Received: 20 December 2020 | Accepted: 29 May 2021

DOI: 10.1111/ijcp.14435

ORIGINAL PAPER

Therapy area: Other

THE INTERNATIONAL JOURNAL OF CLINICAL PRACTICE WILEY

Assessment of the need for pharmacogenomics education among pharmacists in the West Bank of Palestine

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Abstract

Background: Pharmacogenomics testing aims to optimise therapy and reduce the inter-individual variation in drug response. One of the major barriers against the implementation of pharmacogenomics testing is the low level of knowledge on the topic.

Aims: This study aimed to evaluate the need for pharmacogenomics education among pharmacists in the West Bank of Palestine.

Methods: This study was cross-sectional and included 370 pharmacists, among different cities in the West Bank of Palestine between October and December 2020. The questionnaire consisted of 25 close-ended questions that evaluated the exposure to pharmacogenomics education, attitude toward the role of pharmacogenomics testing in clinical practice and self-capability of pharmacists in pharmacogenomics testing.

Results: It was found that 60% of the respondents disagreed that pharmacogenomics was an integral part of the pharmacy school curriculum and/or experiential education. The vast majority of the respondents (94%) agreed that pharmacists should be required to have some knowledge of pharmacogenomics. The majority of the respondents (88.6%) believe that pharmacogenomics testing will improve pharmacists' ability to more effectively control drug therapy expenditures. However, only 38% of the respondents could identify medications that require pharmacogenomics testing, and only 35.1% could identify reliable sources of information regarding pharmacogenomics for healthcare providers and patients.

Conclusion: It is seen from the results of this study that there is a high need to learn about pharmacogenomics testing, which can help the pharmacists make pharmacotherapy decisions. Additionally, current pharmacists have low self-confidence in making decisions depending on the results of pharmacogenomics testing. It is recommended to increase the exposure of pharmacogenomics knowledge by including the subject in courses and workshops in pharmacy school curricula in the West Bank of Palestine.

1 | INTRODUCTION

There is a wide inter-individual variation in drug responses among patients with different diseases in the West Bank of Palestine.[1] The prevalence of drug toxicity and side effects is also high in the region,[2] and these issues can be reduced through pharmacogenomics testing.[3] The Clinical Pharmacogenomics Implementation Consortium supported by the Pharmacogenomics Knowledge Base developed guidelines for health providers to make pharmacotherapy decisions based on pharmacogenomics testing.[4]

Pharmacogenomics concerns the effect of human genetic variants on drug responses.[5] Pharmacogenomics testing aims to personalise therapy through prescribing the appropriate drug in optimal dosages to the patient.[5] This testing is found in the labelling of more than 270 drugs, including cardiovascular, antidepressant and chemotherapeutic agents.[6]

Pharmacists play a major role in personalised therapy.[7] The Accreditation Council for Pharmacy Education recommends adding pharmacogenomics as an educational course in the syllabus of pharmacy schools.[8] Many studies have reported that pharmacists have a positive attitude toward pharmacogenomics and its importance in pharmaceutical practice.[9,10] However a lack of pharmacogenomics education exists in many locations, including Middle Eastern countries.[11]

We previously found that pharmacy students were open to pharmacogenomics testing in the West Bank.[11] However, their knowledge about types of drugs that require such testing is poor due to the absence of pharmacogenomics courses in most pharmacy colleges in the West Bank.[11] As in most Middle Eastern countries, pharmaceutical education and practice follow the systems found in Europe and the USA. However, pharmacogenomics testing is still not practiced in the West Bank.

Although several studies reported the need of pharmacists for pharmacogenomics testing in clinical practice, little is known about pharmacists' opinions regarding the subject and their role in the decisions of pharmacotherapy depending on testing in the West Bank of Palestine. Therefore, we aimed to find out the attitude toward pharmacogenomics testing and the need for pharmacogenomics education among pharmacists from different regions in the West Bank.

What's known

- Pharmacogenomics testing aims to personalise medicine.
- No study has evaluated the need for pharmacogenomics testing in the pharmaceutical profession in the West Bank of Palestine.

What's new

- There is a high need for exposure to pharmacogenomics education among pharmacists in the West Bank of Palestine.
- The self-capacity to make pharmacotherapy decisions, depending on the results of pharmacogenomics testing, is low among pharmacists.

2 | METHODS

2.1 | Study design and survey questionnaire

This study used a cross-sectional method and was conducted among pharmacists who were randomly selected from eight cities in the West Bank of Palestine. The target population included inpatient, outpatient, industry, marketing and administrative pharmacists. The questionnaire was distributed to the pharmacists via e-mail that included a web link to the questionnaire page in a Google Form (https://docs.google.com/forms/d/1o24ffMB3op36MTG2GrurKFPe9cTDvJi96txJLWMpLNk/edit).

This study was conducted between October and December 2020. Informed consent was obtained from each participant before completing the questionnaire. The questionnaire used in this study was developed by McCullough et al[12] and was used in other studies to determine the need of pharmacists to obtain pharmacogenomics education in clinical practice.[13] An introductory section described the purpose and objectives of this research. The survey consisted of 25 close-ended questions, divided into demographic information of the responders, exposure to pharmacogenomics education, attitude toward the role of pharmacogenomics testing in clinical practice and self-capability of pharmacists in pharmacogenomics testing.

Responses, other than demographic data, were based on a 3-point Likert scale: disagree, neutral and agree. The questionnaire was administered in English, since this is the language of pharmacy education in the West Bank of Palestine.[14] Before the questionnaire was sent to pharmacists, it was reviewed by experts in pharmacogenomics and pharmacy education in the West Bank. The protocol was approved by the American University Institutional Review Board in Jenin (Supporting Information Figure S1). The Cronbach alpha of the questions was 0.8, which indicated consistency in the questionnaire.

The sample size was calculated according to the Daniel formula.[15] The significance level was set at = .05. The expected prevalence in the sample with a characteristic of interest was .5. The total number of pharmacists in the West Bank was more than 10 000, and we estimated that a sample size of 310 would represent the pharmacists in the West Bank. We recruited a sample size of 372 pharmacists to increase the statistical robustness of our study. Two out of 372 were later excluded due to missing information in the demographic data.

2.2 | Statistical analysis

Categorical variables are expressed as frequencies and percentages. Descriptive analysis was undertaken using chi-square (χ^2) tests. Statistical analyses were carried out using the Statistical Package for the Social Sciences (SPSS) v25 (IBM, Armonk, NY, USA).

3 | RESULTS

3.1 | Demographic data

Most of the respondents were between 21–30 (38%) and 31–40 (33.5%) years old. Only 0.5% of the respondent pharmacists were older than 60. The majority of the pharmacists were married (62.1%). Two hundred and forty-two (65.5%) of the respondents were females and 128 (34.5%) were males. The respondents' level of pharmaceutical education was as follows: 75.3% had a bachelor's degree, 19.3% had a master's degree, and 5.7% had a doctoral degree.

The majority (62%) of the respondents lived in Palestine, and only 3% lived in refugee camps. Approximately 70% worked five to six days per week and 62.2% worked six to eight hours per day. Regarding the type of pharmaceutical work of the respondents, most (75%) worked in community/outpatient pharmacies, while 6.8% worked in hospital/inpatient pharmacies, 7% were academics in colleges and universities, 6.5% did administrative work, 3.5% worked in pharmaceutical industries, and 5.6% worked in pharmaceutical marketing. Twenty-eight percent of the responders had experience in pharmaceutical careers from 1 to 5 years, 24% had 6 to 10 years, while 13.9% had 11 to 15 years of experience. The majority (70.4%) graduated from universities located in the West Bank, while 17.9% had graduated in Jordan, and 2.7% of the respondent pharmacists had graduated from Israeli schools. The demographic data of these pharmacists are illustrated in Table 1.

3.1.1 | Exposure to pharmacogenomics education

Figure 1 shows the exposure to pharmacogenomics education. Eighty-eight percent of the responders agreed that pharmacogenomics should be a focal point in the pharmacy school curriculum and experiential education (Figure 1A). In addition, around 60% disagreed that pharmacogenomics was an integral part of the pharmacy school curriculum and/or experiential education (Figure 1B).

We found an association between the location of graduation and the exposure to pharmacogenomics education, as shown in Figure 2. Pharmacists who graduated in Jordan responded that pharmacogenomics was an integral part of the pharmacy school curriculum. This frequency of response was significantly higher (P-value $< .05$, χ^2 test) than the frequency of response by pharmacists who graduated from universities located in the West Bank.

3.2 | Attitude toward the role of pharmacogenomics testing in clinical practice for pharmacists

Regarding their attitude toward pharmacogenomics testing, 43.2% agreed, while 26.9% disagreed that pharmacogenomics testing was relevant to their current work. The vast majority of the respondents (94%) agreed that pharmacists should be required to have some knowledge of pharmacogenomics. Additionally, 56% agreed that

TABLE 1 Demographic information of the respondent pharmacists (N = 370)

	Frequency N (%)
Age	
21 to 30	141 (38)
31 to 40	125 (33.7)
41 to 50	79 (21.5)
51 to 60	23 (6.3)
Older than 60	2 (0.5)
Social status	
Single	115 (31.1)
Married	231 (62.1)
Divorce	16 (4.4)
Widow	8 (2.2)
Educational level	
Bachelor	279 (75.3)
Master	71 (19.3)
Doctorate	20 (5.4)
Sex	
Male	128 (34.5)
Female	242 (65.5)
Governorate	
Ramallah	103 (27.7)
Nablus	83 (22.8)
Jenin	38 (10.2)
Tol-Karem	28 (7.5)
Hebron	32 (8.6)
Jerusalem	33 (8.9)
Tobas	3 (0.8)
Jerico	6 (1.6)
Salfit	7 (1.9)
Qalqelia	11 (3)
Bait Lahem	12 (3.2)
Israel	14 (3.8)
Current residency	
City	229 (62)
Village	130 (35)
Refugee Campus	11 (3)
How many hours do you work daily	
Less than 6	45 (12.2)
6 to 8	230 (62.2)
8 to 12	71 (19)
More than 12	24 (6.5)
How many days do you work per week	
1 to 2	24 (6.5)
3 to 4	61 (16.6)

(Continues)

TABLE 1 (Continued)

	Frequency N (%)
5 to 6	258 (69.6)
7	27 (7.3)
Type of pharmaceutical work	
Hospital pharmacy/inpatient	25 (6.8)
Community pharmacy/outpatient	262 (70.7)
Academic	26 (7.1)
Administration	24 (6.5)
Industry	13 (3.5)
Marketing	20 (5.4)
Primary experience	
Less than 1	45 (12.2)
1 to 5	104 (28)
6 to 10	90 (24.2)
11 to 15	51 (13.9)
16 to 20	40 (10.9)
More than 20	40 (10.9)
Location of university where you graduated	
Palestine	261 (70.4)
Jordan	66 (17.9)
Israel	10 (2.7)
Others	33 (9)

Note: "N" indicates the frequency and "%" indicates the percentage.

pharmacists should recommend pharmacogenomics testing within their clinical practice and should ask pharmacists for recommendations on the appropriate use of pharmacogenomics testing. A total of 77% agreed that healthcare providers should ask pharmacists for recommendations regarding therapy changes for previously performed pharmacogenomics testing. Lastly, a majority of the responders (88.6%) believed that pharmacogenomics testing would improve the pharmacist's ability to more effectively control drug therapy expenditures. Table 2 shows the attitude of pharmacists toward their role in pharmacogenomics testing.

The results of this study showed that most (88%) of the pharmacists in the West Bank should be able to provide information on the appropriate use of pharmacogenomics testing. In addition, most of the responders (86.4%) believed that pharmacists should be able to provide recommendations for therapy changes for previously performed pharmacogenomics testing (Table 2).

3.3 | Self-capability of pharmacists in pharmacogenomics testing

Generally, most pharmacists think they are incapable of prescribing and making decisions for pharmacotherapy according to the results of pharmacogenomics testing. The results in Table 3 show that only 38% of the respondents could identify medications that require pharmacogenomics testing. Only 35.1% of the responders could identify reliable sources of information regarding pharmacogenomics for healthcare providers and patients. Additionally, 48.1% could not determine the available pharmacogenomics tests within their health system, and 47% could not accurately apply the results of these tests to drug therapy selection, dosages, or monitoring.

4 | DISCUSSION

Pharmacogenomics testing aims to personalise the therapy, although it still faces some barriers against its implementation in clinical practice.[16] Pharmacists in the West Bank play a major role in personalised therapy.[17] However, pharmacogenomics testing has still not been implemented in the West Bank of Palestine. One major barrier against the implementation of pharmacogenomics testing in clinical practice is the low level of pharmacogenomics knowledge and education.[18] To the best of our knowledge, this is the first survey in the West Bank to evaluate the need of pharmacists to have pharmacogenomics knowledge. This study shows that pharmacists think that pharmacogenomics testing plays a role in the pharmaceutical profession through the selection of appropriate drugs for the patients. Additionally, most of the pharmacists responded that they needed to learn more about pharmacogenomics. Indeed, the pharmacogenomic course is absent in the curriculum of pharmacy in the major universities in the West Bank. Accordingly, this study recommends adding pharmacogenomics as an educational course in the curriculum of the undergraduate programs of pharmacy schools in the West Bank.

The percentage of females was higher than males among the responding pharmacists in this study. This finding is in line with our previous study, in that females constituted a higher number of pharmacy students.[11] This might indicate that pharmacy is studied and practiced more in the West Bank by females than males. The percentage of pharmacists older than 60 was 0.5%, which might not reflect the actual percentage of pharmacists older than 60 in the West Bank. However, since this questionnaire was distributed through emails and online websites, we expect that older pharmacists use the internet less commonly than their younger counterparts, which can explain, at least partly, the low percentage of response among those over age 60.

One limitation of this study that most of the respondents were working in community/outpatient pharmacies, while a lower number of clinical/inpatient pharmacists were included in this study. This might be due to the fact that the Pharm. D program is new in pharmacy schools in the West Bank, and hence the number of graduated pharm. D pharmacists is much lower than pharmacists prepared to work in community pharmacies, industry and marketing. However, we cannot ignore the role of community pharmacists in advising on drug prescriptions. Many drugs, which have pharmacogenomics testing in their labels such as warfarin and clopidogrel, are purchased

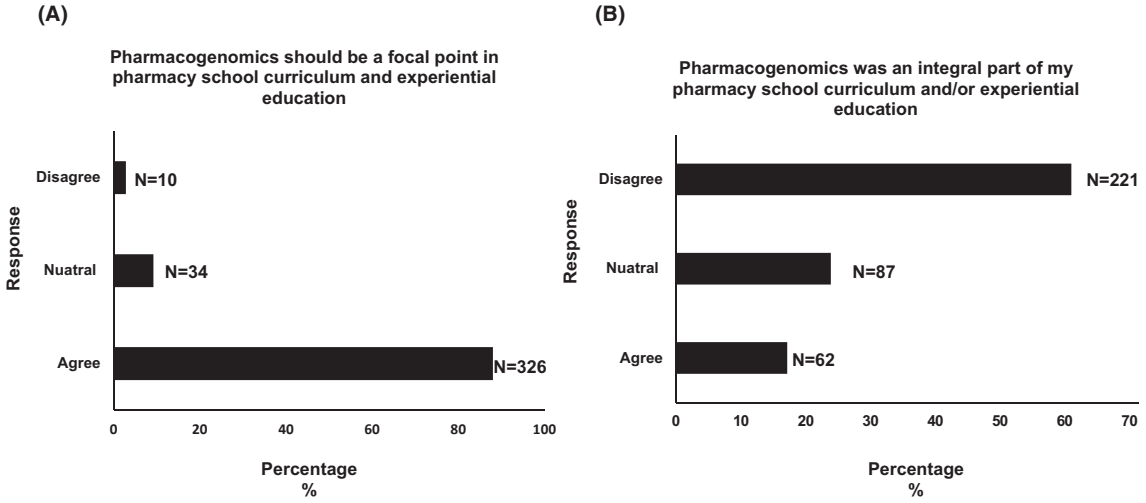

FIGURE 1 A and B, Exposure to pharmacogenomics education

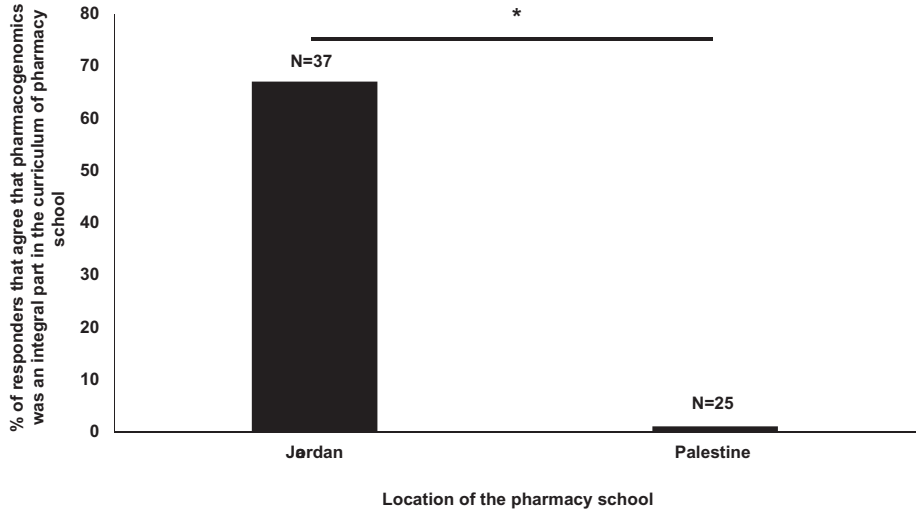

FIGURE 2 Responses to "Pharmacogenomics was an integral part of the pharmacy school curriculum and/or experiential education" in relation to the location of pharmacy school from which responders graduated. The asterisk (*) indicates statistical significance (*P*-value < .05, χ^2 test)

from community pharmacies and pharmacists who advise patients and healthcare providers about the proper dosages and even alternative therapy to patients with a high risk of drugs toxicity.[19]

Additionally, an inter-individual variation in drug response is observed among patients attending community pharmacies.[20] Therefore, community pharmacists should be aware of factors affecting the drug's efficacy, such as genetic variants. In this study, the pharmacists were aware of the importance of pharmacogenomics testing in pharmacotherapy and their major role in pharmacogenomics testing. Indeed, they had low self-confidence regarding prescribing and interpreting results of pharmacogenomics testing, and hence choosing the appropriate therapy, depending on the genome of the patients. In Canada, it was found that only 7.7% of pharmacists felt comfortable advising patients based on pharmacogenomics test results.[21] Another study conducted in the USA indicated that that community pharmacists rated themselves as not confident about their knowledge of pharmacogenomics testing.[12] This attitude is due mainly to the low-level of exposure to pharmacogenomics. This low self-confidence may be a barrier to the application of pharmaceutical care, as suggested previously by Albsoul-Younes et al.[22] We found previously that current pharmacy students, in the West Bank have a low level of knowledge regarding drugs and clinical cases where pharmacogenomics testing can be applied.[11] Therefore, exposure to pharmacogenomics education should be included in the curricula of undergraduate pharmacy schools.

Pharmacogenomics testing can explain the variation in drug response and toxicity.[20,23-25] Many studies, conducted in different countries, show that healthcare providers believe that pharmacogenomics testing is helpful in clinical practice.[10,13,26,27] However, there are some barriers against the implementation of pharmacogenomics testing in clinical practice, including the high cost of genetic tests, limited knowledge regarding pharmacogenomics testing,

TABLE 2 Attitude of pharmacists in the West Bank of Palestine toward pharmacogenomics testing (N = 370)

Statements	Response N (%)		
	Agree	Natural	Disagree
Pharmacogenomics is relevant to my current work	160 (43.2)	110 (29.9)	100 (26.9)
Pharmacists should be required to have some knowledge of pharmacogenomics	348 (94)	13 (3.5)	9 (2.5)
Pharmacists should recommend pharmacogenomics testing within their clinical practice	207 (56)	115 (31)	48 (13)
Healthcare providers should ask pharmacists for recommendations on appropriate use of pharmacogenomics testing	267 (72)	73 (19.8)	30 (8.2)
Healthcare providers should ask pharmacists for recommendations regarding therapy changes for previously performed pharmacogenomics testing	287 (77.5)	59 (16)	24 (6.5)
Pharmacogenomics will improve our ability to more effectively control drug therapy expenditures	328 (88.6)	29 (7.9)	13 (3.5)
I should be able to provide information on appropriate use of pharmacogenomics testing	326 (88)	26 (7.1)	18 (4.9)
I should be able to provide recommendations for therapy changes for previously performed pharmacogenomics testing	320 (86.4)	34 (9.2)	16 (4.4)

Note: "N" indicates the frequency and "%" indicates the percentage.

TABLE 3 Self-capability of pharmacists in pharmacogenomics testing (N = 370)

Statements	Response N (%)		
	Agree	Neutral	Disagree
I can identify medications that require pharmacogenomics testing	141 (38)	123 (33.2)	106 (28.8)
I can identify reliable sources of information regarding pharmacogenomics for healthcare providers and patients	130 (35.1)	128 (34.5)	112 (30.4)
I can readily determine the available pharmacogenomics tests within our health system	77 (20.9)	115 (31)	178 (48.1)
I can accurately apply the results of a pharmacogenomics test to drug therapy selection, dosing, or monitoring	97 (26.1)	100 (26.9)	173 (47)

Note: "N" indicates the frequency and "%" indicates the percentage.

exclusion of pharmacogenomics tests from the medical insurance, and low level of clinical evidence.[28] To prepare the pharmacists in the West Bank for personalised therapy, we need to overcome all of these barriers and apply pharmacogenomics testing and hence move toward personalised therapy.[11]

We attempted to determine if the demography of patients affects the exposure to pharmacogenomics education. We found that exposure to pharmacogenomics education was significantly higher among pharmacists who graduated from universities located in Jordan than pharmacists who graduated from West Bank universities. However, we did not find any correlation between the awareness of pharmacogenomics testing and the demographic data of the responders. This result is in line with what was found previously, ie, that pharmacy students in Jordan have a higher level of knowledge toward pharmacogenomics testing than pharmacy students in the West Bank.[11] This might be due to the fact that some universities in Jordan have started to include pharmacogenomics courses in the bachelor's and master's degree programs. Additionally, the Association of Pharmacists in Jordan conducted some workshops in personalised medicine, including pharmacogenomics testing, in 2019.

5 | CONCLUSION

We investigated the need for pharmacogenomics education among pharmacists in the West Bank of Palestine and found that exposure to pharmacogenomics education is low, although pharmacists realise the importance of pharmacogenomics testing in optimising therapy. We recommend adding pharmacogenomics courses to the curriculum of pharmacy school and offering workshops and

conferences about pharmacogenomics. Further studies are needed to determine the other barriers to the implementation of pharmacogenomics testing in clinical practice in the West Bank of Palestine.

ACKNOWLEDGEMENTS

The authors would like to thank An-Najah University, Nablus, West Bank of Palestine; for supporting this research.

DISCLOSURES

Authors declare that there is no conflict of interest.

DATA AVAILABILITY STATEMENT

Data available on request from the authors.

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SUPPORTING INFORMATION

Additional Supporting Information may be found online in the Supporting Information section.

How to cite this article: Jarrar Y, Musleh R, Ghanim M, AbuKhader I, Jarrar Q. Assessment of the need for pharmacogenomics education among pharmacists in the West Bank of Palestine. *Int J Clin Pract*. 2021;75:e14435. https://doi.org/10.1111/ijcp.14435