<span style="background:red;color:white">**ORIGINAL ARTICLE**</span>

# Medical Students' Perceptions on the Adequacy and Effectiveness of Pharmacology Teaching during Preclinical Years

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## ABSTRAK

*Pembelajaran farmakologi semasa tahun praklinikal adalah penting bagi pelajar perubatan untuk membuat pilihan rasional dalam memilih rawatan yang sesuai untuk pesakit pada masa akan datang. Oleh itu, kajian ini menentukan kecukupan dan keberkesanan pengajaran farmakologi dalam program perubatan prasiswazah di Pusat Perubatan Universiti Kebangsaan Malaysia (PPUKM). Cadangan penambahbaikan kurikulum juga dikenalpasti. Soal selidik dalam talian mengenai persepsi terhadap metodologi pengajaran farmakologi telah diedarkan kepada sejumlah 459 pelajar perubatan dari tahun ke-4 dan ke-5 di PPUKM. Soal selidik meliputi demografi, persepsi tentang pengajaran farmakologi, kaedah pengajaran-pembelajaran yang ideal untuk pembelajaran farmakologi, topik farmakologi yang berguna untuk amalan klinikal masa depan, topik farmakologi yang paling menarik dan cadangan untuk penambahbaikan. Peratusan responden adalah 46.4% dan majoriti peserta adalah perempuan (65.7%). Kebanyakan pelajar bersetuju bahawa pembelajaran interaktif lebih membantu daripada kuliah didaktik (88.0%). Seramai tujuh puluh peratus pelajar melaporkan bahawa kuliah farmakologi semasa tahun praklinikal telah membantu semasa tahun-tahun klinikal. Peratusan pelajar yang bersetuju bahawa pengajaran farmakologi semasa praklinikal adalah mencukupi untuk amalan klinikal adalah 47.0%. Tidak ada kaitan antara pembolehubah demografi (jantina, bangsa, tahun pengajian dan latar belakang keluarga perubatan) dan minat di dalam farmakologi (p>0.05). Kesimpulannya, pengajaran farmakologi semasa tahun praklinikal dianggap berkesan dan berguna untuk amalan klinikal pelajar. Lebih banyak sesi pengajaran farmakologi dalam tahun-tahun klinikal telah dicadangkan yang mungkin boleh meningkatkan kecukupan pengajaran*

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*farmakologi.*

*Kata kunci:    farmakologi, kaedah, pelajar, pengajaran, pembelajaran, perubatan*

## ABSTRACT

Pharmacology teaching during preclinical years is important for medical students to make rational choices in choosing suitable treatment for patients in future. Therefore, the present study determined the adequacy and effectiveness of pharmacology teaching in the undergraduate medical program at the Universiti Kebangsaan Malaysia Medical Center (UKMMC). Suggestions for improvement of the curriculum were also identified. An online questionnaire on the perceptions of pharmacology teaching methodology was distributed to a total of 459 medical students in 4th and 5th year  at UKMMC. The questionnaire covered demographics, perceptions about pharmacology teaching, the ideal teaching learning methodology for learning pharmacology, pharmacology topics which are useful for future clinical practice, the pharmacology topic which was most interesting and recommendations for improvement. The response rate was 46.4% and majority of the participants were females (65.7%). Most of the students agreed that interactive learning was more helpful than didactic lectures (88.0%). Seventy percent of the students reported that pharmacology lectures in the preclinical years were helpful during the clinical years. Percentage of students who agreed that pharmacology teaching in their preclinical was adequate for their clinical practice was 47.0%. There was no association between demographic variables (gender, race, year of study and medical family background) and interest in pharmacology (p>0.05). In conclusion, the pharmacology teaching during preclinical years was perceived to be effective and useful for students' clinical practice. More pharmacology teaching sessions in clinical years was suggested which may improve adequacy of pharmacology teaching.

Keywords:    learning, medical, methodology, pharmacology, student, teaching

## INTRODUCTION

Pharmacology is taught in medical school to enable undergraduate medical students to take rational therapeutic decisions in clinical practice (Vasundara et al. 2010). It is essential for medical students to understand the core pharmacological principles for effective management of diseases and to relate and apply them in the practice of medicine (Sekhri 2012). Pharmacology is also important to train medical students to become critical thinkers, and to be able to use the information in clinical situations.

Continuous review and modifications are essential to ensure the

effectiveness of teaching and learning methodology in pharmacology. One of the approaches to review teaching and learning methodology in undergraduate programs around the world is by determining students' perceptions (Bhosale et al. 2013). Students' perceptions are used to identify which teaching strategy students perceived to be the most effective means to teach pharmacology (Gregson et al. 2010).

The pharmacology subject in Universiti Kebangsaan Malaysia Medical Centre (UKMMC) is mainly taught in the preclinical years, i.e. during the first and second year of medical school. The teaching learning methodology includes concept lectures, meet expert sessions (MES), problem-based learning (PBL), self-learning packages (SLP) and computer-aided learning (Medical Undergraduate Guide Book 2018).

The basic principle of pharmacology in UKMMC is taught under the module 'Membrane and Receptor' which comprises of concepts of pharmacokinetic and pharmacodynamics. Pharmacology is also taught within the modules of the various body systems. The concept lecture is the main teaching methodology. In addition, pharmacology is also incorporated into PBL sessions. There is no formal pharmacology teaching in clinical years. Pharmacology input that was obtained by students was from the clinical lecturers in the different clinical postings.

The aim of the present study was to determine the perceptions of clinical year medical students of their pharmacology teaching, and to determine whether the pharmacology teaching in the preclinical years is adequate and effective for the students when they enter their clinical years. The findings of this study could be used to improve the delivery of this subject.

## MATERIALS AND METHODS

A cross-sectional study was conducted among fourth and fifth year undergraduate medical students at UKMMC. A total of 459 students were selected, which comprised 219 fourth year students and 240 fifth year students. The list of student registration numbers and contact details were obtained from the leaders of respective year. Students were invited to participate in the study using an online questionnaire.

There are three groups of clinical year students at UKMMC. The first group of students comprised the main stream UKM Medical Degree program (UKM). The second group comprised individual from the franchise UKM Medical Degree program who undertook their pharmacology teaching in Allianze Universiti College of Medical Sciences (UKM/AUCMS) using the same curriculum as UKM. The third group comprised students who enrolled in the UKM-UNPAD program who obtained their pharmacology teaching in the Universiti Padjadjaran (UNPAD), Indonesia. The respondents in this study included the UKM (n=356) and UKM/AUCMS (n=103) students since these groups

had the same curriculum. Students from UKM-UNPAD program were excluded because they used a different curriculum. The other exclusion criteria were preclinical students, and 3rd year medical students. Third year students were excluded because they may not be able to provide accurate perceptions on pharmacology teaching since they have just finished preclinical years and have just started their clinical years. Prior consent was obtained from all participants. This study was approved by the Universiti Kebangsaan Malaysia Research Ethics Committee (UKM PPI/111/8/JEP-2017-316).

The questionnaire was adapted from Manjunath et al. (2015) and modified to suit the medical curriculum of UKMMC. A pilot test was done with 37 students to test the validity and reliability of the questionnaire. The questionnaire showed good reliability with Cronbach's alpha value of more than 0.9 for each questionnaire items and an overall value of 0.933. Content validity was confirmed by obtaining verbal feedback from pilot test subjects. The pilot test subjects commented that the statements in the questionnaire were direct and easy to understand. Upon completion of pilot study, the questionnaire was then reformatted into an online arrangement using Google Form. Recruitment period was from 1st August-6th September 2017. Google form link was disseminated to all students via Whatsapp application. Student's matric number was used as the identifier which also prevent duplicated response.

The questionnaire (Appendix) included 5 sections; (A) demographics, (B) attitude and perception about pharmacology, (C) the ideal teaching learning methodology for learning pharmacology, (D) pharmacology topics which are useful for future clinical practice, and (E) the pharmacology topic which was most interesting. The respondents rated the items in sections B-D according to a 5 point Likert scale. In addition, an open-ended question on recommendations for improvement of pharmacology teaching was also asked.

The 5-point Likert scale was recorded into three categories depending on the descriptions of the scale. For example, in section (B), 'Strongly disagree' and 'Disagree' were combined as 'Disagree' scale. Same procedure was applied for the rating scale 'Strongly agree' and 'Agree'. These scales were combined due to low responses for some of the scales. The findings were presented in the form of percentages. The Pearson Chi-Square test was used to determine the association between demographic variables and interest in pharmacology (Statistical Package for Social Sciences (SPSS) version 23). Thematic analysis was used to analyze qualitative data.

## RESULTS

A total of 213 out of 459 students completed the online questionnaire (46.4% response rate, which was reasonable for online questionnaires). There were 65.7% females and 34.3% males. Fourth year students who participated in the study was 53.5%. Most of the students were those who enrolled in the main stream UKM

Table 1: Demographic data

| Demographic | Description | Percentage (%) |
|---|---|---|
| Gender | Male | 34.3 |
| | Female | 65.7 |
| Age | 23 years old | 41.3 |
| | 24 years old | 46.5 |
| | 25 years old | 9.4 |
| | 26 years old | 2.8 |
| Medical program | UKM Medical Degree Program | 67.1 |
| | Franchise UKM-AUCMS Program | 32.9 |
| Ethnicity | Malay | 69.0 |
| | Chinese | 14.0 |
| | India | 13.0 |
| | Others | 4.0 |
| Family background | Medical background | 15.0 |
| | Non-medical background | 85.0 |

Medical Degree program (67.1%), of Malay ethnicity (69.0%) and having a non-medical background family (85.0%) (Table 1).

Section B which was related to perception of pharmacology was separated into two domains; perceptions of the adequacy of pharmacology teaching and perceptions of the teaching-learning methodology. In terms of perceptions of the adequacy of pharmacology teaching, 70.0% agreed that the lessons were helpful for them in the clinical years, while only 8.9% disagreed (Table 2). More than half of the students agreed that the teaching helped them in developing their problem solving and clinical reasoning skills (59.2%). Most of the students (71.8%) agreed that the teaching would benefit them in choosing drugs rationally in their clinical practice. However, only 47.0% of students perceived that the pharmacology syllabus in the preclinical years was adequate for the clinical years. The majority (89.6%) of respondents agreed that pharmacology should also be taught in the clinical years. Interestingly, it was found that the students who enrolled in UKM Medical program had a higher perception of the adequacy of the pharmacology syllabus for clinical years when compared to the students who enrolled in AUCMS (52.4% vs 35.7%) (Figure 1).

In terms of perceptions of the teaching-learning methodology, 58.7%

Table 2: Perception on adequacy of Pharmacology teaching

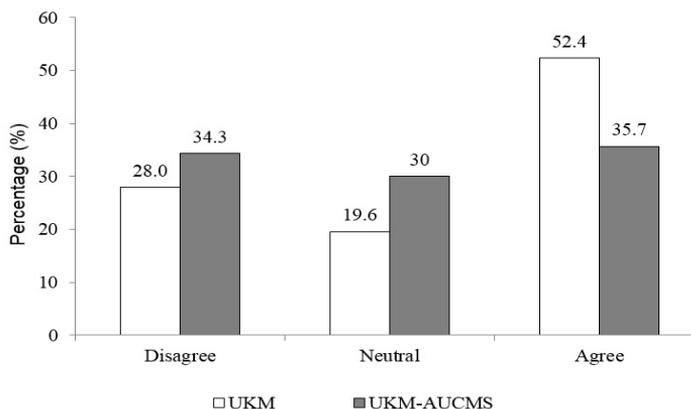| Item | Disagree | Neutral | Agree |
|---|---|---|---|
| Pharmacology lectures in pre-clinical year is helpful for clinical year. | 19 (8.9%) | 45 (21.1%) | 149 (70.0%) |
| The subject has helped me to develop my problem solving and logical reasoning skills in clinical years. | 24 (11.2%) | 63 (29.6%) | 126 (59.2%) |
| The subject will help me immensely in choosing drugs rationally in my future clinical practice. | 18 (8.5%) | 42 (19.7%) | 153 (71.8%) |
| Pharmacology syllabus is adequate for clinical practice/year. | 64 (30.0%) | 49 (23.0%) | 100 (47.0%) |
| Pharmacology should also be thought in clinical years | 4 (1.9%) | 18 (8.5%) | 191 (89.6%) |

Figure 1: Perception on adequacy of Pharmacology syllabus for clinical years among UKM and UKM-AUCMS program students.

Table 3: Perception on teaching learning methodology of Pharmacology

| Item | Disagree | Neutral | Agree |
|------|----------|---------|-------|
| I find pharmacology lectures interesting and stimulating. | 23 (10.8%) | 65 (30.5%) | 125 (58.7%) |
| I would like Pharmacology to be more closely integrated with the clinical sciences and would like real cases in hospital to be used during Problem Based Learning (PBL). | 4 (1.9%) | 9 (4.2%) | 200 (93.9%) |
| There should be more emphasis on problem solving exercises during pre-clinical year rather than on didactic (teaching) lectures. | 7 (3.3%) | 19 (8.9%) | 187 (87.8%) |
| Problem based learning during pre-clinical year is extremely useful in clinical year for better understanding of Pharmacology. | 11 (5.2%) | 32 (15.0%) | 170 (79.8%) |



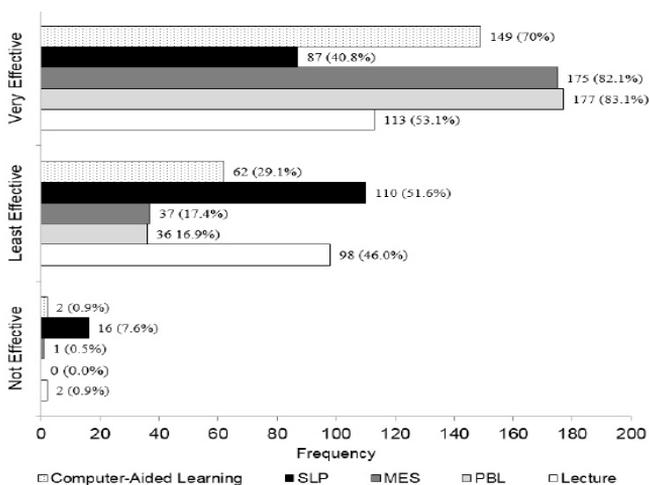Figure 2: Perception on effective teaching learning methodologies in Pharmacology

Table 4: Perception on usefulness of various Pharmacology topics

| Pharmacology topics | Very useful n (%) | Least useful n (%) | Not useful n (%) |
|---|---|---|---|
| General Pharmacology | 165 (77.5) | 47 (22.1) | 1 (0.5) |
| Antimicrobials | 188 (88.3) | 25 (11.7) | 0 (0.0) |
| Cardiovascular | 190 (89.2) | 23 (10.8) | 0 (0.0) |
| Central Nervous System | 179 (84.0) | 34 (16.0) | 0 (0.0) |
| Chemotherapy | 138 (64.8) | 72 (33.8) | 3 (1.4) |
| Endocrine | 183 (85.9) | 30 (14.1) | 0 (0.0) |
| Gastrointestinal | 184 (86.4) | 29 (13.6) | 0 (0.0) |
| Respiratory | 194 (91.1) | 19 (8.9) | 0 (0.0) |
| Reproductive | 169 (79.3) | 43 (20.2) | 1 (0.5) |

of students agreed that pharmacology lectures were interesting and stimulating (Table 3). The majority of students (93.9%) agreed that pharmacology should be more integrated with clinical sciences, and there should be more emphasis on problem solving exercises during preclinical years rather than didactic lectures (87.8%). Students also perceived that problem-based learning used during pre-clinical years was useful in clinical years for better understanding of pharmacology (79.8%).

Among the various teaching learning methodologies used to teach pharmacology in UKMMC, problem-based learning was perceived as the most effective by 177 students (83.1%) (Figure 2). This was followed by meet the expert sessions where 175 (82.1%) students perceived it as being the most effective. On the other hand, concept lectures and Self Learning Packages (SLP) had 53.1% and 40.8% students, respectively, perceived as the most effective.

Table 4 showed the perception on usefulness of various pharmacology topics. The percentage of students who perceived the topics as very useful were quite high, ranging from 64.8% for chemotherapy to 91.1% for respiratory. A small percentage of students perceived the topics as least useful, with chemotherapy showing the highest percentage at 33.8%. Only three topics were perceived as not useful, i.e. general pharmacology, chemotherapy and reproductive. However, the percentage was very small, 0.5% for general pharmacology and reproductive while 1.4% for chemotherapy. In terms of relationship between demographic data and interest in pharmacology subject, no significant difference (p>0.05) was observed (Table 5).

Sixty two students responded to the open-ended question in section E and gave suggestions for improvement of pharmacology teaching. The themes identified were teaching-learning methodologies, curriculum, and syllabus content. The number of students responded in each theme and their typical responses were shown in Table 6.

Table 5: Association between demographic
data and interest in Pharmacology

| Demographic | p value |
|---|---|
| Age (23-26) | 0.843 |
| Gender | 0.922 |
| Year (4th & 5th) | 0.625 |
| Ethnic | 0.703 |
| Origin (UKM & UKM-AUCMS) | 0.692 |
| Family Background (Medical & Non-medical) | 0.551 |

## DISCUSSION

Pharmacology teaching in UKMMC was perceived to be helpful and beneficial for the students in their clinical years. Less than half of the students indicated that pharmacology syllabus was adequate for clinical years. It was noted that only 35.7% of UKM-AUCMS students perceived that the syllabus was adequate which was lower than the UKM students (52.4%). Even though the UKM and UKM-AUCMS students used the same medical curriculum, the different learning environment may influence the students' perceptions. In a previous study, two medical schools which shared the same curriculum were compared. The parent medical school located in the United States of America partnered with a medical school in Malaysia (Tackett et al. 2015). This study found that a positive learning environment was achieved in the partnering country even though the curriculum and teaching were implemented in a different country. This would suggest that further investigations are needed to determine environment factors which are responsible for the differences in perception between UKM and UKM-AUCMS students observed in this current study. UKM students had their preclinical years in Kuala Lumpur while UKM-AUCMS students had theirs in Penang campus. Differences may occur in terms of teaching staff and teaching style between the two locations. Perceptions of the learning environment can be assessed using the Dundee Ready Educational Environment Measure questionnaire as has been used in previous studies (Al-Naggar et al. 2014; Hongkan et al. 2018; Kohli & Dhaliwal 2013; Rahman et al. 2015).

Integration of clinical sciences into the pharmacology syllabus was

Table 6: Suggestions for improvements of Pharmaolcogy teaching

| Themes | Number of responses | Typical response |
|---|---|---|
| Teaching-learning methodologies | 29 | "More PBL and MES session rather than teaching lecture as some of us actually did not pay any attention during the lecture." |
| Curriculum | 10 | "Implement more sessions in clinical than preclinical." |
| Syllabus content | 20 | "In my opinion, it would be nice if the preclinical students were exposed earlier to the real patients, the drugs they are taking and the reason for taking the drugs. Personally from my point of view, teaching pharmacology without relating them to the real patient will not help me to remember the important part of learning the subject." |

emphasized by the clinical students. Students highlighted that there should be more emphasis on problem solving exercises compared to didactic lectures. Incorporation of more case-based discussions may enhance students' interest and help the students to apply basic pharmacology concepts in clinical practice. Such integration is believed to provide students with the opportunity to become acquainted with various diseases and the invaluable role of pharmacology simultaneously (Han & Maxwell 2006). According to a study conducted by Garg et al. (2004), 80% of the students preferred case studies and treatment as part of the regular teaching schedule. In another study, most students admitted that case-based interactive sessions enhance their understanding and aroused intellectual curiosity (Tripathi et al. 2015).

Interactive teaching-learning sessions are preferred by most of the medical students in UKMMC compared to traditional teaching. This study showed that most students agree that the existing pharmacology teaching method consisting of concept lectures and interactive small group sessions was helpful for their clinical years. Previous study reported that two ways communication during lecture session is preferred since it enhances students' knowledge; train them to think critically as well as their soft skills (Ismail et al. 2014). In another study, students were found to score better with problem-based learning (PBL) and modified PBL (combination of lecture and PBL) compared to lecture per se (Al-Faris et al. 2008). Joshi and Ganjiwale (2015)

have also reported that small group interactive sessions were very useful for learning pharmacology. Several studies have shown that students preferred a mixture of lecture and PBL in teaching (Ghosh and Dawka 2000; Srivastava et al. 2008). In addition to enhancing students' knowledge, interactive sessions are also important to inculcate communication skills among the students. It has been shown that houseman showed some incompetencies when communicating with patients and patients' relatives (Abdus et al. 2008).

Three areas have been identified for improvements to pharmacology teaching in UKMMC, mainly teaching-learning methodologies, curriculum, and syllabus content. Students suggested the use of various types of teaching learning methodologies by having more interactive sessions such as problem-based learning (PBL) and meet the expert session (MES). Other suggestions were to include pharmacology teaching during the clinical years by using clinical examples and real cases from the clinical setting, and for the lecturer to conduct interactive sessions with the students during these lectures. This is consistent with the research of Shankar et al. (2005) which reported that the use of practical sessions on rational drug use and introduction of pharmacology modules in clinical years of training was welcomed by students.

The results of this study are supported by outcomes of other studies. For example, they are consistent with another study conducted in Kasturba Medical College, Manipal, where

students emphasized the need to have more problem solving exercises (Amberkar et al. 2011). Similarly, more case or problem based studies, clinical orientation, innovative teaching programs, group discussion and tutorials in regular teaching were suggested by students of GMERS Medical College, Gotri (Saurabh & Agrawa 2015). In addition, the teaching of pharmacology agents have been incorporated into case-based, multidisciplinary curriculum and students perceived the multidisciplinary, case-based approach in teaching to be instructive and valuable learning experience (Faingold & Dunaway 2002).

This study did not observe any correlation between the demographic data and interest in pharmacology as gender, age, ethnicity, the medical degree program enrolled and family background did not influence interest in pharmacology subject. There is limited research available pertaining to the relationship between demographic data and interest in pharmacology. However, in a previous study, it was reported that significantly more male students agreed that pharmacology is their favourite subject compared to female students (Shankar et al. 2005).

Generally, most of the students perceived all pharmacology topics as useful. However, certain percentage of least useful was also observed for all of the topics. Among the topics, chemotherapy had the highest percentage of least useful. Our findings were in agreement with a previous study, in which students perceived cardiovascular topic as the most useful while chemotherapy and central

nervous system as the less useful topics (Agarwal & Mohd-Ismail 2016). Similar findings were also reported in another study, in which a higher percentage of students found that cardiovascular drugs are useful in future while general pharmacology and chemotherapy are the least interesting topics (Rani et al. 2016). The findings for the least useful topics seen in this study may be due to lack of awareness of the clinical importance of these topics. If the clinical aspects are integrated in the teaching as per the student's suggestions, students may have a different perception. Future studies need to be carried out to ascertain this further.

The main limitation of this study was the existence of biases i.e. voluntary response bias and nonresponse bias among the target population. There may be a possibility that those who voluntarily responded had strong opinion about pharmacology teaching and perceived that pharmacology teaching is adequate for clinical years. Response style bias may also existed due to positively worded items in the questionnaire used. A mixture of positive and negative wording items should be considered in future to avoid this bias. Another limitation was that the survey did not consider family background with non-medical occupations that may also have medical knowledge. For qualitative data, in-depth one-to-one interviews can be carried out in future to gather more information regarding the students' perception on pharmacology teaching. In addition, this study was conducted in one medical school in

Malaysia, i.e. UKM. Thus, the findings cannot be generalized to other local or international medical schools. Further studies could be conducted in other medical schools with broader clinical population which may include recent graduates and house-officers. In conclusion, pharmacology teaching sessions in preclinical years was perceived as effective and useful for clinical years. However, adequacy may be further improved by having more teaching sessions in clinical years, as suggested by the students.

## ACKNOWLEDGEMENT

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