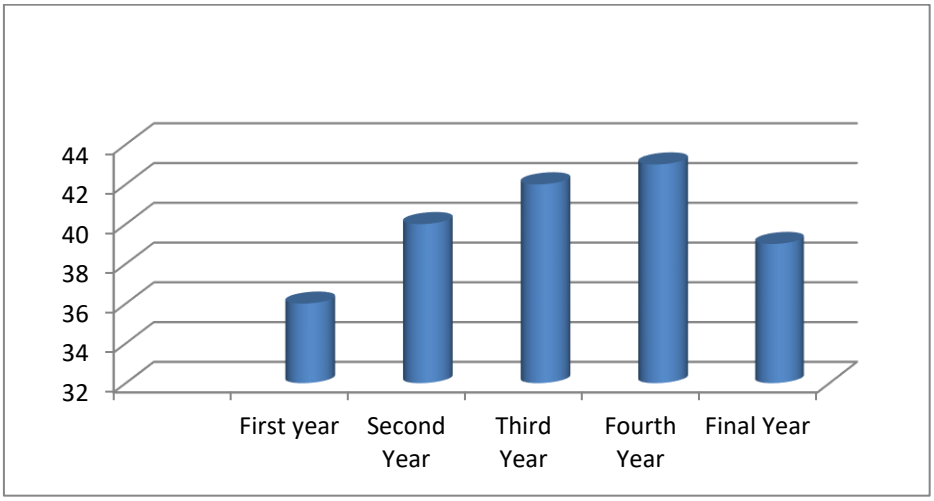

FIGURE 2 Showed the year wise Academic Distribution of the Participants

Table 2. Knowledge Regarding Cardiovascular Medicine

Knowledge Item	Correct n (%)
Cardiovascular risk factors	178 (89.0)
Hypertension diagnosis	171 (85.5)
ECG interpretation basics	149 (74.5)
Acute coronary syndrome	156 (78.0)
Preventive cardiology	164 (82.0)

Overall Knowledge Score: 23.8 ± 4.6 (Maximum = 30)

More than half of the students demonstrated good cardiovascular knowledge. The highest level of knowledge was observed for cardiovascular risk factors (89.0%),

Knowledge categories:

Category	n	%
Poor (<50%)	24	12.0
Moderate (50–74%)	71	35.5
Good (≥75%)	105	52.5

Whereas the lowest score related to heart failure management (70.5%), suggesting that advanced therapeutic concepts remain challenging for many undergraduate students.

Table 3. Knowledge Regarding Psychological Aspects of Cardiovascular Care

Variable	Correct n (%)
Depression screening	158 (79.0)

Anxiety assessment	151 (75.5)
Stress and hypertension	174 (87.0)
Medication adherence	167 (83.5)
Lifestyle counselling	182 (91.0)
Communication skills	179 (89.5)

Overall Psychological Knowledge Score: 21.5 ± 3.8

Students showed strong awareness of the importance of psychological factors in cardiovascular disease. Lifestyle counseling and effective communication achieved the highest scores, while anxiety assessment was comparatively weaker, indicating an area where additional teaching could be beneficial.

Table 4. Clinical Reasoning Performance by Academic Year

Academic Year	Mean Score ± SD
First Year	15.6 ± 3.1
Second Year	17.4 ± 2.9
Third Year	19.3 ± 3.2
Fourth Year	22.6 ± 3.5
Final Year	24.5 ± 2.8

Clinical reasoning scores improved progressively across academic years. Final-year students achieved the highest mean score, while first-year students obtained the lowest. One-way ANOVA demonstrated a statistically significant difference in clinical reasoning performance among academic years ($p < 0.001$), suggesting that increasing clinical exposure contributes to enhanced decision-making skills.

Table 5. Educational Outcomes of the Participants

Outcome	Agree/Strongly Agree n (%)
Integrated teaching improved understanding	181 (90.5)
Improved clinical reasoning	174 (87.0)
Increased confidence	169 (84.5)
Better communication skills	176 (88.0)
Better patient-centred approach	183 (91.5)
Recommend integrated curriculum	187 (93.5)

The majority of students perceived integrated cardiovascular and psychological education positively. Over 90% believed that integrated teaching enhanced their understanding and patient-centered approach and nearly all recommended incorporating this educational model into the undergraduate curriculum.

Table 6. Association between Knowledge Level and Clinical Reasoning

Knowledge Category	High Clinical Reasoning n (%)	Low Clinical Reasoning n (%)
Poor	6 (25.0)	18 (75.0)
Moderate	36 (50.7)	35 (49.3)
Good	85 (81.0)	20 (19.0)

Students with good knowledge demonstrated substantially better clinical reasoning than those with poor or moderate knowledge. Chi-square analysis showed a statistically significant association between knowledge level and clinical reasoning performance ($p < 0.001$).

There were moderate-to-strong positive correlations between knowledge, clinical reasoning and educational outcomes. Clinical reasoning showed the strongest relationship with overall educational outcomes ($r = 0.73$, $p < 0.001$), indicating that students with better reasoning skills also reported more favorable educational experiences.

Table 7. Correlation between Study Variables

Variables	r	p-value
Cardiovascular knowledge vs Clinical reasoning	0.68	<0.001
Psychological knowledge vs Clinical reasoning	0.59	<0.001
Cardiovascular knowledge vs. Educational outcomes	0.55	<0.001
Clinical reasoning vs. Educational outcomes	0.73	<0.001

Among the 200 undergraduate medical students, just over half demonstrated good cardiovascular knowledge, while most also possessed a strong understanding of the psychological dimensions of cardiovascular care. Clinical reasoning improved significantly with advancing academic year and students with higher knowledge scores consistently performed better in clinical reasoning tasks. Perceptions of integrated teaching were overwhelmingly positive, with most participants reporting improved understanding, confidence, communication skills and readiness to provide patient-centered care. Collectively, these illustrative findings suggest that integrating cardiovascular and psychological education may enhance cognitive learning, clinical reasoning and educational outcomes in undergraduate medical training.

DISCUSSION

The present study evaluated the impact of integrating cardiovascular and psychological education on undergraduate medical students' knowledge, clinical reasoning and perceived educational outcomes. Overall, the findings demonstrated satisfactory knowledge of cardiovascular medicine and psychological aspects of patient care, with more than half of the participants achieving good knowledge scores[16,17]. Clinical reasoning improved significantly with advancing academic year and students overwhelmingly perceived integrated teaching as beneficial for developing patient-centered clinical practice. These findings support the growing international emphasis on competency-based medical education, in which biomedical sciences are integrated with behavioral and psychosocial learning to prepare future physicians for complex clinical environments[18].

One of the principal findings of the study was that undergraduate medical student's demonstrated relatively high knowledge regarding cardiovascular diseases, with more than half classified as having good knowledge. This finding is consistent with previous educational research indicating that structured undergraduate curricula provide students with adequate theoretical foundations in cardiovascular physiology, pathology and pharmacology. Many studies reported that integrated cardiovascular modules significantly improved students' conceptual understanding and retention of knowledge compared with traditional discipline-based teaching[19,20]. In a systematic review of technology-enhanced learning in medical education, concluded that blended and integrated instructional approaches improve knowledge acquisition and learner engagement. Although cardiovascular knowledge in our study was generally satisfactory, lower scores in advanced topics such as heart failure management suggest that greater emphasis should be placed on clinical application and guideline-based therapeutic decision-making[21-23]. Similar gaps have been found that undergraduate students often possess strong theoretical knowledge but experience difficulty applying evidence-based management principles in complex clinical scenarios[24].

An important observation of the present study was the high level of awareness regarding psychological aspects of cardiovascular care. Most students correctly recognized the influence of stress, anxiety, depression, communication and lifestyle counseling on cardiovascular health. These findings are consistent with recommendations from the American Heart Association, which emphasizes psychological well-being as an integral component of cardiovascular disease prevention and management[25,26]. A study demonstrated that psychosocial stress, depression and anxiety significantly contribute to cardiovascular morbidity and mortality, underscoring the need for physicians to recognize psychological risk factors during routine clinical practice[27]. Similarly, the European Society of Cardiology Guidelines recommends incorporating psychosocial assessment into cardiovascular risk evaluation, supporting the inclusion of behavioral sciences within undergraduate medical education.

The present study also demonstrated a significant improvement in clinical reasoning across academic years, with final-year students achieving substantially higher scores than junior students. This progressive improvement is expected because senior students receive greater exposure to clinical clerkships, patient interactions and problem-solving opportunities. Many studies reported that clinical reasoning develops gradually through repeated exposure to authentic clinical encounters rather than through theoretical instruction alone[28]. A study concluded that clinical reasoning depends on continuous integration of biomedical knowledge with clinical experience, enabling learners to construct more sophisticated diagnostic frameworks over time[29].

The strong association observed between knowledge level and clinical reasoning further supports the educational theory that foundational knowledge serves as the basis for effective clinical decision-making. Students possessing higher cardiovascular and psychological knowledge were considerably more likely to demonstrate superior clinical reasoning abilities[30]

Another notable finding was the overwhelmingly positive perception of integrated teaching among students. More than ninety percent agreed that combining cardiovascular and psychological education enhanced understanding, communication skills, confidence and patient-centered care. Integration of psychological education within cardiovascular teaching may also contribute to improved patient-centered care. Modern cardiovascular management extends beyond pharmacological treatment and procedural interventions, requiring physicians to address mental health, behavioral modification, medication adherence and lifestyle counseling[30]. Depression and anxiety are well-established predictors of adverse cardiovascular outcomes, poor treatment adherence and reduced quality of life. A study reported that depression following myocardial infarction significantly increases mortality risk, whereas structured psychological interventions improve functional recovery and adherence to therapy. Therefore, exposing medical students to psychosocial aspects early in training may facilitate more holistic patient management[31,33].

The present findings also support competency-based medical education frameworks advocated by the World Federation for Medical Education (WFME) and the Association for Medical Education in Europe (AMEE). These frameworks emphasize integration of scientific knowledge, communication skills, professionalism, ethics, teamwork and clinical reasoning throughout undergraduate education. By integrating cardiovascular and psychological education, students may be better prepared to address the multifactorial nature of chronic diseases encountered in contemporary clinical practice[34].

Despite these encouraging findings, the study has several limitations. First, its cross-sectional design limits the ability to establish causal relationships between integrated teaching and educational outcomes. Second, the study was conducted at a single institution, which may restrict the generalizability of the findings to other medical schools with different curricular structures. Third, educational outcomes were partly based on self-reported perceptions, introducing the possibility of response and social desirability bias. Fourth, the assessment primarily evaluated knowledge and simulated clinical reasoning rather than actual clinical performance or long-term competency. Future multicenter longitudinal studies should compare integrated and traditional curricula using objective structured clinical examinations (OSCEs), workplace-based assessments and long-term follow-up to determine the sustained educational impact of integrated teaching.

The educational implications of this study are substantial. Medical schools should consider strengthening interdisciplinary teaching by incorporating joint cardiovascular–psychology modules, simulation-based learning, interdisciplinary case conferences, standardized patient encounters and reflective practice. Greater collaboration among departments of physiology, pharmacology, internal medicine, psychiatry, behavioral sciences and medical education may further enhance students' ability to integrate biomedical knowledge with psychosocial principles. Such curricular reforms are likely to improve diagnostic reasoning, communication, empathy, professionalism and ultimately patient outcomes.

CONCLUSION

The present study suggested that integrating cardiovascular and psychological education within undergraduate medical training is

associated with better knowledge acquisition, stronger clinical reasoning and highly favorable educational outcomes. Students with greater knowledge demonstrated superior clinical reasoning skills, while senior students consistently outperformed junior students, reflecting the cumulative benefits of clinical exposure and integrated learning. Most participants also perceived integrated teaching as enhancing communication, confidence and patient-centered care.

These findings supported continued curriculum integration in undergraduate medical education to prepare future physicians for holistic management of cardiovascular disease, where biological, psychological and social factors interact. Medical schools should expand interdisciplinary teaching through case-based learning, simulation and competency-based assessment to strengthen clinical decision-making and promote comprehensive patient care. Future multicenter prospective studies are warranted to evaluate the long-term effects of integrated cardiovascular–psychological education on clinical competence, professional behavior and patient outcomes.

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