Original article:

Knowledge, attitudes, and enthusiasm of primary care physicians regarding personalized medicine practice in Saudi Arabia

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Abstract

Introduction: Personalized Medicine (PM) seeks to maximize effectiveness by taking into account individual variability in genes, environment, and lifestyle. This approach will lead to more accurate diagnoses, more rational disease prevention, better treatment, and development of novel therapies. The widespread practice of PM requires competent physicians to deliver it with favorable attitudes, up-to-date knowledge, and enthusiasm.

Objectives: The current study aimed to assess the degree of knowledge, the extent of favorable attitudes, and enthusiasm of Family Physicians (FPs) and General Practitioners (GPs) in practicing PM.

Material & Methods: A cross-sectional analytical design was used to recruit 72 subjects from 2 different government hospitals and 12 primary care centers chosen by the stratified random sampling technique in Tabuk region, KSA.Participants were invited to complete a structured self-administered questionnaire. The questionnaire was designed and pretested to assess the pertinent PM knowledge, attitudes, and enthusiasm.The Statistical Package for Social Sciences (SPSS) was used for data analysis. The level of statistical significance was set at $P<0.05$.

Results: The majority of the studied subjects (98.61%) did not reserve any training on PM and genomic medicine. The unsatisfactory degree of PM knowledge was observed in 87.50% of them, while, favorable attitudes (51.39%) and good enthusiasm (70.84%) have been detected among them.

Conclusions: Emphasizing on essential PM knowledge in medical education should be given a high priority. Meanwhile, realizing the favorable attitudes and good enthusiasm of physicians towards the great potential of PM are promising and should be endorsed by policymakers.

Key-words: Personalized Medicine, Precision Medicine, Family Practice

Introduction

Personalized Medicine (PM) is a new philosophy in healthcare. It consists in the application of innovative diagnostic methods and biotechnologies to the prediction of human pathologies and the development of prevention and individual therapy-planning.[1] This philosophy encompasses a broad and evolving field informed by a patient characteristic information and biomarker profile.[2] However, the concept of PM is not new: It has long observed that similar symptoms, not necessarily the same illnesses, and similarly, that medical interventions may not work well in some patients with a disease but work in others with apparently the same disease. The medications response is approximately ranging from 25 to 60% only. Therefore the remaining

fraction is not receiving the proper medication or is suffering from significant therapeutic problems such as delays by substituting from one medication to another until good prognosis is achieved.[3] What is new is that advances in various fields(genomics, medical imaging, and regenerative medicine), together with the advent of mobile and wireless capability, increased computational power, and other technologies, allowed for a more efficient patients treatment and monitoring in ways that better meet their individual needs.[4]Moreover, research in the '-omic' sciences has resulted in improved understanding of the relationships between genes, proteins, and disease, providing more tools for the PM and driving a shift in medical practice.[5-10] Some applications of PM based on genetic testing are currently in use.[11] Pharmacogenomics, the optimization of drug therapy based on genetic information, has been applied to improve clinical outcomes or reduce side effects and adverse events.[12-13] Also, PM approach has been applied to some disease areas including oncology, psychiatry, and cardiovascular conditions.[14-17]Some of the most exciting PM advances have occurred in oncology, including some diagnostic tests as a clinical prognostic factor and targeted therapeutics, e.g., trastuzumab and irinotecan.[18] The United States Food and Drug Administration (FDA) now includes genomic information and associated recommendations for well over 100 approved drugs.[19] Key components to the successful clinical implementation of PM and pharmacogenomics will include consistent interpretation of pharmacogenomic test results, availability of clinical guidelines for prescribing based on test results, and knowledge-based decision support systems.[20]

Finally, personalized medicine is being used to assess disease risk, facilitating prevention and early detection.[21]As a result of these developments, personalized medicine has become an increasingly important topic for physicians, healthcare organizations and the public.[22-23] A few studies have investigated the adoption of genetic testing and its impact on the role and practice of physicians,[24-28]they focused primarily on the adoption of genetic tests for the diagnosis and treatment of cancer and recommended physician and public education and improved coordination of healthcare delivery and genetic testing services. Inorder to facilitate medical and continuing professional education in PM, it is essential to have a better understanding of current attitudes, knowledge, and practice (KAP).[29]KAP studies are widely used to gather information for planning of health programs.[30] and they are adequately efficient due to their attributable characteristics such as an easy design, quantifiable data, ease of interpretation and concise presentation of results, generalizability of small sample results to a wider population, cross-cultural comparability, and speed of implementation.[31-32]

Furthermore, the collected data could enable health managers to estimate resources required for various activities, set priorities, select the most effective communication channels and messages, establish baseline levels, and for advocacy.[33]

Therefore, the study aimed to assess the degree of knowledge, the extent of favorable attitudes, and enthusiasm of FPs and GPs in practicing PM with high quality in hospitals and primary health care centers.

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Aims and objectives: The study aimed to assess the degree of knowledge, the extent of favorable attitudes, and enthusiasm of FPs and GPs in practicing PM with high quality in hospitals and primary health care centers.

2. Subjects and Methods

Research Setting: The study has been conducted on two different government hospitals and 12 primary care centers in Tabuk province. The Providence has an area of 108,000 km² and a population of 791,535 in 2015. Its capital is Tabuk city and composed of 6 sub-directorates (Tabuk city, Taimaa, Haqel, Dhuba, Alwajh, and Umlujj).[34-35]

Target population: All physicians specialized in family medicine and general practitioners working on governmental hospitals and primary health care (PHC) centers for more than one year were eligible for participation and involvement in the current study. However, physicians who did not provide direct patient care, e.g., administrators have been excluded.

Study Design: A cross-sectional analytical design was used to recruit 72 physicians from 2 different government hospitals, and 12 primary care centers have been randomly selected from Tabuk region in Saudi Arabia. The studied subjects (FPs and GPs) were requested to complete a structured thirty-five-item self-administered questionnaire which was designed to adequately assess the pertinent personalized medicine variables as related to family medicine practice. The independent variables (health facility, age, sex, highest qualification, the source of PM knowledge, work experience years and PM and genomic training) and three principal dependent variables (knowledge, attitudes, and enthusiasm) has been sufficiently revised and approved by five family medicine experts through the Delphi technique. Approximately, 20 minutes were needed to complete it by the respondent. Knowledge assessment was based on fixed choice ten questions with correct or incorrect answer. Assessment of attitude has been based on the Likert scaling method[36] by**defining the focus** of ten statements and **rating them** on a 1-to-3 response scale as follows: 1 for disagreement, 2 for undecided and 3 for agreement on each statement. The final scores of each respondent depended upon a scale composed of the sum of his/her ratings of all the study variables, i.e., summated scale. Regarding the assessment of enthusiasm degree, it was based on the use of forced-choice response scale (yes or no).

Pre-test Study: It has been carried out during the preparatory research phase (1st. 2 months) to formulate the research problem for more precise investigation, refine the study variables, and test the validity and reliability of the study tools and instruments.

Sampling Technique: The multi-stage random sampling technique has been utilized to recruit the required physicians. At the first stage, two sub-directorate from Tabuk province (Tabuk city and Taimaa) have been randomly chosen by the simple random sampling technique. During the second stage, one governmental hospital and six primary health care centers have been chosen by the stratified random sampling technique from each sub-directorate. At the third stage, FPs and GPs were chosen by the systematic random sample technique. Only, the eligible and accepted subjects for participation have been recruited in the study, i.e., 72 subjects.

Analysis: Data were categorized and analyzed using Statistical Package for Social Sciences

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version 22 (SPSS Inc., Chicago, IL). Data were presented as means and standard deviations, and percentages unless otherwise specified. Chi-squared tests were used to determine the associations between factors and t-test for testing the significant difference between quantitative variables. A p-value <0.05 was considered significant.

Ethical Considerations: The research committee of Tabuk medical college approved the research. Further, all of the studied physicians were briefed about the study and informed that their names or any identification leading to them would be kept for the study purpose only and their right to refuse to answer any question or quit from the study at any time. They were informed that there was no "correct" or "incorrect" answer and they were requested to express their opinions and thoughts freely. The collected information was strictly confidential; also, their informed consents were taken.

3. Observations &Results

A total of 77 (out of 81) subjects responded to the study (95.06% overall response rate). Physicians who are not providing direct patient care (n=4) and practicing family medicine (n=1) were excluded. Thus, the respondent group retained for the analysis comprised 72 active subjects with an adjusted response rate of 94.74%. Of the respondents, 51.39% and 48.61% were men and women, respectively, as illustrated in Table (1) with an average age and years of experience of 36.01±3.55 and 11.97±6.47, respectively. Only, 5.56% of them have obtained doctorate or Saudi Board degrees. Surprisingly, 1.39% of them received a PM and Genomic training. The main source of their PM knowledge the internet (56.06%) followed by was Text books (15.90%), Medical journals (12.88%), In-service training (10.61%) and others (4.55%), e.g., scientific meetings, consultations, etc…(4.55%).

It's obvious from Table (2) and Figure (1) that only 5.56**%** of respondents have a good degree of knowledge regarding the studied PM elements. Also, the fair and poor degrees of knowledge among them was 6.94**%** and 87.50**%**, respectively.

It's clear from Table (3) and Figure (1) that nearly half (51.39%) of respondents have a favourable attitude towards important PM aspects. Also, one may notice that 47.22%, 34.72%, 31.95%, 31.94%, and 29.17% of them have a un-favourable attitude towards the current medical curricula PM sufficiency, easy patients' PM accessibility, widespread applicability, current PM achievements and current PM high costs, respectively.

Finally, the results indicate that 70.84% of respondents have a good enthusiasm degree (overall enthusiasms' assessment) regarding PM practicing, meanwhile, 80.56%, 80.56%, and 73.61% of them reporting that they are willing to practice PM, will try to participate in PM workshop(s), and will search for recent PM materials respectively, Table (4) and Figure (1).

4. Discussion

With many advances in PM on the horizon,The researcher has expected that the PM knowledge of the studied FPs and GPs could be satisfactory and increased exponentially. However, the current results showed a considerable very low gap in physicians' knowledge regarding the basic principles of personalized medicine (only 5.56% of them have a good degree of PM knowledge). This is in line with Karlikova M et al. (2014) who concluded that the actual knowledge of the

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principles of personalized medicine among physicians and therefore their application are still low.[1]The present findings call for greater efforts toward physicians' education and dissemination of PM guidelines and training. A further study of personalized medicine published in Canada (2011) has addressed the adoption and practice infamily medicine, oncology, and cardiology and found that most physicians are not confident in discussing genetic testing and personalized medicine with the patients because of the lack of formal education in the field among the surveyed physicians, as well as the lack of time and resources available for doctors to study this subject.[29] Also, as the future of medicine depends on the quality and efficiency of medical students (the future physicians) to a great extent, the need for personalized medicine integration into current curricula is of great Importance. However, personalized medicine knowledge alone may be insufficient to change the medical practice, consequently; there is a need to a positive attitude toward personalized medicine and other system-level factors. Surveys conducted in Canada[29] and the United States[38] havereported the need for physician education for thesuccessful adoption of PM. These studies concludeda lack of education, training, and support necessary for successful adoption in themajority of physicians. They have demonstrated that currentphysician knowledge, real-world data, and guidelinesrelating to PM have often been insufficient for appropriate. Lastly, previous literature reported a knowledge and practice gap, lack of formal training and awareness toward personalized medicine among current Physicians and health workers.[39-44] In all cases, less attention has been paid to health workersandfuture doctors despite their suboptimal knowledge on PM and the related pharmacogenomics.[45-46] Launiala (2009) showed that the top five barriers for physicians adoption of PM practice were: limited provider knowledge,lack of evidence-based clinical information,lack of clinical practice guidelines, attitudes and awareness of benefits, the cost of testing and a lack of time and resources to educate patients.[29] As the current study showed a very low degree of physicians knowledge and a moderate degree of favorable attitudes towards PM, thus, we have to emphasize on the importance of the current educational and raising the awareness for physicians, and other health professionals, and scientists,for the adoption of new curriculato prepare them for the challenges of personalizedmedicine. Also, we have to engage and encourage medical students to move into this new and complex field as endorsed by Paveli et al. (2015) and Özgüç (2014).[47-48]Finally, the research revealed good enthusiasm degree for practicing of personalized medicine among the studied physicians and maybe consider as equally important to knowledge and attitudes, as revealed by other investigators, e.g. Mclaughin (2012)[49]who observed that enthusiasm of practitioners is one of the key factors that can break the energy in the clinic environment. The encouraging finding of the present data is an ideal starting point for pro-active training activities that are likely to gain the target physician's confidence and interest. Such programs should attempt to combine knowledge enhancement with regular competency evaluation for physicians.Regarding the main strengths and limitations of this study, the author has

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adequately and sufficiently surveyed the PM literature related to Saudi Arabia and did find any similar study to the best of his knowledge and efforts, meanwhile, the researcher found some Saudi genomic studies and services[50-53] addressing the basic science mainly and did not adequately investigate the clinical PM providers. Therefore, one may consider that the current study will be very useful as one important baseline source of information for PM practice for future national Saudi studies on this topic. However, the noticed unfamiliarity of the studied FPs and GPs with the topic may have negatively influenced the results. The response may vary depending on the type of their health facility, i.e., hospital or primary health care. The topic of PM in primary care practice may not have been relevant to all FPs and GPs who were requested to respond to the study, which may have negatively affected the results. Also, the results were based on a self-administered structured questionnaire (quick, easy, respondents answer at their convenience, and cost-efficient but may lack conscientious responses, differences in understanding and interpretation by respondents and lack of personalization). However, the current study was limited to Tabuk regain of KSA. Therefore the transferability model of generalizability may be adopted and applied on Tabuk region and the northern parts of Saudi Arabia given the proximal similarity of such geographical and demographic parts.[54]Finally, we have to realize that both individual- and system-level factors likely contribute todifferences by race and ethnicity in use of and responses to PM practice as stressed by Kaphingst, and Goodman (2016).[55] Thus, given the demographic and predominant consanguineous marriage patternin KSA, it is of great importance to conduct national genomic studies and investigations to determine the needed PM areas for Saudi population properly.

5. Conclusion

Endorsing the essential PM knowledge and practice in basic and continuing medical education should be given a high priority. Meanwhile, realizing favorable attitudes and good enthusiasm of FPs and GPs towards the great potential of PM in quality improvement of patient's care are promising and should be endorsed by the health policymakers.

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Table (1): Important Characteristics of the Studied Subjects

Character	Studied Subjects by Health Facility				Total (N. 72)	
	Hospitals (N. 38)		PHC Centres (N.34)			
	No.	%	No.	%	No.	%
Age (years): *Mean± SD*	38.68±4.54		32.15±2.11		36.01±3.55	
	t=11.09, P= 1.00					
Sex:						
Males	24	63.16	13	38.24	37	51.39
Females	14	36.84	21	61.76	35	48.61
	χ^2= 4.4618, *P*= 0.034661					
Highest Qualification:						
MBBS	26	68.42	30	88.24	56	77.78
Diploma	5	13.16	2	5.88	7	9.72
Master	3	7.89	2	5.88	5	6.94
Doctorate or Saudi Board	4	10.53	-	00.00	4	5.56
	χ^2=*5.566, P=0.1347*					
Experience years: *Mean± SD*	14.25±8.34		8.68±3.77		11.97±6.47	
	t=6.62, P= 1.00					
PM and/or Genomic Training:						
Received	1	2.70	-	00.00	1	1.39
Did not receive	37	97.30	34	100.00	71	98.61
Source of PM Knowledge:						
Internet	42	53.85	32	59.26	74	56.06
Textbooks	10	12.82	11	20.37	21	15.90
Medical journals	14	17.95	3	5.56	17	12.88
In-service training	8	10.26	6	11.11	14	10.61
Others	4	5.12	2	3.70	6	4.55
	χ^2=*5.28, P=0. 26*					

Table (2): Assessment of Personalized Medicine Knowledge among the Studied Subjects

Personalized Medicine Aspect	Studied Subjects' Knowledge (N. 72)			
	Correct Answer		Incorrect Answer	
	No.	%	No.	%
Definition	3	4.17	69	95.83
Rationale	4	5.56	68	94.44
Vision	6	8.33	66	91.67
Objectives	4	5.56	68	94.44
Components	4	5.56	68	94.44
Clinical Diagnostic Methods	11	15.28	61	84.72
Required laboratory investigations	9	12.50	63	87.50
Recent PM drugs	10	13.89	62	86.11
Most important defective genes	3	4.17	69	95.83
Recent Management Strategies	4	5.56	68	94.44
Overall Assessment:	**No.**		**%**	
Good	4		5.56	
Fair	5		6.94	
Poor	63		87.50	

Table (3): Attitudes of the Studied Subjects towards Important Personalized Medicine Aspects

Personalized Medicine Aspect	Studied Subjects' Attitudes (N. 72)					
	Favourable		Undecided		Un-favourable	
	No.	%	No.	%	No.	%
Importance in Medical Progress	41	56.92	23	31.94	8	11.11
Physicians' Acceptance	56	77.78	10	13.89	6	8.33
Easy Patients' Accessibility	23	31.94	24	33.33	25	34.72
Current Achievements	21	29.17	28	38.89	23	31.94
Ethical Considerations	45	62.50	14	19.44	13	18.06
Wide Spread Applicability	24	33.33	25	34.72	23	31.95
Medical Curricula Sufficiency	12	16.67	26	36.11	34	47.22
Needed Research	58	80.56	12	16.67	2	2.77
Current High Costs	37	51.39	14	19.44	21	29.17
Future Mapping of Medicine	62	86.12	5	6.94	5	6.94
Overall Attitudes Assessment:	**No.**			**%**		
Favourable	37			51.39		
Undecided	18			25.00		
Un-favourable	17			23.61		

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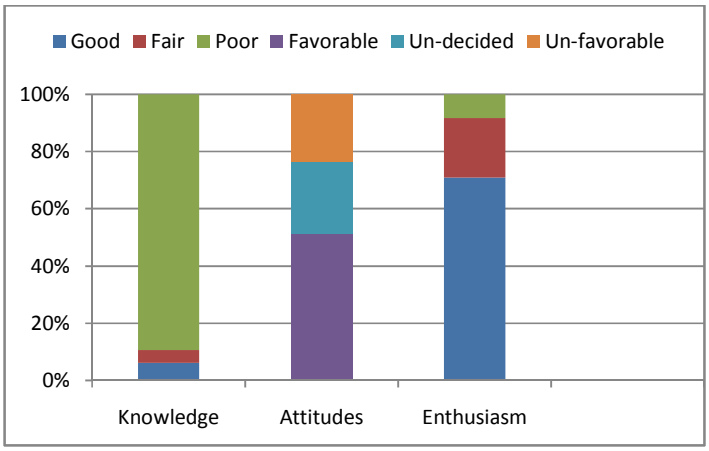
Table (4): Enthusiasm Assessment of the Studied SubjectsRegarding Personalized Medicine Practice

Personalized Medicine Aspect	Studied Subjects' Enthusiasm (N. 72)			
	YES		NO	
	No.	%	No.	%
Intersected in PM Practicing	53	73.61	19	26.39
Willing to Practice PM	58	80.56	14	19.44
Ready to Learn PM Practicing Principles	49	68.06	23	31.94
Keen to have PM Practicing Degree	32	44.44	40	55.56
Looking for training on PM	63	87.50	9	12.50
Will search for recent PM materials	52	72.22	20	27.78
Disseminate PM materials on colleagues	48	66.67	24	33.33
Will try to participate in PM workshop(s)	58	80.56	14	19.44
Will try to attend PM conference(s)	46	63.89	26	36.11
Eager to Practice PM	47	65.28	25	34.72
Overall Enthusiasms' Assessment:	**No.**		**%**	
Good	51		70.84	
Fair	15		20.83	
Poor	6		8.33	

Figure (1): Overall Assessment of the Studied Subjects' Knowledge, Attitudes, and Enthusiasm regarding Personalized Medicine Practice



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