

Knowledge and Awareness about Pharmacogenomics and Personalized Medicine Among the Students of College of Medicine, Shaqra university in Dawadmi, Kingdom of Saudi Arabia

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ABSTRACT

Introduction: Pharmacogenomics and personalized medicine are the two rapidly emerging areas in medical field which will determine the drug therapy of the future. It is very important for current medical students to be aware of these medical fields and apply these principles in their medical practice. There is huge scope for research in this area, hence an awareness study was conducted among medical students of college of medicine, Shaqra university, Dawadmi. **Methods:** A cross sectional questionnaire-based study was conducted among the medical students of Shaqra university, Dawadmi by self-administered questionnaire. 150 students participated in the study. **Results:** Out of the 150 students participated in the study Pharmacogenomics is relevant to my education 25% strongly agree. 45% agreed to recommend pharmacogenomic testing. Familiarity with genetics is only 16% and only 14% are familiar with interpreting results of pharmacogenomic tests. Knowledge testing showed overall less percentage. Only 16% can identify drugs that require pharmacogenomic testing. But 36% are confident to use the results of pharmacogenomics tests to make an appropriate adjustment to a patient's drug therapy. Knowledge about personalized medicine is 31% with scale of 3 out of 7. 40% of students agreed to undergo genetic testing. 52% of the participants agreed to know about their risk for developing genetic based chronic diseases. **Conclusion:** There is genuine interest and awareness about Pharmacogenomics and Personalized medicine among the medical students but the knowledge is lacking. Hence including these areas in the undergraduate medical curriculum will impart valuable knowledge to the future medical students.

Key words: Pharmacogenomics, Personalized medicine, Pharmacogenetic testing.

INTRODUCTION

Pharmacogenomics refers to the study of genetic polymorphisms in drug response.¹ It is a rapidly developing research field due to the newer technologies like next generation sequencing (NGS) to scan the genome with precision.² The potential areas of importance are the prediction of personalized medicine, Tailor made individual drug prescriptions and reducing the potential adverse drug reactions. There is opportunity for increasing the efficacy and reducing the toxicity of drugs as well as promoting research towards newer drug development.³ There is unmet demand of pharmacogenetic studies in special category i.e., pregnancy. In developed countries pregnant women take many prescribed drugs apart from nutritional supplements. There is more chance of adverse effects during this precious period, hence Pharmacogenetic studies are more important for drug therapy in pregnant women.⁴

Personalized medicine is an evolving discipline addressing individual patient's healthcare needs in diagnosis and treatment depending on the genetic sequencing.⁵ It helps in prevention and management of diseases in an effective manner by optimal, targeted drug delivery according to patient needs and provides better prognosis with cost-effectiveness.⁶ In 2019, 11 new personalized medicines were approved by FDA including

gene therapy for spinal muscular atrophy, the first treatment to address the root cause. The other uses of newer personalized drugs are combatting cancer and avoiding potential adverse effects.⁷ As the two fields are growing rapidly, we want to assess the knowledge and awareness about pharmacogenomics and personalized medicine among budding medical students of college of medicine of Shaqra university, Saudi Arabia.

MATERIALS AND METHODS

This study was carried out as a cross-sectional questionnaire based online survey among medical students of college of Medicine, Dawadmi, Shaqra University. The study was conducted from August 2020 to January 2021.

Ethical approval was obtained from the Medical Research Ethics Committee (MREC) of college of medicine, Dawadmi, Shaqra University. The medical students of first year to final year were included in the study. Total of 150 students participated in the study. Online questionnaire was used due to restrictions by Covid-19 pandemic during the study period.

The questionnaires for Pharmacogenomics were designed by referring to the research article⁸ and for Personalized medicine was designed by referring to research articles.^{9,10} Minor modifications to the questionnaire were made according to our Institution and students. Google forms were prepared and types

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of questions modified according to the different formats given in google forms. The google form link was circulated to student groups by email and also through WhatsApp student groups. Data filled in google forms were automatically documented in the response section of google forms. The analysis of questionnaire responses was done by descriptive statistics and results are expressed in percentage % with the help of google forms excel spread sheets.¹¹

RESULTS

Pharmacogenomics experience and attitude

Pharmacogenomics is relevant to my education 25% strongly agreed, 20% agreed and 13% disagreed as shown in the figure 1.

In general, which do you predominantly base your drug dosing 50% age, 42% body weight, 38% sex, 33% body surface, 32% indication. For the question of recommending pharmacogenomic test responded yes by 45%, may be by 37%, no by 18%. Reason given for ordering Pharmacogenomic test, 43% obligatory companion test, 34% diagnostic, 36% dose adjustments, 32% research purpose, Tumor diagnostic 26%. not applicable 12.7 %.

Knowledge of Pharmacogenomics

Familiarity with genetics only 16% strongly agree as shown in the figure 2 and 34% learnt this topic from university. Only 21.2% are familiar with pharmacology and drug metabolism and 42% learnt this topic from university. 19% are familiar with drug metabolizer phenotypes and 38% learnt from university. 14% are familiar with interpreting results of pharmacogenomic tests and 31 % learnt this from university. 43% learn about pharmacogenomic testing and drug prescribing by internet sites, 31% you tube, 28% by drug labels.

Knowledge testing of Pharmacogenomics

Consequence of a pharmacogenomic polymorphism, 36% says an individual cannot metabolize any drugs, 34% individual has higher risk for toxicity when using prescription drugs, 23% single drug dose appropriate for a given indication. The European Medicine Agency currently includes pharmacogenomics information in the drug labels for how many percentages of medications? 31% says 11-50 %. For poor metabolizer (PM) phenotype indication, 36% responded as lower drug safety because of poor metabolism, 25% said good drug efficacy & decrease enzyme activity. Consequence of medication that induces CYP2D6 in poor metabolizer for CYP2D6. 41% said no activity no consequence, 29% decreased activity, 22% increased activity.

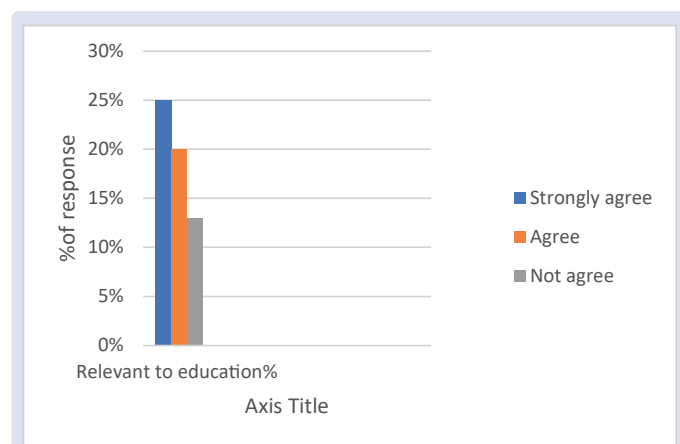


Figure 1: Students opinion about Pharmacogenomics. Figure shows 25% of students strongly agree, 20% agree that Pharmacogenomics is relevant to medical education and 13% did not agree.

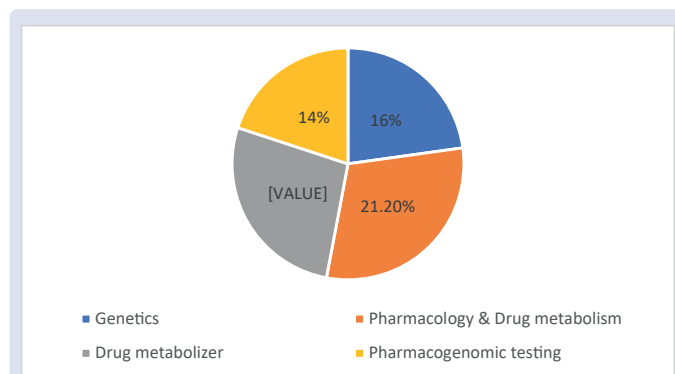


Figure 2: Students knowledge about Pharmacogenomics. Pie chart shows 21.2% of the students are knowledgeable in Pharmacology & drug metabolism, 19% in drug metabolizer, 16% in genetics and 14% in pharmacogenomic testing.

Needs assessment in Pharmacogenomics

For identifying drugs that require pharmacogenomic testing, 16% strongly agree, 19% agree and 20% disagree. Confident to use the results of pharmacogenomics tests to make an appropriate adjustment to a patient's drug therapy, 36% strongly agree, 20% agree and 13% disagree. For the question of which knowledge is essential to adjust the therapy based on pharmacogenomics tests? 40% said need better knowledge on drug metabolism, 36% genetics, 35% Pharmacology. Preferred mode for learning more about pharmacogenomics in the future, 40% by Scientific article, 35% conference talk, 33% accredited learning course, 28% Continuing medical education. How much time would you spend on an e-learning program on pharmacogenomics? 31% less than 30minutes, 29% for 60 minutes.

Knowledge and general interest in personalized medicine concept

For the question of indicate whether you have ever heard of the following terms? 42% heard of Personalized medicine, 38% Health care reform, 25% Individualized care and 39% Pharmacogenomics.

Knowledge about personalized medicine 31% chose the scale of 3 out of 7 (1- Not at all, 7- extremely knowledgeable), 7.6% 2 out of 7, 21.2% 4 out of 7, 16.9% 5 out of 7, and 11% 7 out of 7 (Extremely knowledgeable) shown in the figure 3. How knowledgeable are you about health care reform 20% responded in the scale of 4 and 5. knowledge about Individualized care 33% at scale of 3 knowledge about Pharmacogenomics 35 % at scale 3.

Description of personalized medicine by the participants few examples are given. "a medicine for one person", "a medical model that separates people into different groups", "The form or dose of the drug works on one person and it can't be described for other".

"Personalized medicine means to me good knowledge about drugs to avoid side effects"

Based on the information about personalized medicine, assuming cost is not an issue, how interested are you to take genetic test on a sample of your blood? 40% responded that they will undergo genetic testing.

Most valuable prediction of students related to personalized medicine, 48% told minimizing the impact of diseases through preventive medicine. 39% said it will help in tailoring treatment to individual patients, 38% said it will predict future diseases and 17% said it will help in predicting the good or bad effects of medicine as shown in the Figure 4.

52% of the participants agreed to know about their risk for developing Alzheimer's disease, Cancer, Diabetes, Heart disease, Chronic disease

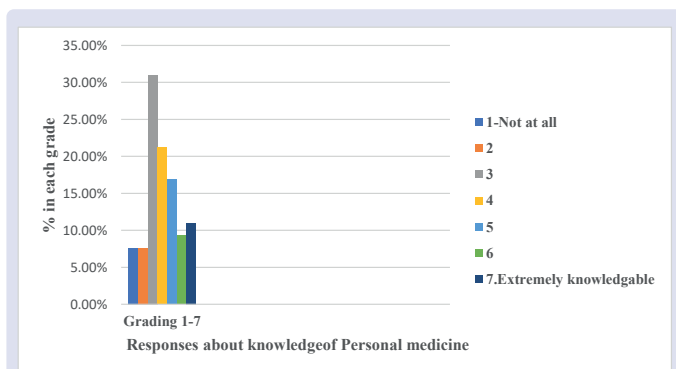


Figure 3: Students knowledge about personalized medicine. Figure shows the % of student's knowledge in personalized medicine in a grading scale of 1-7 (1- not at all and 7-extremely knowledgeable). 31% of student's responses are in the grading scale of 3, 21.2% in scale of 4, 16.9% in scale of 5, 11% in scale of 7, 9.3% in scale of 6 and 7.6% in scale of 1 & 2.

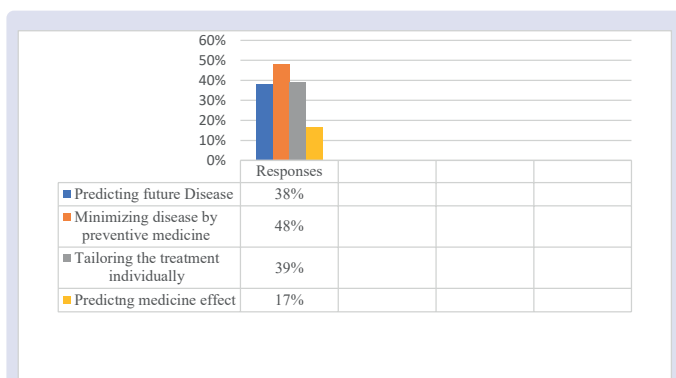


Figure 4: Students prediction about personalized medicine. Bar diagram shows the students prediction about the benefits of personalized medicine in %. 48% predicted that it will minimize the impact of diseases by preventive medicine, 39% will help in tailoring the treatment individually, 38% it will predict occurrence of future diseases and 17% medicine effect.

such as Parkinson's, Rheumatoid Arthritis diseases based on their genetics.

DISCUSSION

Pharmacogenomics

About the Pharmacogenomics experience and attitude. 25% of students felt that the pharmacogenomics is relevant to their medical education. This is an important starting point that awareness is already present among medical students. A similar study done among medical students of Minnesota University USA found 15.9% felt its relevant to medical education.¹² 45% of students agreed to order Pharmacogenomic test as an obligatory test to know the efficacy and adverse drug effects coincides with the response of 62% with a similar study conducted among pharmacist in Japan.¹³

Regarding the knowledge of Pharmacogenomics, familiarity with genetics and pharmacogenomics is only 16% and 19% are familiar with drug metabolizer phenotypes, 14% are familiar with interpreting results of pharmacogenomic tests. This shows there is lack of knowledge among medical students. Hence, this knowledge gap should be filled by taking adequate steps to include pharmacogenomic topics in undergraduate curriculum. A similar study conducted among practicing health practitioners showed 40% familiarity.¹⁴ Which may be due to the increased awareness and knowledge of health care practitioners about these areas.

In terms of knowledge testing which also confirms inadequate knowledge among medical students about genetic polymorphism, pharmacogenomics information in the drug labels and poor metabolizers similar to a study done among medical students in India.¹⁵

Only 16% strongly agree that they can identify the drugs which need pharmacogenetic testing. 36% confident to use the results of pharmacogenomics tests to make an appropriate adjustment to a patient's drug therapy. This show their interest in applying the pharmacogenomic testing but the knowledge is lacking. 40% of the students agree that they need better knowledge on drug metabolism, genetics and pharmacology. Similar opinion was given by another study conducted in the same line.¹⁶

Personalized medicine

As far as the knowledge and general interest in concept of personal medicine, 42% of students heard of the term personalized medicine. Only 31% of students has knowledge about personalized medicine with a scale of 3 out of 7 (1- Not at all & 7- Extremely knowledgeable). This shows inadequate knowledge about personalized medicine among medical students. A similar study conducted in the same line¹⁷ showed only 7.9% extremely knowledgeable, while 36.5% were having lowest knowledge.

The description of personalized medicine by each student was different. One participant described "The form or dose of the drug works on one person and it can't be described for other".

Regarding the interest in prediction of personalized medicine in future, 52.2% of the students interested in knowing about their risk for developing chronic disease through genetic testing. This is an encouraging result as the students are interested in knowing about the risk of developing future chronic illness and want to prevent it at the earliest. This is similar to a study done in Switzerland among healthcare consumers, which showed 56% of participants expressed interest in knowing the risk of developing future debilitating diseases.¹⁷

CONCLUSION

All the participated students expressed genuine interest about Pharmacogenomics and Personalized medicine. But the knowledge about these important fields is lacking. Hence including these important topics in the undergraduate medical curriculum will impart valuable knowledge to the future medical students.

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STATEMENT OF ETHICS

This study protocol was reviewed and approved by Medical Research Ethics Committee (MREC) of college of medicine, Dawadmi, Shaqra University. approval number [CMD/DWD/SU/2020/03/015].

CONSENT TO PARTICIPATE STATEMENT

The study has been granted an exemption from requiring written informed consent by Medical Research Ethics Committee (MREC) of college of medicine, Dawadmi, Shaqra University as it is a questionnaire-based study.

CONFLICTS OF INTEREST STATEMENT

The authors have no conflicts of interest.

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AUTHOR CONTRIBUTIONS

The study designed and carried out by Inbaraj S D, the data collection done by Faisal Fahad Al Otaibi. Article review by Noureldaim Elnoman Elbadawi, result analysis by Prasanna Mohana Bhaskaran, compiling done by Mohammad Azhar Rashikh and referencing done by Dinesh Dimri.

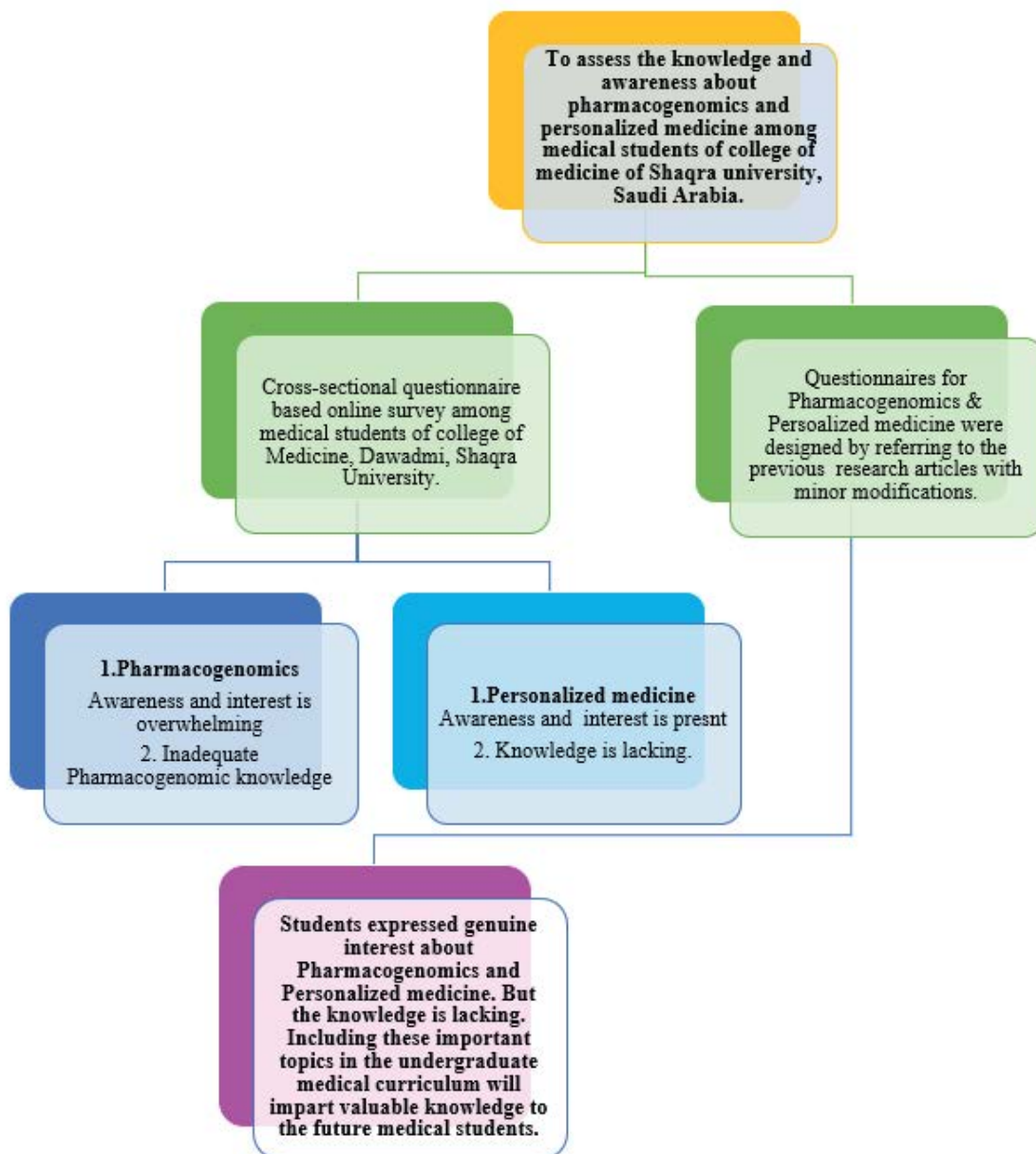
DATA AVAILABILITY STATEMENT

All data generated or analysed during this study are included in this article. Further enquiries can be directed to the corresponding author.

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GRAPHICAL ABSTRACT



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