Adverse drug reaction monitoring and reporting among physicians and pharmacists in Pakistan: A cross-sectional study

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Abstract

Background: The success of a reporting system of adverse drug reaction (ADR) depends on the knowledge, attitudes and practices of health care professionals. However, due to lack of knowledge and poor contribution by healthcare workers, ADR remains underreported. To improve safety, proper identification and ADR reporting is necessary. **Objective:** This study was carried out to determine knowledge, attitude and practices of ADR among physicians and pharmacists working in Pakistan and the factors which encourage and discourage effective reporting. **Methods:** A cross-sectional study was conducted using a pretested questionnaire. Questionnaires were distributed among 333 physicians and 34 pharmacists with a 95.5% response rate. The Statistical Package for Social Science (SPSS) was used for data analysis. **Results:** Pharmacists have more knowledge regarding ADR compared to physicians (47.1% vs 13.8%, $p < 0.001$). Pharmacists have also positive attitude compared to physicians (97.1% vs. 76.3%, $p < 0.001$). No significant difference

was noticed in ADR practice by physicians and pharmacists (12.3% vs 11.8, p = 0.92). The seriousness of ADR was the main factor which encourages nearly all pharmacists to report, whereas among physician's seriousness of the reaction, the unusualness of reaction, the new drug involvement, and confidence in diagnosis were the factors which encourage them to report ADR. **Conclusion:** Overall, pharmacists had more knowledge and a positive attitude regarding ADR reporting compared to physicians, but practices of ADR reporting remained the same among both. Therefore, it is suggested that educational interventions along with training programs should be developed.

Keywords: Adverse drugs reactions, Public health; Pharmacovigilance; health care systems; hospitals; ADR reporting.

1 Introduction

Adverse drug reaction (ADR) is a major problem, occurring worldwide. Consequently, it is important to report every adverse drug reaction and many developing countries are making great efforts in order to develop strong ADR reporting systems (1). ADR is one of the most common cause of morbidity and mortality around the world (2). Yet reducing the incidence associated with ADR is a great challenge for all health care professionals. ADRs have a great impact on the health of people by creating an economic burden on health care systems and society (3). For an efficient ADR reporting system, adequate knowledge and positive attitudes are important in healthcare professionals, as this could lead to the detection, assessment, prevention and reporting of ADR. An effective ADR reporting system is also needed for the development of effective pharmacovigilance programs (4, 5). Yet despite the progress in ADR reporting, the burden of ADR on public health remains significant, as pharmacoeconomic studies show that a considerable

proportion of the health budget is still spent in treating ADR (6). The number of deaths associated with ADR is also significant, as approximately 100,000 people have died due to adverse drug events alone (7)(8-12). Yet almost 30–80% of ADR are preventable, which presents an opportunity for the development of robust reporting programs to enhance patient care and reduce hospital admissions (13).

In Pakistan approximately 10,000 public health care facilities are present, yet the private health care sector serves **7**0% of the population (14). Still, no organized system of disease surveillance, proper health policies or system research is currently present (15). Nevertheless, studies show that irrational drug use and mortality and morbidity associated with ADR is very common in Pakistan and this highlights the importance of improving pharmacovigilance in Pakistan (15). Whilst a National Health Policy (NHP) is present in Pakistan (16), pharmacovigilance is not a part of the National drug policy (NDP) (17). However, the National Pharmacovigilance centre is present (18), and for reporting of ADR, an official form is used and accessed via the Ministry of Health website (19). The NDP states that a monitoring centre for ADR will be established, post-marketing surveillance of new drugs will be done and monitoring of ADR will also be carried out (20). Yet in Pakistan, practices associated with pharmacovigilance are currently poor, and underreporting of ADR remains throughout the world (2, 21-23). Both physicians and pharmacists have an important role in improving the number and quality of ADR report (24-29). Therefore, the aim of the present study is to compare the knowledge, attitude and practice regarding ADR between **p**hysicians and pharmacists to identify reasons for under-reporting and the steps that are needed to increase ADR reporting in Pakistan.

2 Materials and Methods

2.1 Study Setting and Design

A cross-sectional study was conducted in the capital city of Pakistan among physicians and pharmacists. In this study, 367 participants (333 physicians; 34 pharmacists) participated giving an overall response rate of 95.5%.

2.2 Study Tool

A questionnaire was developed after collecting information on the knowledge, attitude and practices of ADR reporting among **p**hysicians and pharmacists around the world. (25, 30-32). The final form of the questionnaire consisted of 5 parts. Part one included 4 questions on respondent's demographic information, second part contains 9 questions to know respondent's knowledge of ADR and pharmacovigilance, third part consisted of 4 questions to determine health professional's attitude towards ADR reporting, fourth part had 9 questions which identify the practice of ADR in hospitals and fifth part of the questionnaire include 2 questions related to factors which encourage and discourage respondents from reporting ADR.

2.3 Validity of Questionnaire

The questionnaire was reviewed by 2 expert pharmacists present at the Quaid-i-Azam University, Pakistan, they checked the questions clarity, relevance and consistencies. After this, a pilot study was conducted by distributing the questionnaire to 30 physicians and 10 pharmacists of four different hospitals to assess questionnaire validity. Slight modifications were carried out and cronbach alpha came out to be 0.72, after that questionnaire was finalised. Data collected during the pilot study was not included in the results reported below.

2.4 Sample Recruitment and Data Collection

Private, governmental, teaching and specialist hospital sites in Islamabad were selected randomly, respondents were then selected via convenience sampling. Surveys were sent to a variety of local hospitals, and the respondents were directly contacted via their department. The respondents were briefed about the objectives of the study and invited to complete the questionnaire. Some questionnaires were left, and then collected after 1-2 days. Some of the questionnaires with attached informed consent were distributed via hospital directors and were collected after 2 weeks.

2.5 Data Analysis

Quantitative data were analysed by using SPSS version 21. The data was coded and then verified systematically for any errors. Descriptive and inferential statistics were carried out. For quantitative variables arithmetic mean and standard deviation and for qualitative variables, percentages and frequencies were calculated. Comparison between knowledge, attitude and practice data obtained from physicians and pharmacists was done by using Chi-square test or Fischer Exact Test. The p value <0.05 was considered significant.

3 Results

3.1 Demographics

In this study, questionnaires were completed by 333 physicians and 34 pharmacists through direct correspondence, email and via hospital directors giving an overall response rate of 95.5%. Among respondents, 64.3% physicians and 23.5% pharmacists were from the public hospital whereas 35.7% physicians and 76.5 pharmacists were from private hospitals ($p < 0.00$). The average age of

physicians and pharmacists was 28.6± 6.9 and 25.4 ±1.9 respectively. Demographics details are shown in Table 1.

Table **1**: Demographic characteristics of respondents.

Demographic features	Categories	Physicians	Pharmacist	p value
Age		Mean age: 28.6 ± 6.9	Mean age: 25.4 ± 1.9	<0.001
Gender	Male Female	204 (61.3) 129 (38.7)	11(32.4) 23 (67.6)	<0.001
Nature of job	Permanent Temporary	132 (39.6) 201 (60.4)	4 (11.8) 30 (88.2)	<0.001
Hospital category	Public Private	214 (64.3) 119 (35.7)	8 (23.5) 26 (76.5)	<0.001

3.2 Description of Knowledge Regarding Pharmacovigilance and ADR

Several items were added to the questionnaire to assess the physicians and pharmacist's knowledge. Results showed that difference between pharmacist and physician knowledge regarding every aspect of ADR and pharmacovigilance varied from question to question. Significantly pharmacists have better knowledge regarding correct definition of pharmacovigilance (61.8% vs 13.2%, $p < 0.001$), correct definition of ADR (61.8% vs 31.8%, $p < 0.001$) and type of ADR (73.5% vs 30.6%, $p < 0.001$). Pharmacists knew significantly more than physicians about International ADR reporting center (52.9% vs 20.7%, $p < 0.001$), National pharmacovigilance centre (47.1% vs 17.4%) and drugs that are banned due to ADR (61.85% vs

131 20.4%). On the other hand, none of the pharmacists was aware of WHO online database whereas

132 19.5% physicians have knowledge about it (p <0.001) (**Error! Reference source not found.**).

133 **Table 2:** ADR reporting knowledge among physicians and pharmacists.

Variables		**Physicians** n = 333	**Pharmacists** n = 34	**P value**
Know about pharmacovigilance definition	Yes= n (%)	44 (13.2)	21 (61.8)	<0.001
	No= n (%)	289 (86.8)	13 (38.2)	
Know about ADR definition	Yes= n (%)	106 (31.8)	21 (61.8)	<0.001
	No= n (%)	227 (68.2)	13 (38.2)	
Know about types of ADR	Yes= n (%)	102 (30.6)	25 (73.5)	<0.001
	No= n (%)	231(69.4)	9 (26.5)	
Know about international canter for ADR monitoring	Yes= n (%)	69 (20.7)	18 (52.9)	<0.001
	No= n (%)	264 (79.3)	16 (47.1)	
Aware of the drug that has been banned in the world	Yes= n (%)	68 (20.4)	21 (61.8)	<0.001
	No= n (%)	265 (79.6)	13 (38.2)	
Know about the ADR reporting centre in Pakistan	Yes= n (%)	58 (17.4)	16 (47.1)	<0.001
	No= n (%)	275 (82.6)	18 (52.9)	
Shared information about ADR with others	Yes= n (%)	38 (11.4)	23 (67.6)	<0.001

	No= n (%)	294 (88.6)	11 (32.4)	
Agree that side effects like a headache, nausea and vomiting should be reported	Yes= n (%)	131 (39.3)	4 (11.8)	0.006
	No= n (%)	202 (60.7)	30 (88.2)	
Know about WHO online database for reporting ADR	Yes= n (%)	65 (19.5)	0 (0.0)	<0.001
	No= n (%)	268 (80.5)	34 (100)	

3.3 Attitudes about ADRs Reporting

No significant difference between physicians and pharmacist's attitude was seen in terms of believing that ADR reporting is necessary (96.7% vs 97.1%) and ADR reporting should be made mandatory (97.2% vs 100%). However, physicians have significantly stronger belief than pharmacists that ADR reporting increase patient safety (97.8% vs 85.2%, $p < 0.001$). Pharmacists significantly outnumbered physicians in believing that ADR reporting is not time consuming (61.7% vs 26.4%, $p < 0.001$) (Table 3).

Table 3: The attitude of health care professionals towards ADR reporting.

Questions	Categories	Physicians	Pharmacist	p value
Is ADR reporting necessary?	Yes = n (%)	322 (96.7)	33 (97)	0.31
	No = n (%)	11 (3.3)	1(2.9)	
ADR reporting should be mandatory	Yes = n (%)	324 (97.2)	34 (100)	0.77
	No = n (%)	9 (2.7)	0 (0.0)	
ADR reporting increase patient safety	Yes = n (%)	326 (97.8)	29 (85.2)	<0.001
	No = n (%)	7 (2.1)	5 (14.7)	
ADR is time consuming	Yes = n (%)	245 (73.5)	13 (38.2)	<0.001
	No = n (%)	88 (26.4)	21 (61.7)	

3.4 ADR Reporting Practice

Among the respondents, 33% physicians and 35.3% pharmacists stated that at their workplace ADR reporting system is present. 34.2% physicians and 23.5% pharmacists have free access to reporting forms of ADR. Significant difference was noticed in the number of ADR respondents encountered per week, 51.4% physicians and 85.3% pharmacists encounter 0–5 ADR per week, 32.1% physicians and 14.7% pharmacists encounter 6–10 ADR per week whereas 16.5% physicians encounter more than 10 ADR per week whereas none of the pharmacists encounters more than 10 ADR per week ($p < 0.001$). Among respondents, 12.3% physicians and 5.9% pharmacists stated that they have reported ADR which they encountered in their daily practice and

among those who have reported only 1.2% physicians have reported to the correct place whereas none of the pharmacists has reported to the correct place.

Among ADR which were reported by physicians 58.5% were severe in nature, 17.8% were moderate and 9.2% were mild in nature. Whereas pharmacists stated that they have reported only those ADR which were severe in nature ($p < 0.001$). Among respondents, 42% physicians and 67.6% pharmacists stated that their workplace encourages them to report adverse drug reaction ($p < 0.001$). 40.8% physician and 73.5% pharmacist stated that their work place provides information regarding ADR ($p < 0.001$). 14.4% physicians stated that they received training on ADR whereas 0% pharmacists have ever trained on ADR. Significant difference ($p < 0.001$) was noticed in the methods which physicians and pharmacists prefer to report ADR; direct contact (59.8% vs 85.3%), email/website (24% vs 14.7%) and telephone (12% vs 0%) (Table 4)

Table 4. ADR reporting practice among physicians and pharmacists.

Variables		**physicians** n = 333	**Pharmacists** n = 34	**p value**
Is there any ADR reporting system present at your workplace?	Yes = n (%)	110 (33.0)	12 (35.3)	0.05
	No = n (%)	174 (52.3)	22 (64.7)	
	Don't know (%)	49 (14.7)	0 (0.0)	
Do you have free access to ADR reporting forms?	Yes = n (%)	114 (34.2)	8 (23.5)	0.2
	No = n (%)	219 (65.8)	26 (76.5)	
	0 – 5 / week	171 (51.4)	29 (85.3)	<0.001

How many ADRs per week do you encounter in your practice?	6 – 10 / week	107 (32.1)	5 (14.7)	
	More than 10 / week	55 (16.5)	0 (0)	
Have you ever reported an ADR	Yes = n (%)	41(12.3)	2 (5.9)	0.4
	No = n (%)	292 (87.7)	32 (94.1)	
Where have you reported?	An ADR reporting centre	9 (2.7)	8(23.5)	0.007
	The concerned pharmaceutical company	8 (2.4)	15 (44.1)	
	Head of your department	312 (93.77)	6 (17.6)	
	Ministry of health	4 (1.2)	5(14.8)	
The adverse drug reaction which you have reported were	Severe	195 (58.5)	34 (100)	<0.001
	Moderate	31 (9.2)	0 (0.0)	
	Mild	59 (17.8)	0 (0.0)	
	All of above	48 (14.5)	0 (0.0)	
Which method would you prefer to send ADR information to an ADR Reporting Center?	Direct contact	199 (59.8)	29 (85.3)	0.01
	Post	14 (4.2)	0 (0.0)	
	Telephone	40 (12.0)	0 (0.0)	
	Email/ websites	80 (24.0)	5 (14.7)	
	Yes = n (%)	140 (42.0)	23 (67.6)	0.004

Does your workplace encourage you to practice/report ADR?	No= n (%)	193 (58.0)	11 (32.4)	
Does your workplace provide information regarding ADR reporting	Yes= n (%)	136 (40.8)	25 (73.5)	<0.001
	No= n (%)	197 (59.2)	9 (26.5)	
Have you ever been trained on how to report ADR?	Yes= n (%)	48 (14.4)	0 (0.0)	0.007
	No= n (%)	285 (85.6)	34 (100)	

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167 ### *3.5 Overall Knowledge, Attitude and Practice of Respondents Regarding ADR*

168 There were 10 questions to assess the respondent's knowledge. Score '1' was given to each right
169 answer and score '0' was given to the wrong answer. The score of knowledge was calculated for
170 each physician and pharmacist and then knowledge was categorised as good for score ranging (6-
171 10) and poor for score ranging (0-5). Pharmacists were found to be more knowledgeable 47.1 %
172 (n=16) about ADR reporting than physicians 13.8% (n=46, p = 0.001). There were four questions
173 of attitude, score '1' was given to positive attitude and negative attitude was given the score '0'.
174 The attitude score was calculated for both physicians and pharmacists, on the basis of which
175 attitude of respondents was categorised as positive for score ranging (6-5) and negative. The results
176 revealed that pharmacists have more positive attitude towards ADR reporting 97.1 % (n=33) than
177 physicians 76.3% (n=254, p = 0.005). The practice of ADR was determined by finding an overall
178 mean practice score of respondents. Score of '1' was given to good practice and score of '0' was
179 given to poor practice. No significant difference was observed in practice of ADR reporting
180 between physicians and pharmacists (12.3% (n=41) vs 11.8% (n=4), P = 0.92) (Fig.1).

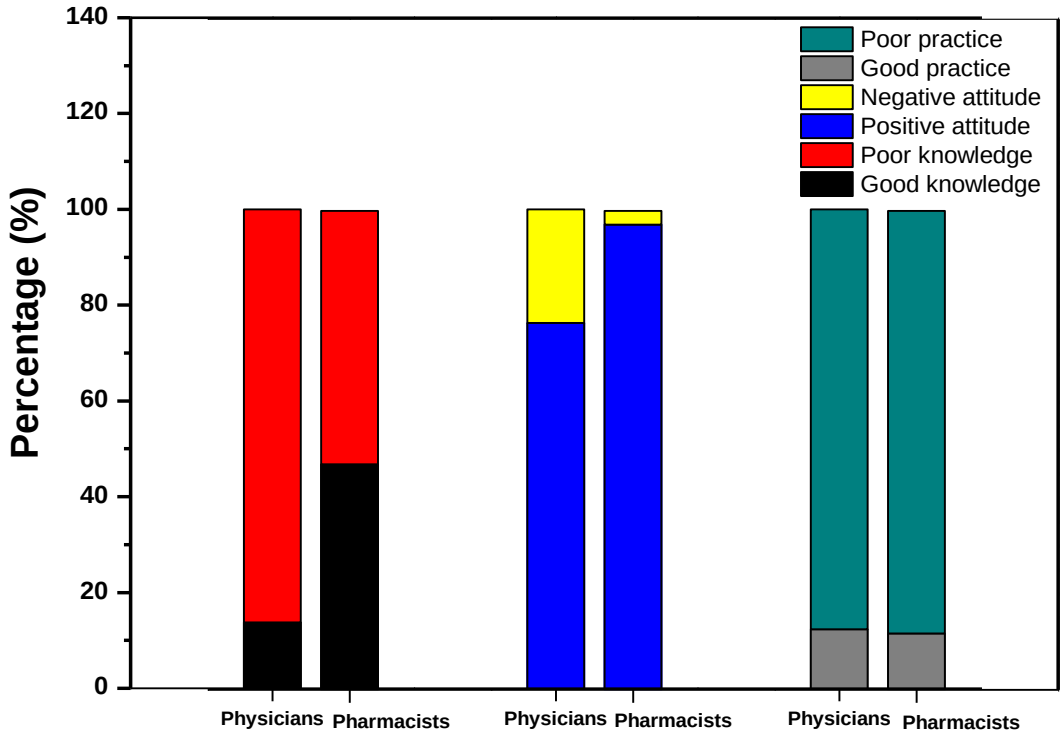

Fig. 1. Overall knowledge, Attitude and practice of respondents regarding ADR.

3.6 Factors which Encourage and Discourage Health Care Professionals to Report ADR

As shown in Fig.2 nearly all pharmacists 94.1% (n=32) stated that the seriousness of reaction encourages them to report ADR. Whereas among doctor's seriousness of reaction 60.7% (n=202), unusualness of reaction 13.8% (n=46), the involvement of new drug 9.3% (n=31), confidence in the diagnosis of reaction 9.9% (n=33) were the main factors which encourage them to report ADR ($p < 0.001$).

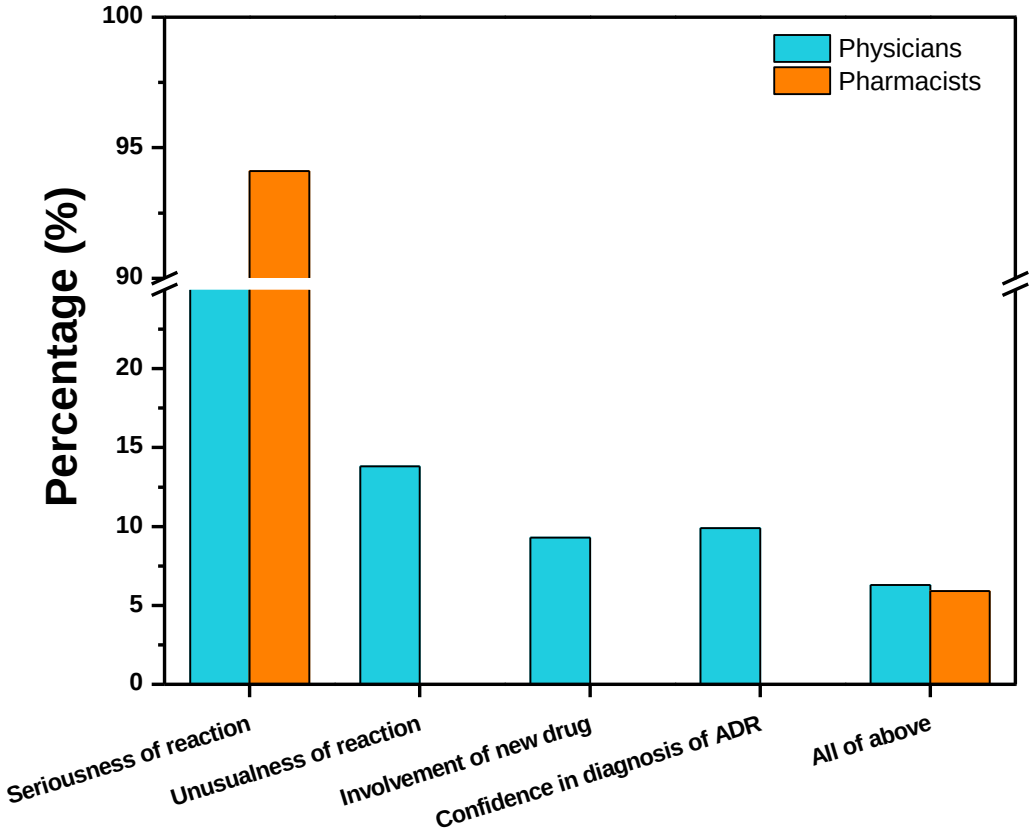

Fig. 2. Factors which encourage physicians and pharmacists to report ADR.

Factors which discourage pharmacists to report ADR include not knowing where and how to report ADR, lack of access to ADR reporting form, patient confidentiality issues and legal liability issues 73.5% (n=25). Among physicians 22.2% (n=74) stated that they do not know how to report ADR, 9.9% (n=33) do not know where to report ADR, 13.5% (n=45) think that managing patient is more important and 12.9% (n=43) physicians do not consider it important to report ADR (Fig.3).

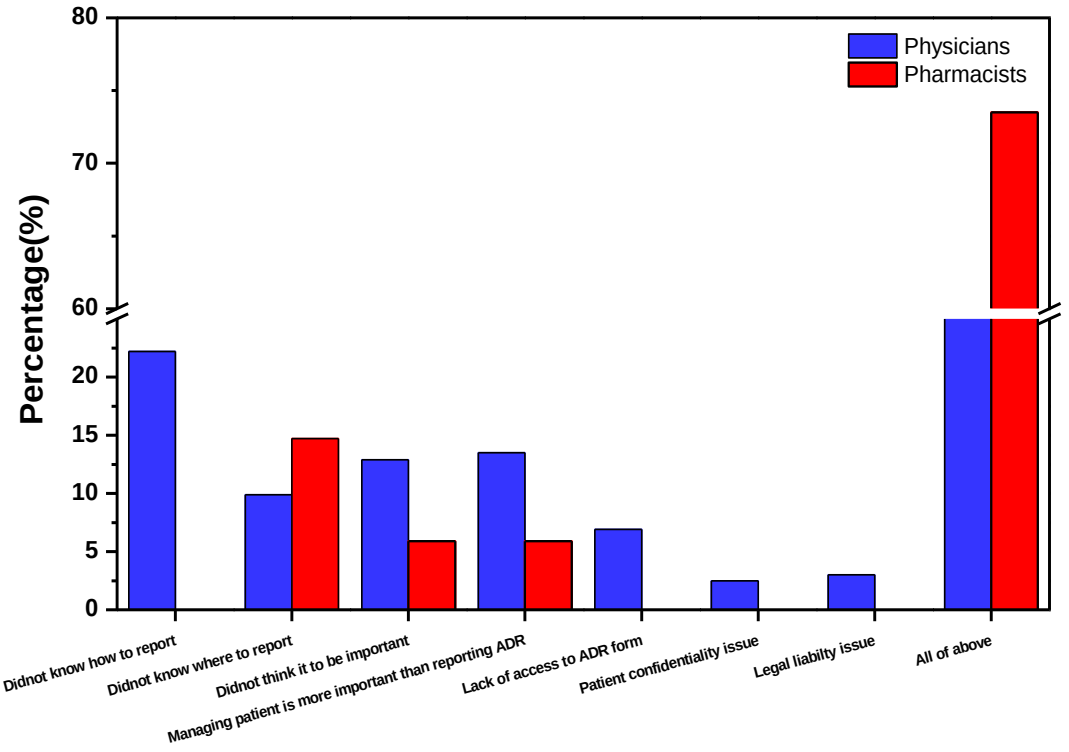

Fig. 3. Factors which discourage physicians and pharmacists to report ADR.

3.7 Association of ADR Knowledge with Attitude and Practice

It can be seen in Fig. 4, that significant association was present between respondent's knowledge and attitude ($p = < 0.001$). Those respondents who have a good knowledge regarding ADR reporting have shown more positive attitude of 91.9% as compared to those who had poor knowledge 75.5%. No significant association was found between knowledge and practice of ADR reporting. Among those who have good knowledge, 14.5% were practising ADR reporting whereas those who had poor knowledge 11.8% practice ADR reporting.

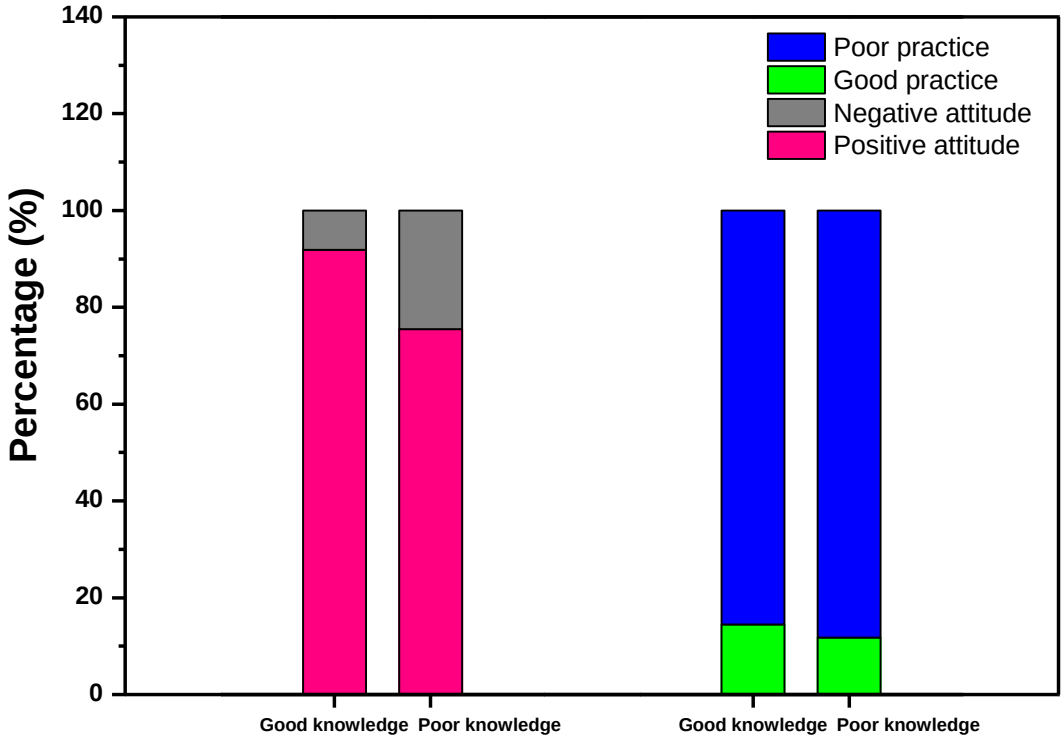

Fig. 4. Association of knowledge of ADR with attitude and practice.

3.8 How could ADR Reporting be Increased?

Both physicians and pharmacists were asked how reporting of adverse drug reaction can be increased (open question) and different responses were given. Pharmacists broadly stated that education and training regarding ADR reporting should be conducted at regular intervals, ADR forms should be made freely available in hospitals, participation on ward rounds, development of local pharmacovigilance unit in hospital, periodic meeting of pharmacists with physicians, nurses and other health care workers are factors which could increase ADR reporting. According to physicians, reporting can be increased by education and training programs and by making it mandatory for all health professionals. The majority of responses given by physicians stated that

the procedure to report ADR should be made simple. Few stated that financial compensation should be provided.

4 Discussion

This study was conducted to determine the knowledge, attitude and practices of ADR reporting among physicians and pharmacists working in secondary and tertiary hospitals of Pakistan. ADR underreporting is still related to poor ADR knowledge (33-35). Yet results presented here showed that pharmacists have generally good knowledge compared to physicians. These results reflect those reported by a similar survey conducted in Kuwait, which also showed that pharmacists had a good knowledge regarding ADR (36), and those from comparable Middle East countries (37, 38). Moreover, the current study showed that physicians have poor ADR knowledge. This finding is comparable to those unearthed in Canada, Nigeria, Malaysia, France, Italy and India where physicians have also been shown to have inadequate ADR knowledge (39-43). In contrast, one study conducted in Nepal demonstrated that physicians actually had better ADR knowledge compared to pharmacists (26).

Very few pharmacists were present in this study. One of the greater challenge pharmacists are facing is the less availability of jobs in hospital and acceptance by physicians (44). Another study related to ADR conducted in Saudi Arabia similarly presented a low ratio of physicians to pharmacists (148 physicians and 37 pharmacists respectively (45). In countries like Malaysia, there is also an acute shortage of pharmacists (46), and in Ghana only 619 pharmacists are present for 2.9 million people (47). In Pakistan 8102 pharmacists are present, but only 15% are engaged in a clinical setting (48).

One unique finding of this study was that pharmacists in Pakistan who knew about PV definition (61.8%) were also aware of ADR definition (61.8%) as well as about drug which were banned due to ADR in the world (61.8%). These results reflect those of other published literature from Kuwait, Saudi Arabia, Oman and China (16, 36, 45, 49). Furthermore, this study revealed that none of the pharmacists in Pakistan was aware of formal ADR reporting centre in other countries and about WHO online database for reporting ADR but approximately half of the pharmacists were aware of national pharmacovigilance centre in Pakistan. In contrast majority of pharmacists are not aware of national pharmacovigilance centre in Kuwait and Jordan (36, 45, 50). This is a critical observation that despite the fact that both physicians and pharmacists had identified ADR during their course of practice only 12.3% physicians and 5.9% pharmacists have ever reported ADR. Furthermore, only a few were reported to the correct place. Similar results were found from other countries, where 32% physicians in Nigeria and 28.5% in China had reported ADR (51) (52). Moreover, only 14.3% pharmacists have ever reported ADR in Hong Kong (53), and a study conducted in Nepal showed only 33.7% reported ADR (26). In Qatar, 21.3% pharmacists have reported ADR whereas 21% in Istanbul and 14.6% in Northern China have ever reported ADR (32) (16). Underreporting of ADR is also seen among pharmacist in Rhode Island (54), Norway (55) and the United Kingdom (56). These findings reflect not only underreporting but also inappropriate reporting. Inadequate reporting is also seen in a study conducted in Saudi Arabia where 50% of ADR reported verbally by physicians and not to the proper place (57).

Results from the current study showed that physicians have a more positive attitude as compare to physicians. An interesting finding was that 100% pharmacists agreed that reporting of ADR should be mandatory and nearly all of them agreed that it is necessary to report ADR and reporting

increase patient safety. The pharmacists positive attitude towards ADR reporting is also seen in Saudi Arabia (58), Turkey (32) and Oman (49). According to this study physicians also exhibit excellent attitude towards reporting of ADR. Yet despite the positive attitude of physicians, the majority of physicians stated that ADR is time-consuming. Other study conducted in Netherland reported that over 35% of physicians think that reporting ADR takes too much time (59). This might suggest that physicians have extra responsibilities, as Pakistan is a densely populated country which faces a shortage of physicians in hospitals, single physician have to attend 100 patient in a couple of hours, on average physician give 1.8 minutes to one patient whereas in the USA physician spends 20 minutes and in Sweden, physician spend 22 minutes with one patient (60).

One of the critical findings of this study was that approximately half of the pharmacists had good knowledge regarding ADR but only a few were practising ADR reporting. The reason for poor practising of ADR by pharmacists may be attributed to lack of training as none of the pharmacists in this study ever get trained on how to report ADR. In the present study, 100% pharmacists stated that they reported only those ADR which were severe. One study that was conducted in the United Kingdom stated that pharmacists are reluctant to report minor ADR as they were of opinion that reporting minor ADR would result in little impact (56).

The reason cited by pharmacists and physicians for not reporting ADR include; lack of awareness regarding where and how to report, reporting ADR is not important, lack of access to reporting form, patient confidentiality and legal liability issues. The reason for underreporting by pharmacists in Norway includes lack of time, confidence and poor knowledge (55). Whereas lack

of time, lack of ADR form, a concern that reporting will generate extra work and concern about generating inappropriate report are the major reason which deters pharmacists to report ADR in the United Kingdom (56). In India, poor knowledge of where to report ADR, busy schedule and lack of incentives are the reasons which discourage physicians to report ADR (61).

This study reveals that both physicians and pharmacists possess poor knowledge of ADR. Poor knowledge about ADR reporting is also seen in Jordan, Kuwait and Islamabad (36, 45, 50, 62). Moreover, 87.4% pharmacists in Hong Kong have poor ADR knowledge despite their positive attitude. According to Herdeiro et al., attitude has a strong influence on ADR reporting (63). An important finding revealed in this study was also the association between knowledge and attitude towards reporting of ADR whereas no significant association was seen between knowledge and practice of ADR reporting. Association was also present between attitude and practice of ADR reporting. These findings are consistent with other studies (64). This suggests that if ADR knowledge is improved among health care professionals then their attitude will also improve which in turn have a positive impact on ADR reporting. This is proved in another study that knowledge has a positive impact on the attitude which in turn influence ADR reporting behaviour in a positive manner (55). The low level of knowledge and poor practices seen in ADR reporting among physicians and pharmacists presented here suggests that there should be more advanced training and provisions designed and available to improve the reporting of ADR. Consequently, the authors of this study call for the development of such evidence-based education and training programs for physicians and pharmacists, as educational interventions play an important role in improving ADR reporting (26, 65-68). Regular inspection and monitoring regarding the implementation of the ADR reporting system may also be required. As such, the Ministry of Health could usefully govern

and monitor the pharmacovigilance center by setting clear policies and legislation on what and how to report which may in turn improve the ADR reporting practices of pharmacist and physicians in Pakistan.

5 Conclusion

The present study is the first to determine physicians and pharmacists' knowledge, attitude and practice towards ADR reporting in Pakistan. Our results reveal that pharmacists in this setting had more knowledge as well as a more positive attitude regarding ADR reporting when compared to physicians, yet practices were found to be the same among both. ADR reporting may be improved through the development of educational training programs. Cooperation between physicians and pharmacists may also be of great importance, leading to improvements in the adverse drug reaction reporting system in Pakistan. The results presented here are not generalizable to other hospitals in Pakistan due to potential differences in the level of knowledge and practices in hospitals in other cities. Further studies are therefore recommended to strengthen the effectiveness of ADR reporting activities in Pakistan.

6 Ethical approval and consent to participate

Ethical approval was taken from the institutional ethical committee of Quaid-i-Azam University to instigate the study. The objectives of the study were explained to respondents, and those who agreed to participate were provided with written informed consent. Ethical approval was also taken from hospitals in which ethical committee was present. Questionnaires were left with the ethical committee of the hospital for assessment. After the assessment, the hospital ethical committee gave permission to conduct this study.

7 Human and Animal Rights

No Animals were used in the study. All the reported experiments on Humans were completed in accordance with the recommendations of the Helsinki Declaration.

8 Conflict of Interest

The authors declare no conflict of interest, financial or otherwise.

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References

1. Wysowski DK, Swartz L. Adverse drug event surveillance and drug withdrawals in the United States, 1969-2002: the importance of reporting suspected reactions. Archives of internal medicine. 2005;165(12):1363-9.
2. Oshikoya KA, Awobusuyi JO. Perceptions of doctors to adverse drug reaction reporting in a teaching hospital in Lagos, Nigeria. BMC clinical pharmacology. 2009;9(1):14.
3. Wu WK, Pantaleo N. Evaluation of outpatient adverse drug reactions leading to hospitalization. American journal of health-system pharmacy. 2003;60(3):253-9.
4. Ramesh M, Pandit J, Parthasarathi G. Adverse drug reactions in a south Indian hospital—their severity and cost involved. Pharmacoepidemiology and drug safety. 2003;12(8):687-92.
5. Khan SA, Rao PG, Rodrigues GS, Rajan S, Heda A. From thalidomide to rofecoxib: Can we afford to wait and watch? International Journal of Risk & Safety in Medicine. 2006;18(4):219-30.
6. White TJ, Arakelian A, Rho JP. Counting the costs of drug-related adverse events. Pharmacoeconomics. 1999;15(5):445-58.
7. Chyka PA. How many deaths occur annually from adverse drug reactions in the United States? The American journal of medicine. 2000;109(2):122-30.
8. Lazarou J, Pomeranz BH, Corey PN. Incidence of adverse drug reactions in hospitalized patients: a meta-analysis of prospective studies. Jama. 1998;279(15):1200-5.
9. Moore N, Lecointre D, Noblet C, Mabille M. Frequency and cost of serious adverse drug reactions in a department of general medicine. British journal of clinical pharmacology. 1998;45(3):301-8.
10. Pattanaik S, Dhamija P, Malhotra S, Sharma N, Pandhi P. Evaluation of cost of treatment of drug-related events in a tertiary care public sector hospital in Northern India: a prospective study. British journal of clinical pharmacology. 2009;67(3):363-9.
11. Thiyagu R, Mallayasamy SR, Rajesh V, Muralidhar V, Smitha P, Sudha V, et al. Development of indicators for identifying adverse drug events in an Indian tertiary care teaching hospital. Drug, healthcare and patient safety. 2010;2:95-100.
12. Arulmani R, Rajendran S, Suresh B. Adverse drug reaction monitoring in a secondary care hospital in South India. British journal of clinical pharmacology. 2008;65(2):210-6.
13. Gholami K, Shalviri G. Factors associated with preventability, predictability, and severity of adverse drug reactions. Annals of pharmacotherapy. 1999;33(2):236-40.
14. Ghaffar A, Kazi BM, Salman M. Health care systems in transition III. Pakistan, part I. An overview of the health care system in Pakistan. Journal of public health medicine. 2000;22(1):38-42.
15. Organization WH. Report of the Health System Review Mission–Pakistan. United Kingdom: World Health Organization, United Nations Children Fund, Department for International Development, The World Bank. 2007:19-28.

16. Su C, Ji H, Su Y. Hospital pharmacists' knowledge and opinions regarding adverse drug reaction reporting in Northern China. Pharmacoepidemiology and drug safety. 2010;19(3):217-22.
17. WHO. National Drug Policy- Pakistan. 2003.
18. Raza A, Jamal H. Assessment of Knowledge, Attitudes and Practice among the Medical and Pharmacy Students towards Pharmacovigilance and Adverse Drug Reactions in Abbottabad, Pakistan. Journal of Pharmacovigilance. 2015;2015.
19. Mahmood KT, Amin F, Tahir M, Haq IU. Pharmacovigilance: a need for best patient care in Pakistan: a review. J Pharm Sci Res. 2011;3(11):1566-84.
20. Rizvi N, Nishtar S. Pakistan's health policy: appropriateness and relevance to women's health needs. Health Policy. 2008;88(2):269-81.
21. Yadav S. Status of adverse drug reaction monitoring and pharmacovigilance in selected countries. Indian journal of pharmacology. 2008;40(Suppl1):S4.
22. Smith C, Bennett P, Pearce H, Harrison P, Reynolds D, Aronson J, et al. Adverse drug reactions in a hospital general medical unit meriting notification to the Committee on Safety of Medicines. British journal of clinical pharmacology. 1996;42(4):423-9.
23. Moride Y, Haramburu F, Requejo AA, Begaud B. Under-reporting of adverse drug reactions in general practice. British journal of clinical pharmacology. 1997;43(2):177-81.
24. van Grootheest K, Olsson S, Couper M, de Jong-van den Berg L. Pharmacists' role in reporting adverse drug reactions in an international perspective. Pharmacoepidemiology and drug safety. 2004;13(7):457-64.
25. Gupta SK, Nayak RP, Shivaranjani R, Vidyarthi SK. A questionnaire study on the knowledge, attitude, and the practice of pharmacovigilance among the healthcare professionals in a teaching hospital in South India. Perspectives in clinical research. 2015;6(1):45.
26. Palaian S, Ibrahim MI, Mishra P. Health professionals' knowledge, attitude and practices towards pharmacovigilance in Nepal. Pharmacy practice. 2011;9(4):228-35.
27. Hanafi S, Torkamandi H, Hayatshahi A, Gholami K, Javadi M. Knowledge, attitudes and practice of nurse regarding adverse drug reaction reporting. Iranian journal of nursing and midwifery research. 2012;17(1):21.
28. Bakhsh TMA, Al-Ghamdi MS, Bawazir SA, Raddadi R, Qureshi NA. Physicians sociodemographics and knowledge, awareness, attitude and practice towards reporting adverse drug reactions: An association study in Jeddah city, Saudi Arabia. British Journal Pharmaceutical Research. 2016;12(3):1-15.
29. Sharrad AK. Pharmacists'knowledge, attitude and practice about adverse drug reaction in basra/iraq. International Journal of Pharmaceutical Sciences and Research. 2017;8(5):2309.
30. Vessal G, Mardani Z, Mollai M. Knowledge, attitudes, and perceptions of pharmacists to adverse drug reaction reporting in Iran. Pharmacy world & science. 2009;31(2):183-7.
31. Hasford J, Goettler M, Munter K-H, Müller-Oerlinghausen B. Physicians' knowledge and attitudes regarding the spontaneous reporting system for adverse drug reactions. Journal of clinical epidemiology. 2002;55(9):945-50.

32. Toklu HZ, Uysal MK. The knowledge and attitude of the Turkish community pharmacists toward pharmacovigilance in the Kadikoy district of Istanbul. Pharmacy world & science. 2008;30(5):556-62.
33. Nazir S. Adverse Drug Reaction Reporting System At Different Hospitals Of Lahore-An Evaluation And Patient Outcome Analysis. Value in Health. 2014;17(3):A166.
34. Anwar M, Haq NU. Assessment Of Knowledge, Attitude And Practice Of Healthcare Professional (Pharmacist) Regarding Adverse Drug Reaction Reporting And Pharmacovigilance In Public Hospitals In Quetta, Pakistan.
35. Iffat W, Shakeel S, Rahim N, Anjum F, Nesar S, Ghayas S. Pakistani physicians knowledge and attitude towards reporting adverse drug reactions. African Journal of Pharmacy and Pharmacology. 2014;8(14):379-85.
36. Alsaleh FM, Alzaid SW, Abahussain EA, Bayoud T, Lemay J. Knowledge, attitude and practices of pharmacovigilance and adverse drug reaction reporting among pharmacists working in secondary and tertiary governmental hospitals in Kuwait. Saudi Pharmaceutical Journal. 2016.
37. John LJ, Arifulla M, Cheriathu JJ, Sreedharan J. Reporting of adverse drug reactions: an exploratory study among nurses in a teaching hospital, Ajman, United Arab Emirates. DARU Journal of Pharmaceutical Sciences. 2012;20(1):44.
38. Mahmoud MA, Alswaida Y, Alshammari T, Khan TM, Alrasheedy A, Hassali MA, et al. Community pharmacists' knowledge, behaviors and experiences about adverse drug reaction reporting in Saudi Arabia. Saudi Pharmaceutical Journal. 2014;22(5):411-8.
39. Nichols V, Thériault-Dubé I, Touzin J, Delisle J-F, Lebel D, Bussières J-F, et al. Risk Perception and Reasons for Noncompliance in Pharmacovigilance. Drug safety. 2009;32(7):579-90.
40. Aziz Z, Siang TC, Badarudin NS. Reporting of adverse drug reactions: predictors of under-reporting in Malaysia. Pharmacoepidemiology and drug safety. 2007;16(2):223-8.
41. Fadare JO, Enwere OO, Afolabi A, Chedi B, Musa A. Knowledge, attitude and practice of adverse drug reaction reporting among healthcare workers in a tertiary centre in Northern Nigeria. Tropical Journal of Pharmaceutical Research. 2011;10(3).
42. Graille V, Lapeyre-Mestre M, Montastruc J. Drug vigilance: opinion survey among residents of a university hospital. Therapie. 1994;49(5):451-4.
43. Cosentino m, leoni o, banfi f, lecchini s, frigo g. Attitudes to adverse drug reaction reporting by medical practitioners in a Northern Italian district. Pharmacological research. 1997;35(2):85-8.
44. Khan T. Challenges to pharmacy and pharmacy practice in Pakistan. The Australasian medical journal. 2011;4(4):230.
45. Abdel-Latif MM, Abdel-Wahab BA. Knowledge and awareness of adverse drug reactions and pharmacovigilance practices among healthcare professionals in Al-Madinah Al-Munawwarah, Kingdom of Saudi Arabia. Saudi pharmaceutical journal. 2015;23(2):154-61.
46. Azhar S, Hassali MA, Ibrahim MIM, Ahmad M, Masood I, Shafie AA. The role of pharmacists in developing countries: the current scenario in Pakistan. Human Resources for Health. 2009;7(1):54.

47. Owusu-Daaku F, Smith F, Shah R. Addressing the workforce crisis: the professional aspirations of pharmacy students in Ghana. Pharmacy world & science. 2008;30(5):577-83.
48. Ahsan N. Pharmacy education and pharmacy council of Pakistan. Pakistan Drug Update Islamabad. 2005;6:7-8.
49. Jose J, Jimmy B, Al-Ghailani ASH, Al Majali MA. A cross sectional pilot study on assessing the knowledge, attitude and behavior of community pharmacists to adverse drug reaction related aspects in the Sultanate of Oman. Saudi Pharmaceutical Journal. 2014;22(2):163-9.
50. Suyagh M, Farah D, Farha RA. Pharmacist's knowledge, practice and attitudes toward pharmacovigilance and adverse drug reactions reporting process. Saudi pharmaceutical journal. 2015;23(2):147-53.
51. Li Q, Zhang S-M, Chen H-T, Fang S-P, Yu X, Liu D, et al. Awareness and attitudes of healthcare professionals in Wuhan, China to the reporting of adverse drug reactions. Chinese medical journal. 2004;117(6):856-61.
52. Okezie EO. Adverse drug reactions reporting by physicians in Ibadan, Nigeria. Pharmacoepidemiology and drug safety. 2008;17(5):517-22.
53. Lee KK, Chan TY, Raymond K, Critchley JA. Pharmacists' attitudes toward adverse drug reaction reporting in Hong Kong. Annals of Pharmacotherapy. 1994;28(12):1400-3.
54. Generali JA, Danish MA, Rosenbaum SE. Knowledge of and attitudes about adverse drug reaction reporting among Rhode Island pharmacists. Annals of Pharmacotherapy. 1995;29(4):365-9.
55. Granas AG, Buajordet M, Stenberg-Nilsen H, Harg P, Horn AM. Pharmacists' attitudes towards the reporting of suspected adverse drug reactions in Norway. Pharmacoepidemiology and drug safety. 2007;16(4):429-34.
56. Green CF, Mottram DR, Rowe PH, Pirmohamed M. Attitudes and knowledge of hospital pharmacists to adverse drug reaction reporting. British journal of clinical pharmacology. 2001;51(1):81-6.
57. Bakhsh A, Mohammed T, Saeed Al-Ghamdi M, Bawazir SA, Omer TY, Qureshi NA. Assessment of Hospital Physicians' Knowledge, Awareness, Attitude and Practice of Reporting Adverse Drug Reactions in Jeddah, Saudi Arabia. 2016.
58. Bawazir SA. Attitude of community pharmacists in Saudi Arabia towards adverse drug reaction reporting. Saudi Pharmaceutical Journal. 2006;14(1):75.
59. Eland I, Belton K, Van Grootheest A, Meiners A, Rawlins M, Stricker BC. Attitudinal survey of voluntary reporting of adverse drug reactions. British journal of clinical pharmacology. 1999;48(4):623.
60. Tribune T. Doctors in Pakistan give less time to patients. The Tribune. 2017 14 November 2017.
61. Kamtane RA, Jayawardhani V. Knowledge, attitude and perception of physicians towards adverse drug reaction (ADR) reporting: A pharmacoepidemiological study. Asian J Pharm Clin Res. 2012;5(3):210-4.

62. Nisa ZU, Zafar A, Sher F. Assessment of knowledge, attitude and practice of adverse drug reaction reporting among healthcare professionals in secondary and tertiary hospitals in the capital of Pakistan. Saudi Pharmaceutical Journal.
63. Herdeiro MT, Figueiras A, Polónia J, Gestal-Otero J. Influence of pharmacists' attitudes on adverse drug reaction reporting. Drug safety. 2006;29(4):331-40.
64. Qassim S, Metwaly Z, Shamsain M, Al Hariri Y. Reporting adverse drug reactions: evaluation of knowledge, attitude and practice among community pharmacists in UAE. IOSR Journal of Pharmacy. 2014;22(30):31-40.
65. Figueiras A, Herdeiro MT, Polˇnia J, Gestal-Otero JJ. An educational intervention to improve physician reporting of adverse drug reactions: a cluster-randomized controlled trial. Jama. 2006;296(9):1086-93.
66. Scott HD, Thacher-Renshaw A, Rosenbaum SE, Waters WJ, Green M, Andrews LG, et al. Physician reporting of adverse drug reactions: results of the Rhode Island adverse drug reaction reporting project. Jama. 1990;263(13):1785-8.
67. Abubakar AR, Simbak NB, Haque M. A Systematic Review of Knowledge, Attitude and Practice on Adverse Drug Reactions and Pharmacovigilance among Doctors. 2014.
68. Adhikary J, Bhandare B, Adarsh E, Satyanarayana V. A study to assess knowledge, attitude and practice of adverse drug reaction reporting among physicians in a tertiary care hospital. Journal of evolution of medical and dental sciences. 2013;2(9):1027-34.