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Use of Case-Based Clinical Reasoning in Medical Education at Libyan International University: A Quantitative Study

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Abstract:

Background:

Clinical instruction in medical education is a complex and challenging task for educators. It requires students to not only possess theoretical knowledge but also a range of competencies such as clinical reasoning, technical skills, decision-making, ethics, leadership, and time management. Clinical reasoning, which encompasses the cognitive process and decision-making in clinical practice, is a fundamental skill for physicians.

The aim of the study was to understand students' views on the use of case-based clinical reasoning (CBCR) in their medical training and evaluate their satisfaction with its application as an instructional approach for developing clinical reasoning abilities.

Participants and Methods:

A descriptive quantitative study was conducted at the Libyan International Medical University (LIMU) to gather data on the utilization of case-based clinical reasoning (CBCR) in medical training. The study focused on 412 medical students in the clinical phase, including 4th and 5th-year students and intern doctors at LIMU. Data were collected through an online questionnaire over a two-month period from January to March 2023. The analysis was based on 129 responses, representing a 30.1% response rate. The questionnaire consisted of 22 questions, including multiple-choice and Likert scale inquiries, and aimed to assess students' satisfaction in three dimensions: perceived benefits and drawbacks of CBCR in medical education, skill enhancement and its impact on self-assurance and teamwork, and the role of LIMU in successfully implementing the program. Data analysis was performed using the SPSS software, with a statistical significance level set at $p < 0.05$.

Results:

The study found that students perceive several benefits of using case-based clinical reasoning (CBCR) in their medical training. These benefits include the accumulation of knowledge and the improvement of skills such as teamwork, communication, critical thinking, reasoning, and self-directed learning abilities. A significant majority of students, approximately three-quarters of the sample, endorsed the use of CBCR with their peers and colleagues. Almost all respondents agreed that CBCR helps them make informed

decisions in their daily practice and boosts their confidence in advancing their medical careers (93% and 86.8% agreement, respectively). Higher satisfaction levels were reported among fifth-year students and during the internship phase. However, fourth-year students expressed more dissatisfaction with CBCR, finding it time-consuming and facing challenges in formulating hypotheses for data collection.

In conclusion, the study highlights the importance of adopting a proactive approach in medical education to promote educational innovation. Employing case-based clinical reasoning (CBCR) is found to be effective in developing clinical competencies, fostering collaboration, enhancing self-assurance, and cultivating critical thinking abilities among students.

Introduction:

Learning involves the acquisition of knowledge and skills, aiming for their retrieval and utilization in the future. It is considered that the process of acquiring new information entails various stages of storage and processing before it can be deemed as "learned" (Sumeracki, 2023). According to adult learning theory, the most effective way for individuals to acquire new knowledge and skills is by contextualizing them within real-life situations (Van Merrien, Sweller, 2005). Traditionally, the primary objective of education has been to enhance students' capacity to transfer acquired knowledge and skills across different contexts. Current educational reform initiatives emphasize the significance of curricula addressing students' development of clinical reasoning in various domains to enhance the quality of patient care (Kassirer, 2010).

Educational experiences are expected to stimulate inquisitiveness, foster individual drive, and facilitate the unrestricted articulation of students' thoughts. The knowledge and competencies acquired in a particular context are subsequently utilized as tools for comprehending and addressing subsequent scenarios effectively (Speicher, Casa 2012).

Despite significant progress in comprehending human cognition over recent decades, the pedagogical approaches employed continue to predominantly rely on expert judgment. It is acknowledged that the well-being of individuals under care is intricately linked to their capacity for critical thinking and adeptness in addressing complex problems, in addition to the incorporation of cutting-edge technological solutions (Kassirer, 2010).

Clinical reasoning is characterized as the ability of healthcare providers to evaluate patient issues and data in order to accurately define and contextualize problems within the patient's unique circumstances (Murphy, 2004). This cognitive process involves the collection and analysis of information to make informed decisions regarding the diagnosis and treatment of patient conditions (Lee, Wenger, 1997). In order to deliver optimal patient care effectively, it is imperative for healthcare professionals to excel in all six core competencies: patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism, and system-based practice (Lauer & Lauer, 2017).

Clinical reasoning involves utilizing cognitive and psychomotor abilities grounded in theoretical frameworks and empirical data, alongside reflective cognitive processes, to guide tailored adjustments and interventions required in particular patient scenarios (Cate, Custers, 2018).

Current training programs may not offer sufficient instruction on clinical reasoning and diagnostic safety. Five categories of clinical reasoning education have been distinguished, each necessitating specific knowledge, abilities, and actions. These categories encompass clinical reasoning concepts, medical history, and physical examination, as well as the selection and interpretation of diagnostic tests, problem

recognition and treatment, and collaborative decision-making. There is currently a dearth of proof indicating that solely teaching the fundamental cognitive processes implicated in clinical decision-making enhances performance. Educators are intrigued by clinical reasoning due to its significance in practice-oriented learning, particularly concerning diagnostic inaccuracies. Diagnostic mistakes tend to manifest even in prevalent illnesses (Cooper, et al., 2021).

Errors in clinical reasoning persist in causing significant morbidity and mortality, notwithstanding evidence-based guidelines and enhanced technology. Professionals in clinical reasoning frequently engage in unconscious cognitive mechanisms that remain unnoticed unless explicitly articulated. Comprehending the intuitive and analytical thought processes serves as a roadmap for educational purposes. The design of curricula should facilitate the assimilation of knowledge by learners in a clinically meaningful manner. Healthcare providers need to identify prevalent errors in clinical reasoning and strategies to circumvent them. Effective acquisition of clinical reasoning skills by trainees is feasible through practical experience, coupled with mentorship on the cognitive processes underpinning diagnostic decision-making (Pinnock, Welch, 2013).

The process of decision-making encompasses various facets of expert professional conduct, such as knowledge, fundamental principles, logical clinical reasoning, and proficient clinical skills directed towards delivering superior, patient-centric healthcare. The act of reasoning can be likened to constructing a sequence of thoughts, delineating causes and effects, although healthcare practitioners may hastily arrive at a conclusion, occasionally without full awareness of their clinical reasoning process (Martínez et al., 2020).

Case-based clinical reasoning embodies numerous key characteristics that manifest during the interaction between a healthcare provider and a patient. Initially, clinical information is introduced, examined, and deliberated upon in a sequential manner. Subsequently, rather than presenting an exhaustive, consolidated narrative incorporating all available data, as is customary in conventional case presentations, information is disclosed and analyzed incrementally. Furthermore, any cases under scrutiny ought to feature authentic, unaltered patient data. The utilization of simulated or altered real cases should be avoided, as they may not accurately depict the genuine inconsistencies, misleading clues, improper hints, and ambiguous data inherent in genuine patient records. Ultimately, a meticulous curation of illustrative instances of problem-solving ensures a comprehensive coverage of cognitive principles (Kassirer, 2010).

The justification for this lies in the emphasis placed by CBCR on the utilization of knowledge that has been previously obtained, rather than being designed as a mere representation of clinical or basic science theory. Of greater significance is the requirement that, at the commencement of the case, students are not to be prompted towards particular directions or diagnoses (Lee, Wenger, 1997).

The objective of the current investigation is to assess the benefits, drawbacks, and level of contentment among students regarding the implementation of CBCR in the clinical stage of the medical program at the Libyan International Medical University (LIMU), as well as its potential to improve their professional growth through interactive learning. Additionally, the study aims to explore the necessity of incorporating CBCR into the current medical curriculum of the clinical phase based on the perspectives of the students.

Methodology and participants:

A descriptive quantitative study conducted at LIMU. Data was collected through an on-line questionnaire for two months period from January to March 2023. Targeted population were medical students at clinical phase who are currently using case-based clinical reasoning (4th,5th years medical students) and during

the previous two years of their study at the faculty of medicine in LIMU (intern doctors). Total of 412 students.

Case-based Clinical Reasoning is one approach to preparing students to think like doctors before they become engaged in patients' care. Case-based clinical reasoning is the practice of clinical reasoning in small groups, a series of group sessions over a prolonged time span. Students regularly meet in a fixed group of 10–12, usually every 3–4 weeks, consist of an introductory case vignette reflecting the way a patient presents at the clinician's office. Participants sessions are led by three (sometimes two) students of the group. They are called peer teachers and take turns in this role over the whole course. Every student must act as a peer teacher.

One hundred and twenty-nine responses were received and analysed (response rate was 31.3% of the targeted population) The questionnaire contained twenty-two questions (twelve multiple choice type, and ten Likert scale questions). The questionnaire evaluated three dimensions to measure students' satisfaction: perceived advantages and disadvantages of the use of CBCR in medical education, skills development and its effect on self- confidence and teamwork and thirdly the role of LIMU in the success of implementing the program. Use of SPSS program used for data analysis.

Results

In the present study the total of 129 students participated by answering the online questionnaire. 88.4% were in the age group 20 – 24 years and 11.6% were in 25-30 years. Majority of them 79% were female. About 69.8 % were fourth year class.

Table 1: Demographic distribution of the participants

Distribution of participants	Total number=129.	%
Male	27	21
Female	102	79
Average age	22.6±1.76	

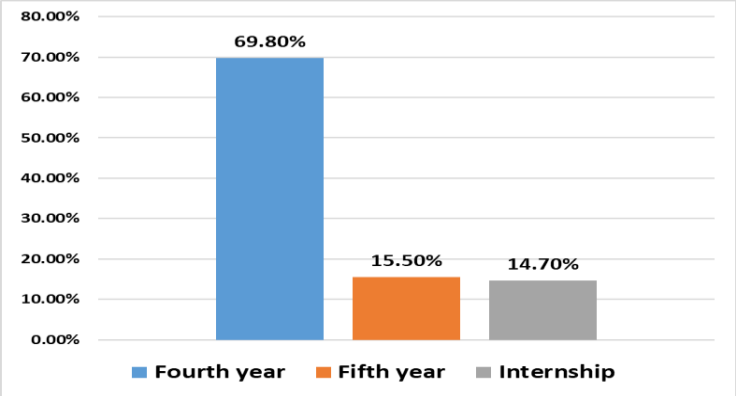

Figure1: Distribution of students according to academic years.

More than two-thirds of responders were fourth year students, fifth year students and intern doctors represented the other one-third of the sample.

Active participation of the students in the learning process was the main reason (45.8%) of the students chose to enrol at problem based LIMU medical school chosen by nearly half the participants.

Table II: Causes of choosing Problem -Based Learning (PBL) as a learning method in Medical School

Causes of choosing PBL in medical education	**Number**	**%**
Curriculum & teaching methods allow active participation	59	45.8
Lack of concentration in long traditional method of learning	24	18.6
Preference of application of knowledge and skills than recalling of facts	22	17.1
Preference of more self-directed learning	13	10.1
More enjoyable and supportive	11	8.4
Total	129	100

The perceived advantages of the use of CBCR in medical curricula at LIMU from the students' point of view: the course was highly organized and convenient, teamwork and communication, building -up of knowledge and skills already exist. Development of skills such as the use of critical thinking and reasoning, self-directed learning skills statistically significant (P=0.02) Table3

Table III: Students' point of view of perceived advantages of the use of CBCR in medical curricula:

Perceived advantages	Number= 129	%	P Value
Building -up of knowledge and skills already exists.	32	24.8	0.02
Enhancement of teamwork and communication	27	21.0	
Critical thinking and reasoning.	22	17.1	
Active participation.	15	11.6	
Learning environment is more stimulating and satisfying	11	8.5	
Self-directed learning skills.	10	7.8	
Life -long learning	6	4.6	
Others	6	4.6	
Total	129	100	

Unequal participation, a time-consuming method, and difficulty in generating hypothesis to guide data gathering were enumerated as the disadvantages of the use of CBCR as a teaching method at LIMU by (57%) of sample participants. Table 4.

Table IV: Students' point of view of perceived disadvantages of the use of CBCR at LIMU medical curricula.

Perceived disadvantages	Number=129	%
1-Unequal Participation	27	20.9
2- Time consuming method of learning	26	20.1
3- Difficulty in generating hypotheses to guide data gathering	22	17.0
4-Sometimes, premature closure.	21	16.2
5- Inadequate resources.	19	14.7
6- Difficulty in prioritizing problems	14	10.8

Total	129	100

Most (93%) of the students had ability to make decisions affecting their daily work, and majority (87%) of them feel confident to develop their medical carrier. Nearly three-quarter (70%) of the participants agree that LIMU university dedicated to enhance their professional development through active learning. Table 5

Table V: Role of CBCR in the enhancement of professional development.

Skills developed by CBCR participants at medical school in LIMU	Total Number= 129	%
-Ability to make decisions affecting their daily work - Yes - No	120 9	93% 7%
-Confidence to develop medical carrier - Yes -No	 112 17	 87% 13%
-Dedication of LIMU to enhance professional development through active learning (PBL, CBCR.): - Yes - No - Don't know	 89 9 31	 69% 7% 24%

More than two -thirds (70.6%) of the students were satisfied about the use of CBCR as a teaching method in medical education. Table 6

Table VI: Satisfaction about use of CBCR in medical education.

Students' Satisfaction	Total Number= 129	%
Satisfaction about use of CBCR in medical curriculum: - Strongly satisfied. - Satisfied - Undecided - Dissatisfied. - Strongly dissatisfied	 18 73 27 5 6	 14% 56.6% 20.9% 3.9% 4.6%
Total	129	100

The current study revealed that nearly two-third of the participants (63.5%) agreed that CBCR was a better way of studying medicine. Table 7

Table VII: agreement of participants about the usefulness of the use of CBCR in medical education.

Students; point of view about usefulness of the CBCR	Total Number= 129	%
Strongly agree	23	17.9
Agree	59	45.7
Undecided	27	20.9
Disagree	13	10.1
Completely disagree	7	5.4
Total	129	100

Most of the participants (85%) will recommend the CBCR as a teaching method of the medical curricula, they either recommend, moderately, and strongly recommend to friends and colleagues. Table 8

Table VIII: Recommendation of Case -Based-Clinical Reasoning (CBCR) to friends or colleagues.

Recommendation to friends or colleagues	**Number**	**%**
Strongly recommend	23	17.8
Moderately recommend	47	36.4
Recommend	40	31.1
A little	16	12.4
Strongly not recommending	3	2.3
Total	**129**	**100**

Discussion:

The existing research examined the viewpoint of students and their contentment with the application of case-based clinical reasoning in the clinical phase of their medical education as a cognitive approach involving diverse methods for formulating, assessing, and validating diagnoses, analyzing the pros and cons of tests and treatments, and gauging the consequences of these cognitive achievements. Daniel (2019) expounded that clinical reasoning comprises both conscious and subconscious cognitive mechanisms that engage with contextual factors like the patient's individual conditions and preferences, along with the attributes of the clinical environment. Campell and Kassirer argued that clinical medicine encompasses more than just clinical thinking, encompassing thorough data gathering, comprehensive patient evaluations, empathy towards the sick, efficient patient interaction, and professional demeanour, among other factors (Palisano, Campbell, Harris, 2006 and Kassirer, 2010). The importance of clinical reasoning was also emphasized by Cooper who asserted that adepting clinical reasoning is crucial for upholding patient safety. Students and postgraduate trainees predominantly gain the knowledge, abilities, and conduct essential for effective clinical reasoning through practical learning and mentorship (Cooper, 2021).

Audétat's qualitative investigation identified the five typical challenges in clinical reasoning encountered by residents. These challenges include formulating hypotheses for guiding data collection, premature closure, prioritizing issues, creating a comprehensive overview of the clinical scenario, and developing a management strategy (Audétat et al., 2013). Cate recommended that the case-centered clinical reasoning training technique should concentrate on dual strategies. The first strategy involves constructing illness

scripts early in the educational program, commencing with uncomplicated cases and progressively advancing to more intricate scripts for retention. The second approach entails instilling a methodical, analytical reasoning practice, commencing with patient presentation scenarios and culminating in a determination concerning the diagnosis, the pathophysiology, and the necessary patient care interventions (Cate, 2018).

Boshuizen explicated that the manner in which medical students attain clinical reasoning abilities remains somewhat ambiguous, yet they inevitably acquire them, regardless of whether their curriculum includes targeted training (Boshuizen, 2000). Williams observed a significant disparity in reasoning aptitude among students at various stages of clinical experience and from different educational institutions. Even if reasoning capabilities naturally progress throughout medical training, it does not imply that educational schemes are incapable of enhancement (Williams et al., 2011). Schell provided a definition of clinical reasoning as a multifaceted process, through which distinct categories of clinical or professional reasoning have evolved over time, encompassing scientific, diagnostic, procedural, narrative, pragmatic, ethical, interactive, and conditional reasoning (Schell & Schell, 2018).

In our investigation, it was identified that an escalation in contentment is associated with an increase in the number of years of practical exposure. Chamberland put forward suggestions on guiding clinical reasoning instruction to students by enhancing the learning process through recollecting numerous patient interactions, recollecting similar scenarios as experience grows, establishing a basis for differential diagnosis utilizing anatomy, pathology, and organ systems in conjunction with semantic qualifiers such as age, gender, ethnicity, and primary complaint. Moreover, distinguishing between probable and less probable yet significant diagnoses, and comparing diagnoses by outlining essential historical inquiries and physical examination techniques in a structured manner were emphasized (Chamberland, 2015). Hruska elaborated on findings that suggest inexperienced learners tend to resort to rule-based reasoning solutions in intricate cases, characterized by a mode of analytical thinking focusing on presumed causes and effects, which is gradual and demanding. Conversely, seasoned clinicians persist in seeking cases from memory, displaying instant recognition and formulation of a hypothesis if the current patient's characteristics resemble those of a previously encountered illness script (Hruska et al., 2016).

Conclusion:

In our study we found that the advantages perceived by students regarding the implementation of case-based clinical reasoning (CBCR) as a pedagogical approach in medical curricula encompass its potential to foster the acquisition of clinical skills, teamwork, self-assurance, and critical thinking. The satisfaction expressed by students towards this approach plays a crucial role in its utilization as a pioneering teaching methodology. The advancement of educational innovation within the medical field requires early cultivation of a doctor-like mindset among students, with CBCR serving as a prime illustration of innovative teaching practices in medical education that can significantly impact the professional growth of learners.

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