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Medical Students' Clinical Knowledge of Integrated Management of Childhood Illness

A cross-sectional comparative study

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Abstract

Objectives: This study aimed to investigate and compare the clinical knowledge implications of the Integrated Management of Childhood Illness (IMCI) preservice education between pre-clerkship and junior clerkship medical students at Sultan Qaboos University, Muscat. ***Methods:*** This is an observational comparative cross-sectional study that was conducted between 1st June and 30th August 2022, at Sultan Qaboos University, Muscat. A self-administered questionnaire was utilized and included questions on sociodemographic data, duration of IMCI preservice training, and knowledge of the participants concerning the IMCI objectives and information on a range of childhood conditions. ***Results:*** A total of 97 medical students were included. The majority of the students (45.3%) had two lectures. The role of the IMCI approach in reducing childhood morbidity and mortality was advocated by the majority of the students (80.7% JCR, 73.4% pre-clerkship). The awareness of IMCI component of improving health system was higher in JCR as compared to pre-clerkship participants (P value=0.044). When compared to pre-clerkship students, JCR participants demonstrated a slightly higher awareness of skin pinch (p-value = 0.038), chest indrawing (p-value = 0.008), anemia assessment based on nail bed

examination (p-value=0.002), diagnostic assessment of malnutrition based on palm examination (p-value = 0.018), sucking capacity in breast feeding (p-value = 0.025), and vaccines such as tuberculosis (p-value=0.001) and pneumococcal (p-value = 0.018) and rotavirus vaccine (p-value=0.007). ***Conclusion:*** The majority of the students displayed good IMCI knowledge, and JCR students showed better knowledge as compared to pre-clerkship candidates.
Keywords**:** Integrated Management of Childhood Illness; Pediatrics; Childhood; Disease Management; Students; Education, medical, undergraduate; Oman.

Advances in Knowledge

- This study was the first conducted in Oman to evaluate the influence of Integrated Management of Childhood Illness (IMCI) pre-service education on the clinical knowledge of medical students.

Application to Patient Care

- Enhancing pre-service education in IMCI for undergraduate medical students will lead to improved patient care by strengthening their clinical knowledge and skills applied in practice.

Introduction

Infectious conditions disproportionately influence the health and wellness of underprivileged pediatric populations across the globe.[1] Accordingly, the World Health Organization (WHO) initiated a project to maintain the database of childhood diseases, including malaria, pneumonia, and diarrhea based on their prevalence in children under five years of age.[2] The findings from the contemporary literature revealed high preventable mortality rates in children under five years of age (5.2 million children), attributed to the increasing prevalence of infectious conditions, such as malaria, diarrhea, and pneumonia.[3] A recent analysis found that diarrhea affected 1.7 billion children worldwide, resulting in the deaths of 5.25×10^5 children.[4] Data indicated a 35.4% prevalence rate of malaria in children and the annual reporting of 151 million new malaria cases across the globe.[5,6] In Oman there is a widespread of childhood diseases such as diarrhea.[7] A decade ago, the Sultanate had large numbers of malaria cases but diarrhea was even more prevalent (about 20%).[7,8]

The Integrated Management of Childhood Illness (IMCI) is an innovative approach devised by the WHO to counter the high incidence of childhood diseases and their deleterious outcomes.[9] The primary aim of the IMCI intervention is to enhance comprehensive medical training and education among healthcare professionals to foster the overall health and wellness of pediatric populations. It also aims to enhance the nutrition and feeding practices in children to safeguard their health and reduce the occurrence of preventable illnesses.[10] The IMCI strategy promotes the precise recognition of childhood illnesses in outpatient settings within health facilities. It also ensures the suitable and comprehensive treatment of all significant conditions that affect young children. Additionally, it strengthens caregiver counseling and expedites the referral process for severely ill newborns and children. In home settings, it encourages appropriate care-seeking behaviors, improved nutrition, and support for early childhood development, prevention of illness, and the correct implementation and adherence to treatment.[9] Notably, the IMCI approach consists of three main components: improving the case management skills of healthcare providers, reinforcing health systems to offer high-quality care, and enhancing family and community health practices to promote overall health, growth, and development.[9]

A cross-sectional survey conducted in 95 countries revealed that the IMCI strategy was fully implemented in at least 90% of districts.[11] Notably, nations that fully implemented the IMCI strategy were 3.6 times more likely to achieve Millennium Development Goal 4 in comparison to countries that did not fully implement the strategy.[11]

The WHO recommends the implementation of IMCI training sessions for undergraduate students due to its potential role in improving their clinical knowledge.[12] The results from a recent cross-sectional study indicated the advantage of the IMCI approach in improving the case management and disease assessment expertise of undergraduate medical students.[13] These outcomes warrant the enhancement of medical education to effectively improve the clinical skills of medical students in concordance with the evolving healthcare demands of pediatric populations. IMCI was formally incorporated into Oman's healthcare system in 1999. In 2007, the IMCI was incorporated into the Medical Degree (MD) program curriculum at Sultan Qaboos University (SQU). The MD program at SQU is structured into three distinct phases. Phase 1, which

commences in the first year, concentrates on acquiring foundational knowledge. Phase II spans the second and third years, offering a comprehensive academic experience. Phase IIIA, starting at the beginning of the fourth year, is dedicated to the pre-clerkship phase, emphasizing clinical readiness. Lastly, Phase IIIB encompasses both junior and senior clerkships, extending through the fifth and sixth years, respectively, providing students with extensive practical experience in clinical settings. These well-defined phases provide students with a guided path as they progress through their medical education. IMCI was integrated into lectures of one hour duration during the second phase (phase 2). The aim of these lectures was to introduce students to the IMCI, its components, common childhood disorders, and treatment concepts. In phase 3, students have additional opportunities to practice the IMCI strategy at primary healthcare facilities. In addition, the IMCI was incorporated into the rotations' summative assessments.

Initiating IMCI preservice education during the early stages of medical school (phase II) may encounter challenges due to students' limited exposure to clinical practice in the earlier phases of their medical education. The primary challenge to the integration of IMCI into the MD program persists due to the absence of solid evidence substantiating its implementation, despite its incorporation into the Medical Degree (MD) program curriculum more than 15 years ago. Therefore, this study aims to determine the impact of Integrated Management of Childhood Illness (IMCI) pre-service education on pre-clerkship and junior clerkship medical students' clinical knowledge at Sultan Qaboos University, Muscat.

Methods

Study design

This comparative cross-sectional study was conducted between 1st June and 30th August 2022 at the college of medicine and health sciences at Sultan Qaboos University, Muscat. The inclusion criteria were undergraduate medical students in phase 3 (3A: pre-clerkship and 3B: junior-clerkship), who had attended at least one session on IMCI. Exclusion criteria were students who had never attended any IMCI sessions and those who declined to participate. Convenient sampling was used for recruitment. Eligible students were invited to participate and the co-investigators explained the purpose of the study. Informed written consent was obtained from those who agreed to participate. Furthermore, the process was anonymous, in order to maintain

the confidentiality of the students. The enrolled participants were assigned a unique number in chronological order. Ethical approval was obtained from the Medical Research Ethics Committee (MREC), College of Medicine and Health Sciences, Sultan Qaboos University.

Questionnaire

The eligible participants were invited to fill in a self-administered paper-based semi-structured questionnaire using a convenient sampling method. The questionnaire consisted of two parts. Part one was the sociodemographic characteristics, such as age, gender, educational level and duration of pre-service IMCI training received. The second part consisted of ten IMCI case-based close-ended questions addressing their clinical knowledge of the IMCI objectives (such as reduce morbidity and mortality of under five children, promote growth and development of child through counseling the mothers and caretakers) and components (i.e. improving case management skills of health workers, improving the health system and improving family and community practice).The questionnaire further included information on a range of childhood conditions, including anemia, pneumonia, and diarrhea, and their attributes (e.g., symptomatology) and disease prevention (e.g., vaccination). Permission to use the questionnaire was obtained from the corresponding author .[14] The questionnaire is presented in Appendix 1.

Sample size

The sample size was determined for a finite population in phase 3A and 3B (118 and 128 students, respectively), using the Krejcie & Morgan (1970) table.[15] A sample size of 95 students was required. Investigators utilized a convenient sampling approach to recruit the study subjects.

Statistical analysis

Data were analyzed using IBM SPSS Statistics software version 26. The sociodemographic characteristics and results were displayed as descriptive statistics in frequency tables and bar charts. The responses between the participant groups and relevant variable categories were tested for statistical significance by Chi square test of association. A p value of <0.05 was considered significant.

Results

A total of 97 medical students participated in this study. Respondents were between the ages of 20 and 24. A large number, 60 (61.9%) of respondents were females and 37 (38.1%) were males. The numbers of JCR and pre-clerkship students were 52 and 45, respectively. Remarkable variations in the number of IMCI training sessions were observed among the participants. About 28.9% of respondents received one lecture or tutorial, 45.3% received two lectures or tutorials, 1% received three lectures or more and 27.8% received practical sessions at family medicine rotation. The sociodemographic characteristics of participants and the duration of IMCI training are depicted in Table 1.

Knowledge of the IMCI's first and second objectives

The analysis of the first IMCI objective revealed the agreement of 73.4% of pre-clerkship and 80.7% of JCR participants, regarding the role of IMCI training sessions in reducing morbidity and mortality in pediatric populations. The second IMCI objective, which is the role of caregiver counseling in improving child growth, was advocated by 57.7% and 61.6% of pre-clerkship and JCR students, respectively; however, nearly one-third of students had no insight into their knowledge levels concerning the caregiver counseling implications in the developmental outcomes of the pediatric populations. Table 2 indicates the students' knowledge of the IMCI's first and second objectives.

Knowledge of the IMCI components

The outcomes of the second question concerning the role of IMCI components in improving family/community practice, healthcare systems, and the skills of healthcare workers are illustrated in Figure 1. The responses from 57.4% of pre-clerkship and 68% of JCR students indicated the influence of the first IMCI component on the skill improvement of healthcare workers. In addition, 38.3% of pre-clerkship and 68% of JCR students advocated the healthcare system improvement implications of the IMCI training sessions. However, 53.1% and 74.9% of the pre-clerkship and JCR students, respectively, indicated the community and family practice benefits of the IMCI training approach.

Knowledge of common childhood and vaccine-preventable diseases

Questions 3-8 were designed to investigate the clinical features, examination, and diagnostic implications of the IMCI training strategy. They particularly evaluated the clinical practice applications of the IMCI approach in the assessment of severe dehydration, malnutrition, anemia, pneumonia, and diarrhea. Table 3 presents the perceptions of a range of disease characteristics in the pre-clerkship and JCR participants. The findings revealed the advocacy of 66% and 78% of pre-clerkship and JCR participants regarding the significance of assessing the consciousness levels of pediatric patients with diarrhea. Most participants (66%-89.4% of pre-clerkship and 68-80% in JCR) provided the consensus to examine the general condition of diarrhea-affected children to improve their disease management effectively. The findings revealed that students possessed knowledge of skin pinch. Nevertheless, when compared to pre-clerkship students, JCR participants demonstrated a slightly higher awareness of this diagnostic assessment (82% versus 66%, p value=0.038).

Except for the breathlessness attribute, most of the JCR students were aware of the clinical features of pneumonia. Nearly 47% of pre-clerkship students were unaware of the significance of chest in-drawing, while approximately 43% of them knew this diagnostic attribute. Notably, a significant difference was observed in the knowledge of the clinical manifestation of pneumonia related to chest indrawing between pre-clerkship and JCR students (P value=0.008).

The JCR students were more aware of the clinical signs/manifestations of anemia. Nearly 66% of the pre-clerkship students were aware of the nail bed examination, while a higher percentage of the JCR students had awareness of the tongue, palm, and conjunctive assessments. Compared to the pre-clerkship students, JCR participants had a better knowledge and understanding of the diagnostic assessment of malnutrition, based on the systematic evaluations of growth factor charts, palms (p value=0.018), and ankle edema. The unconscious sign of dehydration was better understood by 82.4% of JCR students, compared to 73.3% of those with pre-clerkship enrolment. In comparison with the JCR participants, pre-clerkship students had a better insight into the assessment of skin tone loss, sunken eyes, and latency. Nearly 81% of the pre-clerkship candidates had a better knowledge of the general condition of infants, compared to 78% of the JCR participants. Approximately 80% of the JCR students had a better insight into the sucking capacity of infants/babies, in comparison to 72% of the pre-clerkship participants. Compared to the pre-clerkship enrollees, a higher percentage of JCR students knew about examining the

sucking capacity (80.4% versus 72.3%, P value=0.025)). The findings further revealed better knowledge among JCR students, concerning the characteristics of vaccine-preventable diseases in pediatric populations. For example, 78.4% of JCR students had knowledge about pneumococcal vaccine, compared to 45.7% of pre-clerkship students (p value=0.008). However, polio and measles-related awareness was found to be higher in pre-clerkship students compared to the JCR candidates though the difference was not statistically significant (p value=0.473). Similarly, a greater number of JCR students understood the danger signs of pediatric conditions, including unconsciousness, lethargy, convulsions, and vomiting. Figure 2 depicts the responses of the pre-clerkship and JCR students regarding the assessments of drinking inability, severe vomiting, convulsions, lethargy, and unconsciousness in children, with various disease conditions.

Discussion

The overall results of this cross-sectional study indicated a good IMCI knowledge in most participants and better IMCI knowledge among JCR respondents, compared to the pre-clerkship candidates. The higher engagement of the JCR students in the preservice IMCI training sessions, as well as the impact of seniority and greater clinical exposure in pediatric rotations, was the probable cause of their enhanced childhood disease management knowledge compared to those with pre-clerkship enrollment. The study findings revealed the knowledge of IMCI components and objectives among most participants. This finding is contrary to the results of Khatun et al., which indicated IMCI awareness among half of the respondents only.[14]

Approximately 60% of the participants in the present study had a thorough knowledge of pediatric diarrhea management in contrast to the outcomes of Joshi et al., which indicated a lack of awareness of diarrhea assessment in 55.5% of study subjects.[16] Our findings further revealed a thorough knowledge of the clinical attributes of pediatric pneumonia in the majority of JCR participants, comparing favorably with the pre-clerkship candidates. In addition, most students in our study had a sound knowledge of anemia assessment, in contrast to a study by Hasin et al..[14]

Most students in this study were found to have a concrete understanding of pediatric malnutrition-related growth charts. This outcome was contrary to the results of a prospective

single-arm study by Sahu et al. indicating a lack of growth chart assessment and monitoring in Puducherry, India.[17] The present study further revealed the knowledge of two-thirds of students concerning the malnutrition assessment of 2 months old infants via their ankle edema assessment. This finding challenged the outcomes of Joshi et al. which revealed a lack of malnutrition assessment knowledge among respondents.[16] Importantly, most students in the current study were found to be aware of severe dehydration manifestations, including loss of skin tone, dilated eyes, latency in memory responses, and unconsciousness. These findings concurred with the outcomes of Shaheen et al., indicating the knowledge of water intake recommendation, dehydration prevention, and dehydration definition among the majority of participants.[18] Findings of the study indicated insignificant differences regarding the knowledge of vaccine-preventable diseases between the study groups. The overall results revealed a thorough knowledge among most participants regarding the role of vaccination in preventing various disease conditions. The findings of Khatun et al. favored the current study results concerning the awareness of vaccine-preventable diseases, excluding mumps, among participants.[14] Our results also supported the concept of improving vaccination knowledge among medical students to reduce the incidence of communicable diseases in pediatric populations.[19,20]

Limitations

The primary limitation of this study lied in its cross-sectional design, which hindered the establishment of a causal relationship. In addition, the small sample size further restricted the generalizability of the analysis. Also, the results of this study were not devoid of possible recall bias based on the self-administered questionnaire. Importantly, the studies focusing on IMCI were limited, and the variability in the duration of IMCI training across different studies, made direct comparisons with the findings of the current study challenging. Finally, the absence of a pre-post intervention comparison could have influenced our findings.

Implications and recommendations

The findings of this study revealed a generally good comprehension of the clinical knowledge implications of pre-service IMCI training among undergraduate medical students. These results underscore the importance of enhancing the IMCI knowledge base of medical students to effectively manage infant morbidity and mortality rates, thereby promoting the overall growth

and development of pediatric populations. As this is the first study conducted in Oman about the influence of IMCI pre-service training on the knowledge of medical students, we anticipate that the current findings will contribute valuable data to the existing literature. Future research should employ qualitative group discussions to acquire data regarding medical students' knowledge of IMCI preservice training. These group discussions will assist in minimizing ambiguity in responses and adding clarity to the final results.

Conclusions

The IMCI approach is a holistic strategy to diagnose and manage efficiently a range of simple-to-complex childhood illnesses. Results from this study indicated an overall good understanding of the preservice IMCI training's clinical practice implications among undergraduate medical students. Probably due to a higher engagement of the JCR student group in the IMCI preservice training and family medicine and pediatric rotations, their IMCI-related knowledge was found to be stronger than the pre-clerkship students. These results advocate the need for improving the IMCI knowledge base of medical students to control infant morbidity and mortality rates effectively while improving the overall growth and development of pediatric populations. Future qualitative studies should evaluate these findings with wider student populations.

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Conflicts of Interest

The authors declare no conflict of interests.

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Authors' Contribution

ZA, MHK and MS conceptualized the study. ZA, MHK, SJ and MS designed the study. ZA and MHK collected the data and provided the resources. SJ analyzed the data. ZA, MHK and SJ drafted the manuscript. MS reviewed the manuscript. MHK and MS supervised the work. All authors approved the final ve

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Table 1: Sociodemographic Characteristics

Variable	Categories	Frequency	Percent (%)
Age	20	1	1
	21	12	12.4
	22	41	42.3
	23	36	37.1
	24	7	7.2
Gender	Male	37	38.1
	Female	60	61.9
Educational level	Phase 3A pre-clerkship	45	46.4
	Phase 3B JCR	52	53.6
Pre-service IMCI training duration	1 lecture/tutorial	28	28.9
	2 lectures/tutorials	41	42.3
	≥3 lecture/tutorial	1	1
	Practical sessions at the JCR family medicine rotation	27	27.8

Table 2: Student groups' responses based on their knowledge of the IMCI's first and second objectives

	Students with knowledge of the IMCI's first objective* n (%)	**Students with no knowledge of the IMCI's first objective n (%)**	**Students without any awareness of their knowledge of the IMCI's first objective n (%)**	**P-Value**	**Students with knowledge of the IMCI's second objective** n (%)**	**Students with no knowledge of the IMCI's second objective n (%)**	**Students without any awareness of their knowledge of the IMCI's second objective n (%)**	**P-Value**
Pre-clerkship (n=45)	33 (73.4)	2 (4.4)	10 (22.2)	0.624	26 (57.7)	2 (4.4)	17 (37.9)	0.745
JCR (n=52)	42 (80.7)	1 (1.9)	9 (17.4)		32 (61.6)	4 (7.7)	16 (30.7)	

**First objective: To reduce morbidity and mortality of under five children*
***Second objective: To promote growth and development of child through counseling the mothers and caretakers*

Table 3: Responses of student groups concerning the diagnostic assessment of diarrhea, pneumonia, anemia, malnutrition, severe dehydration, difficulty in breastfeeding, and vaccine-preventable diseases

Attributes	Characteristics	Pre-clerkship			JCR			P value
		Yes	No	I don't know	Yes	No	I don't know	
Examination of diarrhea	Level of consciousness	66.0%	6.4%	27.7%	78.0%	2.0%	20.0%	0.228
	The general condition of the body	89.4%	0.0%	10.6%	80.0%	0.0%	20.0%	0.159
	Skin pinch	66.0%	10.6%	23.4%	82.0%	0.0%	18.0%	0.038
	Examination of eye	61.7%	6.4%	31.9%	68.0%	8.0%	24.0%	0.532
Clinical features of pneumonia	Breathlessness	78.7%	6.4%	14.9%	78.0%	0.0%	22.0%	0.144
	Cough	83.0%	4.2%	12.8%	84.2%	2.2%	13.6%	0.389
	Increased respiratory rate	76.6%	2.1%	21.3%	80.0%	4.0%	16.0%	0.556
	In-drawing of chest	42.6%	10.6%	46.8%	68.0%	0.0%	32.0%	0.008
Anemia assessment	Examination of conjunctiva	76.6%	6.4%	17.0%	82.0%	0.0%	18.0%	0.163
	Examination of the nail bed	40.4%	31.9%	27.7%	66.0%	6.0%	28.0%	0.002
	Examination of the palm hand	59.6%	8.5%	31.9%	72.0%	2.0%	26.0%	0.238
	Examination of tongue	40.4%	19.1%	40.5%	48.2%	7.8%	44.0%	0.204
Pediatric assessment for malnutrition	Examination of ankle edema	53.2%	17.0%	29.8%	62.4%	7.3%	29.3%	0.603
	Examination of the palm	25.5%	34.1%	40.4%	52.0%	16.0%	32.0%	0.018
	assess the degree of malnutrition for the growth chart	93.6%	0.0%	6.4%	86.0%	0.0%	14.0%	0.331
Signs of severe dehydration	Unconsciousness in child	72.3%	8.5%	19.2%	82.4%	0.0%	17.7%	0.264
	Latency	80.9%	2.1%	17%	76.5%	0.0%	21.5%	0.914
	Sunken eyes	91.5%	0%	8.5%	78.4%	2.0%	19.6%	0.214
	Loss of skin tone	68.1%	10.6%	21.3%	62.7%	11.8%	25.5%	0.942
Examination of difficulty in breastfeeding	The general condition of the baby	80.9%	0%	19.1%	78.4%	2.0%	19.6%	0.580
	Sucking capacity	72.3%	12.8%	14.9%	80.4%	0%	19.6%	0.025
	Physical attachment of baby with mother	57.4%	6.4%	36.2%	70.6%	2.0%	27.5%	0.341
Vaccine-preventable diseases	Tuberculosis	45.7%	26.1%	28.3%	80.4%	3.9%	15.7%	0.001
	Polio	87.0%	2.2%	10.9%	84.3%	0.0%	15.7%	0.473
	Measles	89.1%	0.0%	10.9%	80.4%	2.2%	17.4%	0.568
	Diphtheria	73.9%	2.2%	23.9%	82.4%	0.0%	17.6%	0.364
	Whooping cough	80.4%	2.2%	17.4%	85.4%	2.0%	12.6%	0.554
	Tetanus	69.6%	6.5%	23.9%	84.3%	0.0%	15.7%	0.072

	Hepatitis B	76.1%	8.7%	15.2%	80.0%	2.8%	17.2%	0.301
	Mumps	84.8%	0.0%	15.2%	87.0%	2.2%	10.9%	1.000
	Rubella	80.4%	2.2%	17.4%	80.9%	0%	19.1%	0.522
	Pneumococcal (conjugate)	45.7%	10.9%	43.4%	78.4%	3.9%	17.6%	0.008
	Haemophilus influenza type B	63.0%	10.9%	25.1%	80.4%	3.9%	15.7%	0.111
	Rotavirus	37.0%	8.7%	54.3%	58.8%	17.6%	23.5%	0.007

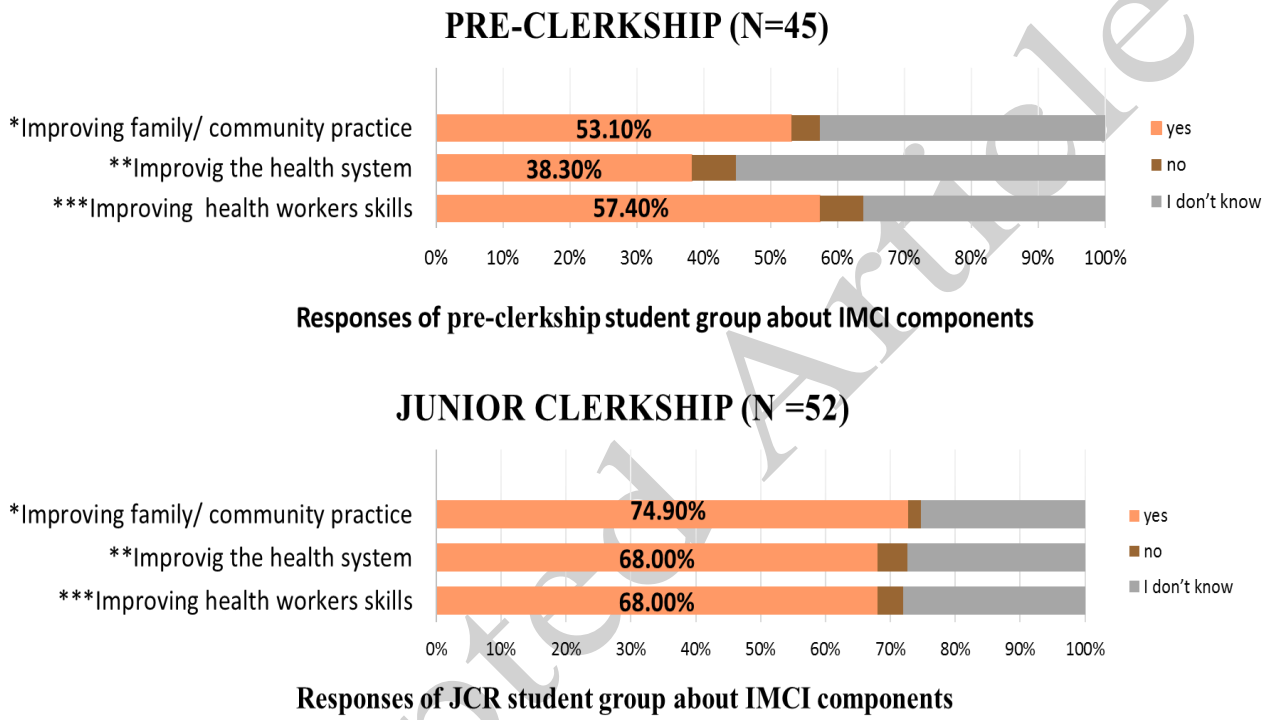

Figure 1: Responses of student groups regarding IMCI components.
**P value=0.185*
***P value=0.044*
****P value=0.588*

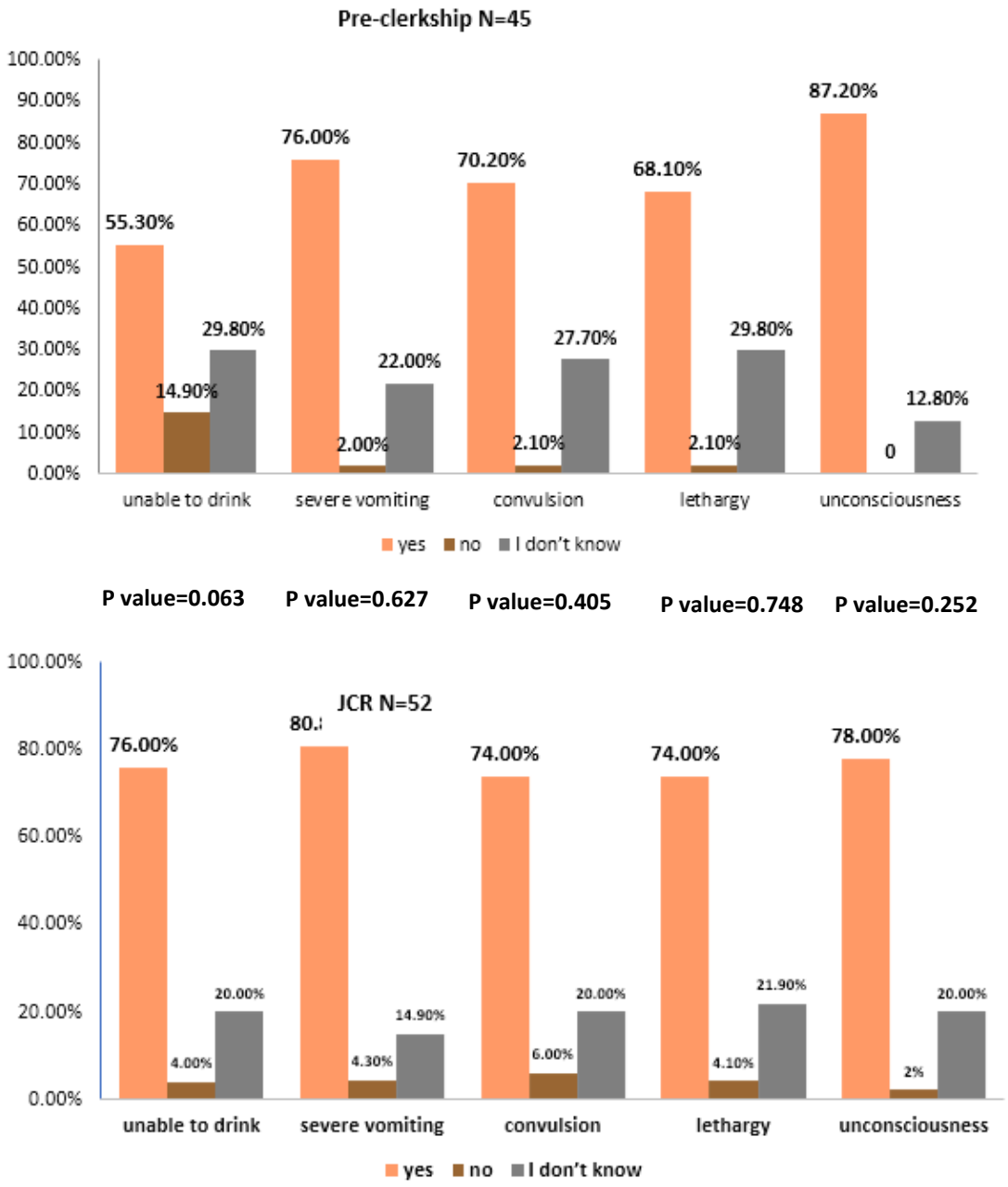

Figure 2: Responses of student groups regarding the clinical signs of pediatric conditions.