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RESEARCH PAPER

Knowledge, attitude and practice about pharmaceutical bioinformatics among medical practitioners of health-care institutions of Qassim University, KSA

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ABSTRACT

The aim of the study is to evaluate the knowledge, attitude and practice (KAP) of medical practitioners for the use of pharmaceutical bioinformatics in their profession. The study was a survey-based cross-sectional questionnaire analysis. 90 professionals of health care institutions affiliated to the Qassim University of Kingdom of Saudi Arabia were surveyed to assess their KAP about pharmaceutical bioinformatics. The data was collected either through interviews or online and analyzed on a spreadsheet in excel file. Statistical significance was measured by using One-way ANOVA followed by non-parametric analysis. $p<0.05$ was considered to indicate the level of significance. The results of the study suggests that majority of medical practitioners surveyed were less than 35 years age (64.7%), possessing bachelors' degree (58.8%) and less than 5 years of experience (47.1%) in the profession. Among the respondents, majority (> 50%) showed moderate information on the knowledge, attitude and practice of pharmaceutical bioinformatics. The questions used to find the advanced information about the topic indicated that only 30 – 40% have the latest information. The results of the analysis suggested that the surveyed medical practitioners have fair basic information only about pharmaceutical bioinformatics. Activities such as seminars, workshops, conferences on the pharmaceutical bioinformatics might benefit the medical professionals about the emerging field of new drug discovery.

Keywords: - *Knowledge, Pharmaceutical bioinformatics, Attitude, Software, Practice, Drug discovery, Medical practitioners.*

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INTRODUCTION

During The branch of science that combines the application of computers, databases, statistics and graphs to determine the biological response is referred as bioinformatics. [1] It has been reported that bioinformatics' use in new drug discovery can reduce the time and expenditure that is incurred on testing the new drug molecule for the safety and efficacy in biological tissues. [2] Bioinformatics tools can determine in-advance the possible biological response of a chemical without being subjected to various tests

that require time, resources, reagents on cell-lines, tissues, animals and human subjects. [3]

Bioinformatics in pharmaceutical industry can provide the researchers a vital information about the complex mathematical and statistical equation that are needed for understanding the drug discovery, drug development, structure-activity relationship and product development at a faster rate. [4] Research also indicated that bioinformatics can be used in drug target identification and validation and, in the development of biomarkers, toxicogenomic and pharmacogenomic tools to maximize the therapeutic benefit of drugs. [3,4]

Earlier studies also suggest that bioinformatics tools / softwares can predict the drug metabolism in the body, the fate of metabolites, and the type of metabolic reaction (s) a drug molecule will undergo in the body and the most likely organ that will cause the metabolism of the drug. [5] Computer-aided drug design (CADD) methods are frequently used in new drug discovery and these tools are also depending on the technology of bioinformatics. [6]

The field of pharmaceutical bioinformatics has been reported to possess a good career potential for the medicine and its related professionals. [2-4] Although this field is emerging as an important link in determining the response of a drug in genetically different patients, but many health-care professionals still lacks inclusive information about it. Hence, this survey-based study was planned among the different professionals of medical field. In our earlier study, we evaluated the KAP about bioinformatics among the academicians of health care institutions and our finding suggested that although the faculty possesses basic information about bioinformatics but there is a need to update the latest advances. [7] In this study, we planned to evaluated the KAP among the medical practitioners of health care institutions affiliated to the Qassim University in Saudi Arabia. The findings of the study could provide the data for planning the strategies to enlighten the information on pharmaceutical bioinformatics.

MATERIAL AND METHODS

The aim of this study is to assess the knowledge, and measure the professional attitude and practice among the medical practitioners of health care institutions affiliated to Qassim University.

A. Study setting and population

The study is a survey-based program conducted in Qassim province of Saudi Arabia, among the medical practitioners. Both male (n=42) and female (n=48) participants interested in participation were enrolled with this study (Total = 90). The participants were from the institutions of medical, dental, pharmacy and applied medical sciences. Participants having a degree in medical or allied profession, involved in practicing their profession and, willing to participate in the survey were considered as the inclusion criteria and otherwise as exclusion criteria.

B. Study tool

The questionnaire was targeted to medical practitioners of health care colleges to evaluate their knowledge, attitude and practice about the pharmaceutical bioinformatics.

C. Questionnaires development

A questionnaire was developed in English and Arabic language**.** The questionnaires were divided in to two part viz., socio-demographic section and KAP section. In socio-demographic part information about the respondents such as age, sex, profession, qualification and experience were collected. While in the KAP, prepared questions related to knowledge, attitude and practice was asked with set answer such as 'Yes', 'No' and 'Don't know' for knowledge, attitude and practice questions. [7,8]

The questionnaires were validated by the expert committee constituted by the department. A pilot study was done before the questions were circulated for the data collection. The questionnaires of the KAP domains were categorized in to basic and critical information questions. Correct response to the basic questions reflected the fundamental information about the KAP of pharmaceutical bioinformatics and correct response to the critical questions were considered as advanced information about the topic.

The basic information questions of knowledge domain were about the definition of bioinformatics (Q-1), application of bioinformatics (Q-2), use of computer knowledge in bioinformatics (Q-3), target drug identification use (Q-4), toxicogenomic and pharmacogenomic applications (Q-5), drug delivery system application (Q-6), designing experiments by using bioinformatics (Q-7), outsourcing the bioinformatics studies (Q-8) and safety and efficacy testing using bioinformatics (Q-9). The critical questions of the domain were on; receptor-based pharmacophore (Q-10) and sparse logistic regression (Q-11).

The basic information question of the attitude domain were; relationship between pathogenesis and genomic data (Q-1), bioinformatics in determining biological responses (Q-2), bioinformatics in diagnosis of diseases (Q-4), topics of bioinformatics in curriculum (Q-6), career options in pharmaceutical bioinformatics (Q-7). The critical questions in this domain were on; KinetDS® software application (Q-3) and Stat-Ease® software application (Q-5).

The basic information questions of practice domain were on; bioinformatics in drug-related complications (Q-1), bioinformatics on cost and duration effectiveness in new drug discovery (Q-2), evidence base medicine application (Q-3), human genomic project (Q-4), Dispensing the drug based on bioinformatics studies (Q-7), bioinformatics monographs of the drugs (Q-7a), use of bioinformatics tools in profession (Q-8) and usefulness of bioinformatics tools (Q-8a). The questions marked as critical were on; use of bioinformatics in synthesizing oral insulin preparation (Q-5) and bioinformatics use in the discovery of new antibiotics 'Meropenem' against superbug (Q-6).

D. Study design

This was a cross-sectional questionnaire-based survey. The professionals of health-care institutions were surveyed to assess their KAP about pharmaceutical bioinformatics (9). The potential participants were contacted personally by visiting their workplace and the response was collected through interviews. Online survey facility was also provided for those participants who were busy and preferred to participate in the study at their time of convenience.

E. Statistics:

All completed survey forms were evaluated and their response was recorded in an excel spreadsheet. The data was analyzed and statistical significance of the results was done through One-way ANOVA followed by non-parametric post-hoc test (10). The non-parametric tests include: Spearman's Rho Correlation was used to find the association between knowledge, Attitude and Practices. Mann-Whitney U was used to compare scores of each domain with binary demographic groups: (Gender and Nationality). Kruskal-Wallis H was used to compare scores of each domain with demographic with more than two categories (Age, Qualification and Experience). Chi-square test was used to determine whether there is a significant association between each domain scores of the participants and Demographics.

RESULTS

A. Demographic characteristics of participants in the survey

The demographic characteristics of the participants indicated that 47.1% (N=42) were male medical practitioners and 52.9% (N=48) were females. Their age-group characteristic indicated that majority of them were less than 35 years (64.7%) and none were above 56 years. The qualification criteria indicated that most of the professionals hold bachelors' degree (58.8%), followed by Ph.D (23.5%) and masters' degree (17.6%). In the experience category, most of the medical practitioners has less than 5 years (47.1%) experience and lowest was found be between 11 – 15 years (5.9%) (Table-1).

B. Frequency of response of academicians for KAP questionnaires.

The percentage response to each questionnaire is represented in table-2. Questions -1,2,4 and 5 received maximum 'Yes' response (> 60%). The highest 'No' response (> 20%) was found for Q-1, 10 and 11) and 'Don't know' for Q-6,7 and 8 (> 30%). The response of medical practitioners for the critical questions indicated that Q-10 received 41.2% 'Yes', 29.4% 'No' and 29.4% 'Don't know' and for Q-11, 35.3% 'Yes', 29.4% 'No' and 35.3% 'Don't know'.

The reply to attitude domain questions suggests that Q-1,4 and 7 received maximum 'Yes' response (> 60%), Q-2 received maximum 'No' and Q-2,3 and 5 obtained maximum 'Don't know' (> 50%) reply. The response for the critical questions indicated that Q-3 received 11.8% 'Yes', 5.9% 'No' and 82.4% 'Don't know' and Q-5 got 11.8% 'Yes', 17.6% 'No' and 70.6% 'Don't know'.

The practice domain's questions response indicated that Q-1,2 and 7a received more than 60% 'Yes', Q-3,7 and 8 obtained maximum 'No' response such as 35.3%, 23.5% and 58.8%, respectively. The highest 'Don't know' reply (> 50%) was found for Q-5 and 6 questions. The Q-5 and 6 were marked as critical and the 'Yes' response for these questions were 35.3% and 'No' were 11.8%.

C. Mean score of academician's response on the domains of KAP with respect to demographic characteristics.

The table-3 representing the mean scores of medical practitioners indicated that there was no-significant difference (p>0.05) on the response in knowledge domain questions on any of the demographic distributions such as gender, age, qualification and experience. However, in the attitude domain, it was found that the qualification category of the participants showed significant variation (p<0.05) while other categories such as gender, age and experience did not produce any significant change. Similarly, the practice domain showed significant difference (p<0.05) on the scores recorded for the various questionnaires.

D. Correlation between various domains of KAP for academician's response.

The analysis to correlate the knowledge, attitude and practice domains indicated a positive Rho value and significant (p<0.01) difference when the domains were compared. Similar observations were found when the Rho value and level of significant are correlated between knowledge – practice and practice – attitude (Table-4).

E. Analysis of academician's response on the domains of KAP.

Table-5 represents the analysis of medical practitioners' response on the domains of KAP of pharmaceutical bioinformatics. The data from the analysis revealed that gender has shown significant difference (p<0.01) on the knowledge domain of the topic, while other categories such as age, qualification and experience did not produce any significant difference. The attitude domain's analysis suggests that the demographic categories did not influence the response while answering the questionnaires.

In practice domain, it was observed that age of the participants has shown significant variation (p<0.05) while responding to the questions and, other characterization of the medical practitioners did not show any significant influence.

DISCUSSION

The demographic analysis of the participants involved in this survey-based study indicated that 42 and 48 male and female medical practitioners took part, respectively. Among them, maximum were in the age group of less than 35 years with bachelor's degree qualification and less than 5 years of experience in the profession (Table-1).

Bioinformatics is the branch of science in which the technology of computers is used to study those activities that occur in the living cells. It is an emerging field in new drug discovery where the design, structure-activity relationship, interactions with biomolecules of the new therapeutic agents are studies. [11,12] The data from these studies provides most-likely outcome of the actions of the new drug molecule when it is tested in living organism and is a useful tool in the new drug discovery. [13]

The percentage of response to the knowledge domain questionnaires revealed that majority of participants (> 50%) have average information on the pharmaceutical bioinformatics as indicated in table-2. The response to the critical questions (Q-10 and 11) was also found to be less than 50% as most of the participants indicated either 'No' or 'Don't know' response to these question (Table-2). The critical questions were used to evaluate in-depth knowledge about the pharmaceutical bioinformatics and the response of medical practitioners is less than satisfactory. Question-10 was about 'receptor-based pharmacophore' and question-11 was regarding 'sparse logistics regression'. These two terms are reported to play a vital role in the field by pharmaceutical bioinformatics. The receptor-based pharmacophore provides information about pharmacological interactions and sparse logistics regression provides classification and characterizing information encoded in population activity. [14,15]

The response of the medical practitioners towards 'attitude' domain also indicated average scores to the questionnaires. If the mean of the response was calculated the response will be less than 50%. The response to critical questions (Q-3 and 5) in this domain indicated that more than 80% of the respondents replied 'No' or 'Don't know' option (Table-2). The analysis indicated that the participant has either incorrect answer or they were not aware about the information mentioned in those questions. The question-3 and 5 were about the Kinet DS® and Stat-Ease® softwares, respectively. The KinetDS software is used for pharmacokinetics studies of a drug while Stat-Ease software is utilized for designing an experiment and studying the biological responses. [16,17]

Similar observations were found when the response of the participants about the practice domain was analyzed (Table-2). The overall response to this domain's questions indicated that less 50% of practitioners answered as 'Yes' and more than 50% selected either 'No' or 'Don't know' reply. The critical questions (Q-5 and 6) in this domain indicated that more than 50% of the respondents choose 'Don't know' as their reply (Table-2). The Q-5 and 6 is related to application of bioinformatics in solving the issues regarding the oral insulin formulation and discovery of 'Meropenem' for superbug, respectively. A lot of research is under-progress to formulate the oral insulin preparation by utilizing the bioinformatics. [18] Extensive studies were carried out to discover the newer antibiotic 'Meropenem' against the multi-drug resistant 'superbug'. [19]

The mean scores of the participants' response on the domains of KAP indicated that qualification of the medical practitioners could influence the attitude and practice domain of the pharmaceutical bioinformatics. Other characteristics such as gender, age and experience seems to have insignificant influence on the response (Table-3). The positive Rho value and the correlation between knowledge – attitude, knowledge – practice and practice – attitude showed significant difference when responses of practitioners were correlated (Table-4). The analysis of the medical practitioners' response indicated that gender and age can influence significantly ($p<0.05$) the response of the participants towards the questions of the pharmaceutical bioinformatics (Table-5).

To summarize, it can be suggested from the study that the medical practitioners have less than satisfactory knowledge, attitude and practice towards pharmaceutical bioinformatics, the gender and age of the participants could have an influence on their response.

LIMITATIONS OF THE STUDY

The study was conducted with survey-based questionnaires through both online as well by interviews on medical practitioners of health care profession. The study covered most of the health related professionals however; there is every possibility that the study might have missed the potential candidate having thorough information on pharmaceutical bioinformatics due to unavoidable reasons. Further, this study was done on selected participants of Qassim University of Saudi Arabia and hence does not reflect the opinion of whole University or the province of the country.

CONCLUSION

The data from the survey-study reveals that medical practitioners affiliated to health care institutions of Qassim University has moderate knowledge, attitude and practice towards pharmaceutical bioinformatics. There is an influence of gender and age on their response to the domains of KAP which needs update and can be achieved by encouraging the professionals to actively participate the conferences / workshops / seminars / other related activities to enlighten the information on the emerging field of new drug discovery called pharmaceutical bioinformatics.

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Table-1: Demographic characteristics of participants in the survey

Demographic Variables		Practitioners (%)
Gender	Male	47.1%
	Female	52.9%
Age (years)	Less than 35	64.7 %
	36-45	17.6%
	46-55	17.6%
	56 and above	--
Qualification	Bachelor	58.8%
	Master	17.6%
	Ph.D	23.5%
Experience	Less than 5 years	47.1%
	6-10 years	17.6%
	11-15 years	5.9%
	16-20 years	17.6%
	Above 21 years	11.8%

Table-2: Frequency of response of medical practitioners for KAP questionnaires.

Domain	Item No.	Percentage response of practitioners		
		Yes	No	Don't know
Knowledge	1	64.7 %	29.4 %	5.9 %
	2	76.5 %	0	23.5 %
	3	58.8 %	11.8 %	29.4 %
	4	64.7 %	5.9 %	29.4 %
	5	70.6 %	5.9 %	23.5 %
	6	58.8 %	5.9 %	35.3 %
	7	47.1 %	11.8 %	41.2 %
	8	41.2 %	17.6 %	41.2 %
	9	47.1 %	23.5 %	29.4 %
	10*	41.2 %	29.4 %	29.4 %
	11*	35.3 %	29.4 %	35.3 %
Attitude	1	64.7 %	5.9 %	29.4 %
	2	17.6 %	29.4 %	52.9 %
	3*	11.8 %	5.9 %	82.4 %
	4	64.7 %	5.9 %	29.4 %
	5*	11.8 %	17.6 %	70.6 %
	6	47.1 %	11.8 %	41.2 %
	7	64.7 %	11.8 %	23.5 %
Practice	1	64.7 %	5.9 %	29.4 %
	2	76.5 %	5.9 %	17.6 %
	3	47.1 %	35.3 %	17.6 %
	4	52.9 %	--	47.1 %
	5*	35.3 %	11.8 %	52.9 %
	6*	35.3 %	11.8 %	52.9 %
	7	47.1 %	23.5 %	29.4 %
	7.a	64.7 %	5.9 %	29.4 %
	8	23.5 %	58.8 %	17.6 %
	8.a	23.5 %	0	0

*Critical questions

Table-3: Mean score of medical practitioners' response on the domains of KAP with respect to demographic characteristics.

Demographic Variables		K-Score 1.76 ± 0.819 Mean rank	*p*-value	A-Score 1.41 ± 0.500 Mean rank	*p*-value	P-Score 1.58 ± 0.701 Mean rank	*p*-value
Gender	Male	16.63	0.646	18.25	0.695	15.25	0.224
	Female	18.28		16.83		19.50	
Age	Less than 35	17.05	0.221	15.95	0.455	17.95	0.859
	36-45	13.50		20.17		17.83	
	46-55	23.17		20.50		15.50	
Qualification	Bachelor	17.40	0.126	15.90	0.014*	17.80	0.020*
	Master	23.17		27.83		25.50	
	Ph.D	13.50		13.75		10.75	
Experience	Less than 5 years	18.25	0.420	15.88	0.514	18.25	0.209
	6-10 years	13.83		21.50		19.17	
	11-15 years	23.50		25.50		25.50	
	16-20 years	13.50		14.83		9.50	
	Above 21 years	23.00		18.00		20.00	

Note: K-Score = Average knowledge score, A-Score = Average attitude score and P-Score = Average practice score.

Statistics: One-way Anova followed by post-hoc analysis.

*p<0.05, **P<0.01 compared among different groups.

Table-4: Correlation between various domains of KAP for medical practitioner's response.

Variables	Rho value	*P*-value
Knowledge ,Attitude	0.686	0.01**
Knowledge, Practice	0.731	0.01**
Practice, Attitude	0.791	0.01**

Statistics: One-way Anova followed by post-hoc analysis.

**P<0.01 compared among different groups.

Table-5: Analysis of medical practitioner's response on the domains of KAP.

Demographic Variables		Knowledge			*p*-value	Attitude			*p*-value	Practice			*p*-value
		Good	Fair	Poor		Good	Fair	Poor		Good	Fair	Poor	
Gender	Male	0	8	8	0.003**	0	6	10	0.681	0	6	10	0.128
	Female	8	2	8		0	8	10		4	6	8	
Age	Less than 35	6	6	10	0.622	0	6	16	0.083	2	6	16	0.035*
	36-45	0	2	4		0	4	2		2	20	18	
	46-55	2	2	2		0	4	2		4	2	10	
Qualification	Bachelor	4	4	4	0.756	1	2	9	0.725	2	2	8	0.143
	Master	8	6	10		1	9	14		0	12	12	
	Ph.D	18	16	12		2	17	27		6	14	26	
Experience	Less than 5 years	6	4	6	0.119	0	4	12	0.166	4	2	10	0.107
	6-10 years	0	2	4		0	4	22		0	4	2	
	11-15 years	0	2	0		0	2	0		0	2	0	
	16-20 years	0	2	4		0	2	4		0	2	4	
	Above 21 years	2	0	2		0	2	2		0	2	2	

Statistics: One-way Anova followed by post-hoc analysis.

*p<0.05, **P<0.01 compared among different groups.