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Evaluation of the need for pharmacogenomics testing among physicians in the West Bank of Palestine

https://doi.org/10.1515/dmpt-2021-0121
Received March 12, 2021; accepted April 19, 2021; published online June 7, 2021

Abstract

Objectives: Pharmacogenomics (PGx) testing optimizes pharmacotherapy and reduces interindividual variation in drug responses. However, it is still not implemented in clinical practice in the West Bank of Palestine (WBP). The aim of this study was to determine the need for PGx education and testing among physicians from different specialties in WBP.
Methods: This study used a cross-sectional survey that was administered to 381 physicians from different cities in WBP. The questionnaire consisted of 27 closed-ended questions that evaluate the exposure and attitude toward PGx education, the role of PGx testing in clinical practice, and the capabilities of physicians in PGx testing.
Results: It was found that exposure to PGx education is low, with most of the respondents (81.1%) answering that PGx was not an integral part of their medical education. The majority (>90%) of the participants agreed that PGx should be included in the medical school curriculum. It was also found that 58.5% of the participants agreed that PGx testing is relevant to their current clinical practice. In addition, most of the participant physicians (>60%) think that they are currently not capable of prescribing and making decisions for pharmacotherapy based on PGx testing.
Conclusions: It is concluded that there is a high need for PGx education and implementation in clinical practice in WBP. We recommend adding PGx courses to the curricula of medical schools and going forward with the implementation of PGx testing in clinical practice in WBP.

Keywords: education; pharmacogenomics; physicians; questionnaire; West Bank of Palestine.

Introduction

Pharmacogenomics (PGx) testing is used to predict the drug response according to the genetic background of the patient [1]. PGx testing optimizes pharmacotherapy by decreasing unwanted side effects and increasing the efficacy of drugs [2]. Genetic variants of cytochrome *(CYP) 2C9* and vitamin K epoxide reductase can be used in optimizing warfarin therapy [3]. In addition, Udp-glucuronosyltransferase *(UGT) 1A1*26* variants are used as a genetic predictor of the toxicity of anticancer irinotecan [4]. Human leukocyte antigen gene variants can also predict severe cutaneous reactions associated with antiviral and anti epileptic drugs [5].

The United States Food and Drug Administration has added PGx testing to the labeling of more than 250 drugs [6]. Additionally, the PGx database (PhamGKB) has released multiple clinical guidelines for pharmacotherapy according to the genetic background of the patients [7]. Physicians play the main role in personalized therapy through prescribing suitable drugs in suitable doses to patients [8]. Several factors affect the drug response, such as health status, age, and drug–drug interactions. However, genetic factors can significantly explain the interindividual variations in drug response [9]. Therefore, PGx testing was introduced to medical courses and is practiced clinically in different countries [10].

Recently, a symposium was held by the Ibero–American Network for PGx, which highlighted the need for PGx education among research teams for clinical research on vulnerable and autochthonous populations. This represented a step toward clinical implementation of PGx testing among Hispanics of Latin America and the Iberian Peninsula [11]. However, there is still no association for the clinical implementation of PGx testing for Middle Eastern populations, including Arab, Turkish, Persian, and Israeli populations.

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The prevalence of medication errors and side effects of drugs are high in the West Bank of Palestine (WBP) [12]. However, PGx courses are still not incorporated in the curricula of medical students, and PGx testing is still not practiced clinically in pharmacotherapy. Accordingly, the aim of the present study was to assess the need for PGx knowledge and practice among physicians from different medical specialties working in WBP.

Materials and methods

Study design and survey questionnaire

The present study used a cross-sectional survey that was administered to physicians from eight cities in WBP. The targeted physicians were from different medical specialties and included cardiologists, psychiatrists, oncologists, and endocrinologists who prescribe drugs that are influenced by the genetic backgrounds of patients. A link to the questionnaire page was distributed to the physicians through e-mail, which included an introduction and the aims of the research. The questionnaire was prepared using Google Forms, and the link to the questionnaire is tiny.cc/t6mvtz.

The protocol of this study was approved by An-Najah National University Institutional Review Board in Nablus, WBP. The study was conducted from December 2020 to February 2021. Informed consent was obtained from each responder before filling out the questionnaire. The questionnaire was developed by McCullough et al. [13] and has been used in other studies to find out the need for PGx knowledge and implementation in clinical practice [14].

The questionnaire consisted of 27 close-ended questions, which are divided into four parts: 1) demographic information of the participants, 2) exposure to PGx education, 3) attitude toward PGx testing, and 4) capability of physicians in using and interpreting the results of PGx testing. The responses of parts 2–4 were based on a three-point Likert scale with answers corresponding to "disagree," "neutral," and "agree." The questionnaire was written and distributed to the participants in English since it is the language of medical education in WBP. The questionnaire was reviewed by experts in PGx and physicians before distributing it to the participants.

The sample size of the participants in this study was calculated using Daniel's formula [15]. The significance level was set as $\alpha=0.05$, the expected prevalence in the sample with a characteristic of interest was 0.5, and the total number of physicians in WBP is more than 10,000. Accordingly, it was estimated that a sample size of 370 physicians would represent the physician population in WBP. Thus, we recruited a sample size of 383 physicians. However, two out of 383 questionnaire responses were later excluded due to missing information.

The study population included all physicians working in healthcare settings in WBP. The population had diverse educational backgrounds with education and training from Palestine, other Middle Eastern countries, and other countries, such as the United States of America (USA), Canada, the United Kingdom, India, and others. The targeted physicians were also from different medical specialties and included cardiologists, psychiatrists, oncologists, and endocrinologists who prescribe drugs that are influenced by the genetic backgrounds of patients.

Probability sampling was used to choose the study sample. The sampling included random selection of samples from a larger population using a method based on the theory of probability (https://www.sciencedirect.com/topics/computer-science/probability-sample). Consequently, the physicians were randomly selected according to the methodology described by the World Health Organization [16] from the official medical websites in WBP, which include the physicians' names, their addresses, and phone numbers. The physicians could be contacted by phone calls or visited personally to provide them an explanation about the study aims. They were free to agree or decline to participate. The online questionnaire was sent to those who agreed to participate in the study via e-mail.

Statistical analysis

Categorical variables were expressed as frequencies and percentages (%). The chi-squared (χ^2) test was used to analyze and compare the frequency of responses provided by the participants. All of the statistical analyses in this study were done using the program SPSS v25 (IBM, Armonk, NY, USA).

Results

Demographic data

Most of the physician participants were in the ages groups of 21–30 years (n=102, 26.8%) and 41–50 years (n=89, 23.4%). The percentages of participants older than 60 years and those 31–40 years old were 19.2% (n=73) and 17.1% (n=65), respectively. The majority of the responders were married (n=275, 72.2%), while 23.4% (n=89) were unmarried, 3.1% (n=12) were divorced, and 1% (n=4) were widowed. Most of the physician responders were males (n=284, 74.5%).

The levels of the responders' education were as follows: 40.4% (n=154) had a bachelor's degree, 26.2% (n=100) had a master's degree, and 33.3% (n=127) had doctorates. Most of the responders were living in the cities Nablus (18.9%), Hebron (15.8%), Jenin (12.9%), and Ramallah (12.1%). There were 174 (38.7%) physicians who were working in special clinics, while 24.2% (n=92) were working in governmental hospitals. There were 23 (6.1%) physicians working with hospitals and clinics belonging to the UN and NGOs.

The majority of responders were consultants (n=130, 34.2%) and specialists (n=129, 33.9%). The specialties included dentists (19.7%), general physicians (13.4%), internists (5.2%), gynecologists (9.2%), oncologists (1%), pediatricians (7.9%), psychiatrists (1.8%), ophthalmologists (3.1%), and others. Around 76% (n=289) of the participants worked 5–6 days per week, and 48.8% (n=186) worked 6–8 h per day. Most of the physicians (n=123, 32.3%) had more than 20 years of medical experience, 14.2% (n=54) had 16–20 years of medical experience, and 14.7% (n=56) had less than 1 year of medical experience. The majority (n=216, 56.7%) of respondents had graduated from universities located outside Palestine, Jordan, and Israel. The demographic data of the participants are illustrated in Table 1.

Exposure and attitude toward PGx education

Table 2 presents the exposure to PGx education. The majority of the participants agreed that PGx should be included in the medical school curricula as a focal point (n=338, 89%) and integral part (n=308, 81.1%). In addition, most of the participants (n=363, 95.3%) agreed that knowledge of at least some basics of PGx testing is required for physicians. On the other hand, it was found that exposure to PGx education is low, with most of the respondents (81.1%) answering that PGx was not an integral part of the medical education.

Attitude toward the role of PGx testing in clinical practice

Table 3 shows the attitude of respondent physicians toward their role in PGx testing. It was found that 58.5% (n=223) agreed that PGx testing is relevant to their current clinical practice, while 14.4% (n=55) disagreed. The vast majority of the participants (n=337, 88.5%) believe that PGx testing would help them and develop their capabilities in prescribing appropriate medications for patients. Most of the participants (n=316, 82.9%) think that they should be able to provide information regarding the appropriate use of PGx testing (see Table 4).

Furthermore, it was found that 59.3% (n=226) of the responders think that they should recommend PGx testing for drugs affected by the genetic backgrounds of patients, and 77.2% (n=294) of the participants agreed that physicians should be able to provide appropriate recommendations for pharmacotherapy changes based on previously performed PGx testing. In addition, 57.2% (n=218) of the participants agreed that other healthcare providers, such as pharmacists and nurses, can ask the physicians for recommendations of the appropriate use of PGx testing. The results of this study showed that most (88%) of the pharmacists in WBP should be able to provide information on the appropriate use of PGx testing, and most of the responders (86.4%) believe that pharmacists should be

Table 1: Demographic information of the respondent physicians (n=381).

	Frequency, n (%)
Age	
21–30 years	102 (26.8)
31–40 years	65 (17.1)
41–50 years	89 (23.4)
51–60 years	52 (13.6)
Older than 60 years	73 (19.2)
Marital status	
Single	89 (23.4)
Married	275 (72.2)
Divorce	12 (3.1)
Widowed	4 (1)
	102 (26.8)
Educational level	
Bachelor	154 (40.4)
Master	100 (26.2)
Doctorate	127 (33.3)
Sex	
Male	284 (74.5)
Female	97 (25.5)
Governorate	
Ramallah	46 (12.1)
Nablus	72 (18.9)
Jenin	49 (12.9)
Tol-Karem	27 (7.1)
Hebron	60 (15.7)
Jerusalem	24 (6.3)
Tobas	11 (2.9)
Jerico	6 (1.6)
Salfit	5 (1.3)
Qalqelia	10 (2.6)
Bait Lahem	24 (6.3)
Gaza	19 (5)
Israel	28 (7.3)
Current residency	
City	262 (68.8)
Village	105 (27.6)
Refugee campus	14 (3.7)
How many hours do you work daily	
Less than 6	48 (12.6)
6–8	186 (48.8)
8–12	120 (31.5)
More than 12	27 (7.1)
How many days do you work per week	
1–2	14 (3.7)
3–4	42 (11)
5–6	289 (75.9)
7	36 (9.4)
Medical specialty	
Dentistry	75 (19.7)
General medicine	51 (13.4)
Paediatrics	30 (7.9)
Medicine and gastrointestinal tract diseases	20 (5.2)
Nose, ear, and throat	22 (5.8)
Gynecology	35 (9.2)
Neurology	6 (1.6)

Table 1: (continued)

	Frequency, n (%)
Psychiatry	7 (1.8)
Dermatology	9 (2.4)
Oncology	4 (1)
Hematology	3 (0.8)
Cardiac surgery	3 (0.8)
Nephrology	7 (1.8)
Ophthalmology	12 (3.1)
Respiratory	1 (0.3)
Endocrinology	6 (1.6)
Emergency	3 (0.8)
Aesthesia	10 (2.6)
Orthopedic	22 (5.8%)
Experience	
Less than 1 year	56 (147)
1–5 years	57 (15)
6–10 years	40 (10.5)
11–15 years	51 (13.4)
16–20 years	54 (14.2)
More than 20 years	123 (32.3)
Location of university where you graduated	
West Bank of Palestine	101 (26.5)
Gaza	4 (1)
Jerusalem	7 (1.8)
Jordan	46 (12.1)
Israel	7 (1.8)
Others	216 (56.7)

n indicates the frequency.

Table 2: Exposure toward pharmacogenomics (PGx) education and attitude of physicians in West Bank of Palestine (WBP) toward PGx testing (n=381).

Question	Response, n (%)		
	Agree	Natural	Disagree
PGx should be a focal point in the medical curricula and experiential education	339 (89)	37 (9.7)	5 (1.3)
PGx is an integral part of the medical school curricula and/or experiential education	13 (3.4)	59 (15.5)	309 (81.1)
Knowledge of at least some basics of PGx is required for physicians	363 (95.3)	14 (3.7)	4 (1)

n indicates the frequency. PGx, pharmacogenomics; WBP, West Bank of Palestine.

able to provide recommendations for therapy changes for previously performed PGx testing (Table 2).

Capability of physicians in PGx testing

Generally, most of the participants think that they are not capable of prescribing and making decisions for pharmacotherapy based on PGx testing. The results showed that only 35.7% (n=136) of the physicians thought that they can identify medications that require PGx testing. In addition, 36.5% (n=139) did not know, and 21.3% (n=81) disagreed that they could identify reliable sources of information regarding PGx testing for healthcare providers and patients. Furthermore, 38.8% (n=148) did not know whether they could determine the available PGx tests within their health system, and 28.9% (n=110) disagreed that they could. Lastly, 34.4% (n=131) did not know whether they could accurately apply the results of PGx tests to pharmacotherapy selection and dosing, and 29.7% (n=113) of the participants disagreed that they could. The results of the capability of physicians in PGx testing are illustrated in Table 3.

Table 3: Attitude of physicians in WBP toward PGx testing (n=381).

Question	Response, n (%)		
	Agree	Natural	Disagree
PGx is relevant to my current work			
Physicians should recommend PGx testing within their clinical practice	223 (58.5)	103 (27)	55 (14.4)
Healthcare providers should ask physicians for recommendations on appropriate use of PGx testing	226 (59.3)	119 (31.2)	36 (9.4)
PGx will improve our ability to more effectively control drug therapy expenditures	218 (57.2)	105 (27.6)	58 (15.2)
I should be able to provide information on appropriate use of PGx testing	337 (88.5)	39 (10.2)	5 (1.3)
I should be able to provide recommendations for therapy changes for previously performed PGx testing	316 (82.9)	53 (13.9)	12 (3.1)

n indicates the frequency. PGx, pharmacogenomics; WBP, West Bank of Palestine.

Table 4: Selfcapability of physicians in PGx testing (n=381).

Question	Response, n (%)		
	Agree	Neutral	Disagree
I can identify medications that require PGx testing	136 (35.7)	149 (39.1)	96 (25.2)
I can identify reliable sources of information regarding PGx for healthcare providers and patients	161 (42.3)	139 (36.5)	81 (21.3)
I can readily determine the available PGx tests within our health system	132 (32.3)	148 (38.8)	110 (28.9)
I can accurately apply the results of a PGx test to drug therapy selection, dosing, or monitoring	137 (36)	131 (34.4)	113 (29.7)

n indicates the frequency. PGx, pharmacogenomics.

Discussion

There is high interindividual variation in drug therapy in WBP. PGx testing promises to reduce this variation and optimize the pharmacotherapy. In this study, we found out that physicians from different specialties believe that PGx testing would help them in choosing the appropriate drugs in appropriate doses for patients. Also, the respondents wanted to learn more about PGx testing and believe that PGx courses should be incorporated in the curricula of medical schools in WBP.

However, the exposure of PGx education is still low in WBP. This might have resulted in the low capability of the participants observed in this study regarding recommendations and the interpretation of PGx results and hence choosing the appropriate dose. Collectively, these findings indicated that there is a high need for PGx education in the medical schools and implementation of PGx testing in clinical practice in WBP. Accordingly, the present study recommends introducing PGx testing in medical education and clinical practice in WBP.

A survey was done by the European association of PGx and included 69 universities in different countries in the world. It was found that the state of PGx education at the surveyed universities has improved since 2005 [17], when the first recommendation for incorporating PGx education had been made by Gurwitz et al. [18]. In addition, they found that PGx was taught mainly as a part of the pharmacology curricula. The present study recommends incorporation of PGx into the medical education, and we hope that PGx will be improved in WBP. Additionally, we recommend the incorporation of PGx at least as a part of pharmacology and therapeutics, where the medical students learn about personalized therapy.

The findings in this study are in line with what was found previously in that there is a high need among health providers, including physicians, to learn and implement PGx testing [19]. However, the progress of PGx implementation in clinical practice is still slow, especially in Arabic Middle Eastern countries [20]. Therefore, the barriers against clinical implementation of PGx testing should be identified and overcome.

The barriers against the clinical implementation of PGx in clinical practice include low knowledge of PGx and an absence of PGx testing in healthcare centers [21, 22]. In this study, most of the participants responded that exposure to PGx education is low, and most of the participants responded that they are not capable of determining whether PGx testing is provided in the healthcare centers and hospitals where they are currently working. The low education regarding PGx can be improved through PGx workshops and schools, like the summer schools for PGx held by the European Society of Pharmacogenomics and Personalized Therapy. In addition, there are multiple commercial, cost-effective, and clinically validated kits for PGx testing [23]. However, the absence of PGx knowledge makes healthcare providers incapable of using and interpreting the results of PGx testing.

In this study, we tried to find out whether the demographic data of the participants affected the attitude, exposure, and capability regarding PGx testing. However, we did not find any significant correlation (p value >0.05) (data not shown). We previously found that exposure to PGx education was higher among pharmacists who graduated from Jordan than from WBP [24]. However, in this study, the country of graduation did not affect the exposure to PGx education among physicians in WBP.

The percentage of physicians older than 60 years (19.2%) was comparable to that of other groups, as shown in Table 1. This might reflect the actual percentage of aged physicians in the WBP. This questionnaire was distributed through e-mails and online, and we expect that young physicians would use the Internet more commonly than aged physicians, which could at least partly explain the higher percentage (26.8%) of responses from young physicians (younger than 30 year old). Nevertheless, we did not find that age affects the exposure to PGx education (data not shown).

Most of the participants were highly educated, and most of them had masters or doctorate degrees. In addition, many of the participants had more than 15 years of clinical experience. The highly expressed need for PGx education and testing among those educated and expert physicians indicates the importance of PGx testing in clinical practice, which can optimize pharmacotherapy.

Dentists were the most common participants in this study. The dentists prescribe some drugs that are affected by genetic variants in patients, such as antibacterial, anesthetic, and analgesic drugs [25]. PGx testing can help dentists in reducing the interindividual variation in drug response. Therefore, dentists are required to know more about PGx testing and its implementation in clinical practice.

This study has some limitations. First, the number of physicians from some specialties, such as oncology, was not enough to compare the physicians' attitudes according to specialty. Second, there was a small number of participants from Gaza city, where the political and health systems are slightly different than in WBP. Lastly, some information that may affect capability, such as the source of PGx education and the duration of exposure, was not collected from the participants.

In conclusion, this study found out that there is a high need for PGx education and implementation in clinical practice in WBP. We recommend adding PGx courses to the curricula of medical schools and making workshops and conferences about PGx. Further studies are needed to find out the other barriers against the implementation of PGx testing in clinical practice in WBP.

Acknowledgments: The authors would like to thank An-Najah University, Nablus, West Bank of Palestine; for supporting this research.
Research funding: None declared.
Author contributions: All authors have accepted responsibility for the entire content of this manuscript and approved its submission.
Competing interests: Authors state no conflict of interest.
Informed consent: Informed consent was obtained from all individuals included in this study.
Ethical approval: The local Institutional Review Board deemed the study exempt from review.

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