ORIGINAL RESEARCH

Perceptions of the final year medical students and recent graduates of a medical school in Sri Lanka regarding the application and relevance of preclinical sciences in their clinical training and practice

J H A S Chamanthi[1], S M G S A Bandara[1], S M G S M W Bandara[1], B S L Biyanwila[1], B G M S Bombugala[1], R P N P Chandrasekara[1], H M A G Karunarathne[1], C S Paththinige[1]

[1]*Faculty of Medicine and Allied Sciences, Rajarata University of Sri Lanka*

Abstract

Objective: This study was conducted to determine perceptions regarding retention, application, and relevance of pre-clinical sciences in clinical training and practice, among final-year medical students and intern medical officers (IMOs) who graduated from the Rajarata University of Sri Lanka.

Methods: A descriptive cross-sectional study was conducted using an online questionnaire, and the data were analyzed using descriptive statistics and t-test.

Results: A total of 211; 110 final-year students (52.1%) and 101 IMOs (47.9%) responded. Perceived knowledge retention was highest in Physiology (5.73±1.81/10), followed by Anatomy (5.12±1.7/10) and Biochemistry (3.99±1.97/10). The majority reported higher retention of clinically relevant concepts (79.6%) and a gradual decline in retained knowledge during clinical years (75.8%). Content areas with the highest perceived clinical relevance were neuroanatomy, abdomen, pelvis and perineum, radiological anatomy, and head and neck in Anatomy, blood, gastrointestinal and hepatobiliary, and endocrine Biochemistry and physiology of cardiovascular, respiratory, endocrine, urinary, gastrointestinal and reproductive systems. Knowledge on biomolecules, metabolism, molecular genetics, histology, embryology and genetics were considered least clinically relevant. Pre-clinical sciences were perceived as fundamental for clinical training by the majority. They perceived that Anatomy and Physiology were applied more in diagnosis and patient management than Biochemistry. The majority expressed the need to revisit and re-evaluate Anatomy and Physiology during the clinical phase.

Conclusion: A high level of relevance of pre-clinical sciences in many content areas was perceived by the participants. The study highlights the need for an early introduction to the clinical concepts within the preclinical curriculum and revisiting preclinical sciences during clinical training.

Key words: Preclinical sciences, Basic Sciences, Clinical relevance, Knowledge retention

DOI: https://doi.org/10.4038/slaj.v8i1.225

Sri Lanka Anatomy Journal 2024; 8(I): 21–29

Corresponding author
CS Paththinige
E-mail: pcsampath@med.rjt.ac.lk

https://orcid.org/0000-0001-9214-7808

Introduction

Advanced medical sciences are built on the solid foundation of Anatomy, Physiology, and Biochemistry that are traditionally known as 'basic sciences' or 'pre-clinical sciences' in the medical curricula. However, their role in clinical training and practice has been debated frequently (1-4). Knowledge of basic sciences is thought to improve the understanding and retention of information in clinical sciences by making appropriate connections and facilitating the transfer of knowledge to the clinical setting. Long-term retention of basic science knowledge and its use in clinical reasoning and appraisal is shown to be promoted by the early introduction to the clinical material and integrated curriculum approaches (5,6). In many traditional medical curricula, one to two whole years of undergraduate teaching and training are dedicated to studying basic sciences. However, according to common experience, the knowledge retention of basic sciences gradually weakens beyond these yearly years, making their application difficult in clinical training. Medical educators and scientists are also concerned that the application of basic science knowledge is not commonly highlighted by clinicians in their clinical practice so medical students do not perceive the relevance of these disciplines in the clinical decision-making process (3,7-9). Amidst all these concerns, the critical role of basic sciences even in modern medical education, has been described in two aspects. First, basic knowledge regarding the structure and function of the human body is necessary for clinical application by facilitating the identification/recognition of abnormal structure and function. Secondly, this fundamental knowledge is required to develop effective thinking skills for systematic methods of inquiry, logical reasoning, critical analysis, problem-solving, and decision-making, which are essential to effective patient management (10). Understanding the relevance and application of basic sciences in clinical training and practice from the beginning of basic sciences learning is expected to increase the student's interest in learning these subjects. Therefore, it is necessary to be aware of the applications and relevance of different content areas in basic sciences in the clinical setting, especially in the routine clinical practice of a basic doctor.

The Faculty of Medicine and Allied Sciences, Rajarata University of Sri Lanka (FMAS, RUSL) follows a conventional curriculum model, in which the preclinical sciences (Anatomy, Biochemistry, and Physiology) are taught in the first one and half years of the academic program, with horizontal integration among these three disciplines and early theoretical introduction to the basic clinical materials. The three subjects are mainly taught employing didactic lectures, tutorials, and practical classes, and there is no interaction with real patients during this 'pre-clinical' period. Moreover, there are minimal formal inputs of these three subjects during their clinical years, so there is little vertical integration. Senior medical students and teaching clinicians have informally expressed their concerns regarding poor retention of basic sciences as the students progress in their clinical training. Therefore, this study was conducted to determine the perceptions of the final-year medical students and intern medical

officers (IMOs) who graduated from FMAS, RUSL regarding knowledge retention, and the application and relevance of preclinical sciences to current clinical training and practice.

Material and Methods

A descriptive cross-sectional study was conducted among final-year medical students of the FMAS, RUSL, and the IMOs who graduated from the FMAS, RUSL. A self-administered questionnaire was developed by the researchers based on the research objectives, using the information in the previous studies of similar interest available in scientific literature. The questionnaire was prepared in English as a Google form, pilot-tested, and administered online. The study group was approached through social media and the link to the Google form was distributed. The participants were requested to provide consent by responding to a question in the Google form. The Google form consisted of the following sections in line with the specific objectives of the research; perceptions regarding pre-clinical teaching and learning, retention of basic sciences knowledge, clinical relevance of pre-clinical disciplines and their content areas, and the application of basic science knowledge in clinical training. The participants were asked to mark the perceived amount of retained knowledge in each preclinical subject on a scale from 0 to 10. Lists of broad content areas in preclinical disciplines were prepared consulting the subject experts in three preclinical departments. The participants marked the perceived clinical relevance of each of the content areas on a scale from 'not relevant' to 'highly relevant'. They were also asked to select in which clinical specialties and subspecialties the knowledge in each of the preclinical subjects was mostly applied during clinical training. Collected data were coded and exported to the Statistical Package for Social Sciences (SPSS) worksheet for analysis. Ethics approval for the study was obtained from the Ethics Review Committee, FMAS, RUSL.

Results

A total of 211; 110 final-year students (52.1%) and 101 IMOs (47.9%) responded. The majority (63.5%) of the respondents were females.

Perceived retention of knowledge in Anatomy, Physiology, and Biochemistry

On a scale from 0 to 10, perceived retention of knowledge was highest in Physiology (5.73 $\pm$ 1.81), followed by Anatomy (5.12 $\pm$ 1.74), and was lowest in Biochemistry (3.99 $\pm$ 1.97). The majority (79.6%) stated that they remember the clinically relevant content areas in each of the preclinical disciplines, but not the fine details of contents, and the amount of content retained in preclinical subjects gradually dropped during the clinical years of the MBBS program (75.8%). There was no statistically significant difference in the perceived amount of retained knowledge in Anatomy, Physiology, or Biochemistry between males

and females and between final-year students and IMOs.

Perceived clinical relevance of the different broad content areas in Anatomy, Physiology and Biochemistry

The content areas that were most highly rated in Anatomy, with more than 40% of the respondents rating each as 'highly relevant' for clinical training and practice include neuroanatomy, anatomy of the abdomen, anatomy of the pelvis, and the perineum, radiological anatomy, anatomy of the head and neck, and the thorax in the descending order of frequency (Figure 1A). Histology, embryology, and genetics were rated as either 'little relevant' or 'not relevant' by 58.8%, 49.3%, and 41.7% of the respondents respectively. Blood, gastrointestinal and hepatobiliary biochemistry, endocrine biochemistry, and urinary biochemistry were the content areas with the highest perceived clinical relevance in Biochemistry. Among the 211 respondents, 70.1%, 63.5% and 35.1% rated the biomolecules, molecular genetics, and metabolism as 'little' or 'not relevant' respectively (Figure 1B). All the content areas in Physiology showed a high perceived relevance with the highest frequencies for cardiovascular physiology, respiratory physiology, blood, and endocrine physiology (Figure 1C).

Perception regarding the Anatomy, Physiology, and Biochemistry in clinical teaching, training, and practice

The majority of the respondents 'strongly agreed' that Anatomy and Physiology are fundamental for good clinical training and practice (61.4% and 63.8% respectively). They perceived (either 'strongly agreed' or 'agreed') that Anatomy and Physiology were applied more in diagnosis (90.9% and 91.8% respectively) and patient management (91.9% and 91.0%), than Biochemistry (diagnosis – 56.3%, management – 61.9%). The majority expressed the need to revisit and reassess Anatomy (82.0% and 53.8% respectively) and Physiology (77.7% and 54.3% respectively) during the clinical years of the MBBS program (Figure 2).

Application of knowledge in Anatomy, Physiology, and Biochemistry in clinical training in different specialties and subspecialties

The respondents stated that the Anatomy knowledge was mostly applied in clinical training in general surgery (97.6%), obstetrics and gynecology (92.8%), neurosurgery (92.8%), orthopedic surgery (92.8%), radiology (92.8%) and ophthalmology/otolaryngorhinology (ENT) (89.0%).

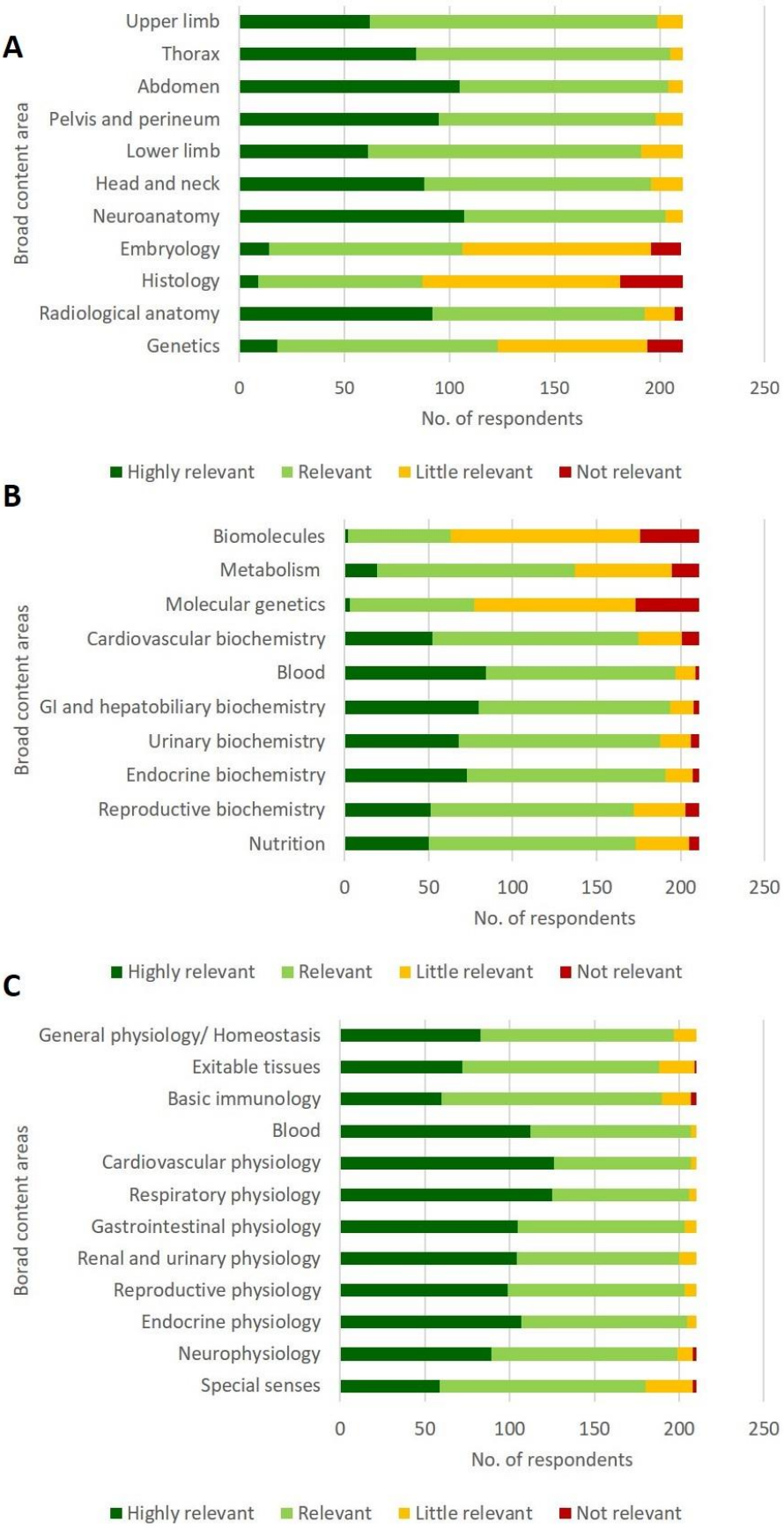

Figure 1: Perceived clinical relevance of the different broad content areas in (A) Anatomy, (B) Biochemistry, and (C) Physiology

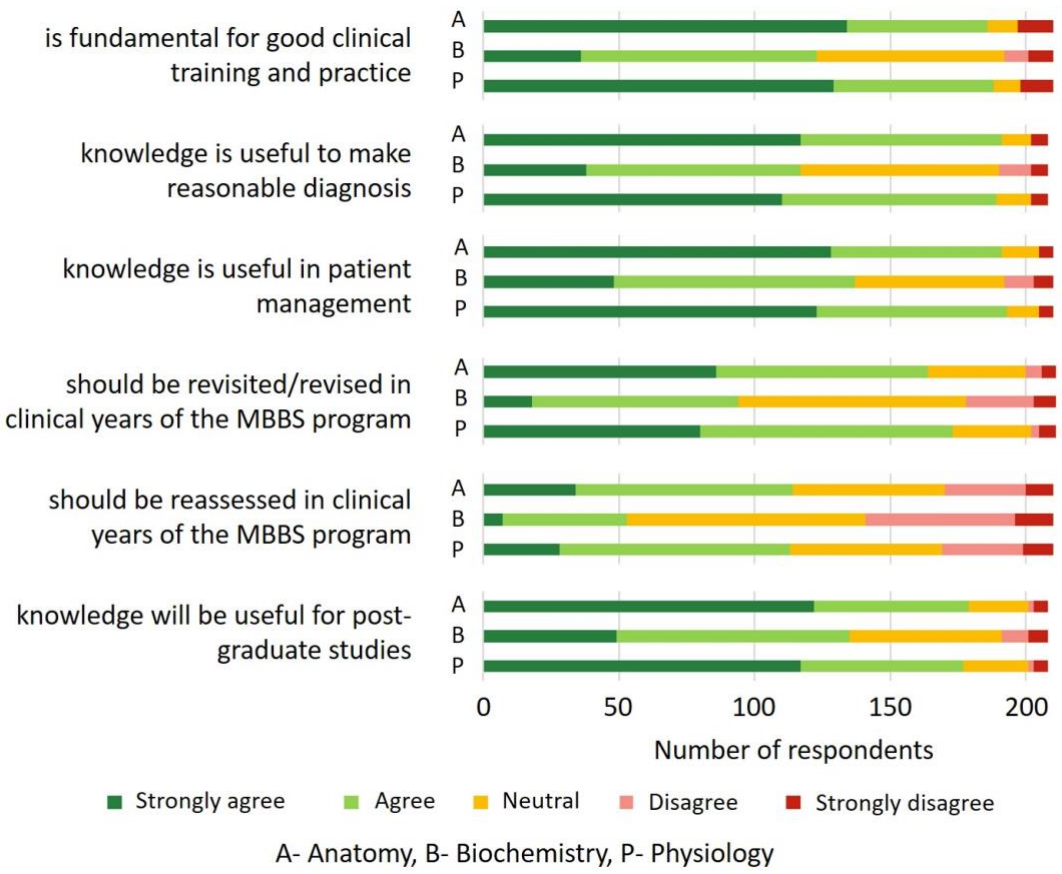

Figure 2: Perception regarding preclinical sciences in clinical teaching, training, and practice

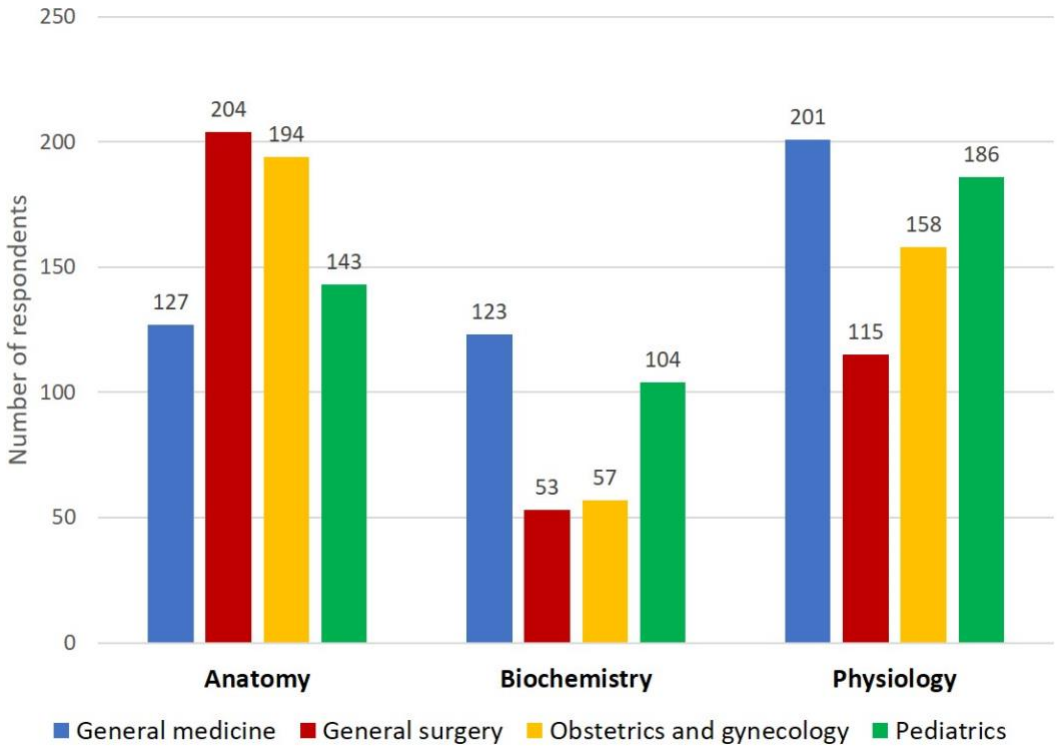

Figure 3: Application of knowledge of preclinical sciences in clinical training

Knowledge in Biochemistry was mostly applied in general medicine (58.9%), clinical pathology (52.6%), pediatrics (49.8%), and nephrology/urology (42.6%). Clinical specialties/subspecialties where Physiology knowledge was mostly applied in training were general medicine (96.2%), pediatrics (89.0%), cardiology (88.0%), respiratory medicine (87.6%), nephrology/urology (82.8%), and neurology (79.9%). Application of the knowledge in three preclinical disciplines in the four major specialty training (i.e. general medicine, general surgery, obstetrics and gynecology, and pediatrics) as perceived by the respondents is presented in Figure 3.

Discussion

This study investigated the perceptions of final-year medical students and recent graduates (intern medical officers) at a Sri Lankan medical school regarding the application and relevance of preclinical sciences (Anatomy, Physiology, and Biochemistry) in their clinical training and practice. Our findings corroborate with previous research conducted internationally, demonstrating a generally positive perception of the importance of preclinical sciences for clinical practice (11-14). However, our study also reveals nuances that might be specific to the Sri Lankan context that warrant further exploration. Our finding that Anatomy and Physiology were perceived as having a higher clinical relevance aligns with studies from India, Saudi Arabia, and Australia (11,14,15). This emphasis on Anatomy and Physiology might be due to the strong foundation they provide for visualization and understanding of pathophysiological mechanisms of diseases and clinical procedures. Still, content overload in Anatomy was a common concern among medical students as reported in studies conducted in Asian settings (11,12,15). Students reported difficulty retaining detailed knowledge in all three disciplines, with the lowest retention in Biochemistry. This aligns with findings from Punjab, India, and Saudi Arabia (11, 15). Possible reasons for poor retention in Biochemistry, as well as in other basic science subjects could be rote memorization-based teaching approaches or a lack of spaced repetition strategies. The perceived lower retention and relevance of Biochemistry compared to Anatomy and Physiology in the present study and previous studies (11,15, 16) deserves further investigation. Studies comparing course structures and teaching methodologies in Sri Lanka with countries where pre-clinical sciences, specifically Biochemistry were perceived as more relevant could provide valuable insights. Sri Lankan medical educators might also benefit from exploring active learning techniques and incorporating clinical case studies throughout the preclinical curriculum to enhance long-term knowledge retention.

A key strength of this study is its focus on a Sri Lankan medical school, providing valuable insights into the unique perspective of students and graduates within this specific educational and healthcare context. However, focusing on a single institution limits the generalizability of the findings. Future research involving multiple medical schools across Sri Lanka would provide a more comprehensive picture.

Still, our findings highlight the need for curricular reform to bridge the gap between preclinical and clinical training. While the current curriculum structure separates these disciplines, students clearly see the value of preclinical knowledge in clinical settings. Implementing an integrated curriculum that emphasizes the application of preclinical knowledge in clinical scenarios could be beneficial. This could involve introducing clinical cases early in the preclinical years and using problem-solving exercises that bridge the gap between theoretical knowledge and practical application.

Conclusions

This study demonstrates that final-year medical students and intern medical officers in Sri Lanka value the importance of preclinical sciences for clinical practice. However, challenges exist with knowledge retention and the perceived relevance of some content areas. These findings advocate for curricular reform that emphasizes the integration of preclinical and clinical sciences, fostering a deeper understanding of the application of basic sciences in clinical scenarios. Future research should explore effective teaching strategies to enhance knowledge retention, address the specific curricular needs of Sri Lankan medical students, and investigate the factors influencing the perceived relevance of preclinical disciplines.

References

1. Dahle LO, Brynhildsen J, Behrbohm Fallsberg M, Rundquist I, Hammar M. Pros and cons of vertical integration between clinical medicine and basic science within a problem-based undergraduate medical curriculum: examples and experiences from Linköping, Sweden. Med Teach. 2002; 24: 280–285.

2. de Bruin AB, Schmidt HG, Rikers RM. The role of basic science knowledge and clinical knowledge in diagnostic reasoning: a structural equation modeling approach. Acad Med. 2005; 80: 765–773.

3. Pangaro L. The role and value of the basic sciences in medical education: the perspective of clinical education–students' progress from understanding to action. J Int Assoc Med Sci Educ. 2006; 20: 307–313.

4. Grande JP. Training of physicians for the twenty-first century: role of the basic sciences. Med Teach. 2009; 31: 802–806.

5. Dahle LO, Brynhildsen J, Behrbohm Fallsberg M, Rundquist I, Hammar M. Pros and cons of vertical integration between clinical medicine and basic science within a problem-based undergraduate medical curriculum: examples and experiences from Linköping, Sweden. Med Teach. 2002; 24: 280–285.

6. Ling Y, Swanson DB, Holtzman K, Bucak SD. Retention of basic science information by senior medical students. Acad Med. 2008; 83, Suppl: S82–S85.

7. Patel VL, Groen GJ, Scott HM. Biomedical knowledge in explanations of clinical problems by medical students. Med Educ. 1988; 22: 398–406.

8. D'Eon MF. Knowledge loss of medical students on first year basic science courses at the University of Saskatchewan. BMC Med Educ. 2006; 6: 5. doi:10.1186/1472-6920-6-5

9. Khalid BA. The current status of medical education in the Gulf Cooperation Council countries. Ann Saudi Med. 2008; 28: 83–88.

10. Finnerty EP, Chauvin S, Bonaminio G, Andrews M, Carroll RG, Pangaro LN. Flexner revisited: the role and value of the basic sciences in medical education. Acad Med. 2010; 85: 349–355.

11. Gupta S, Gupta AK, Verma M, Kaur H, Kaur A, Singh K. The attitudes and perceptions of medical students towards basic science subjects during their clinical years: A cross-sectional survey. Int J Appl Basic Med Res. 2014; 4: 16-19.

12. Yograj S, Bhat AN, Gupta RK, Gupta G, Kalsotra L. Role of basic sciences in making of a clinician: Perspectives of medical students from North India. J Educ Health Promot. 2019; 8. doi: 10.4103/jehp.jehp_66_19.

13. Aborajooh E, Al-Taher R, Tarboush NA, Al-Ani A, Qasem N, Ababneh S, et al. A cross-sectional study of basic education influence on the clinical training: Attitudes and perception among Jordanian medical students. Ann Med Surg. 2020; 60: 456-461.

14. Malau-Aduli BS, Alele FO, Heggarty P, Teague PA, Sen Gupta T, Hays R. Perceived clinical relevance and retention of basic sciences across the medical education continuum. Adv Physiol Educ. 2019; 43(3): 293-299.

15. Alam A. How do medical students in their clinical years perceive basic sciences courses at King Saud University? Ann Saudi Med. 2011; 31(1): 58-61.

16. Rudland JR, Rennie SC. The determination of the relevance of basic sciences learning objectives to clinical practice using a questionnaire survey. Med Educ. 2003; 37(11): 962-965.