ATTITUDE OF TEACHING FACULTY TOWARDS STATISTICS AT A MEDICAL UNIVERSITY IN KARACHI, PAKISTAN

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Background: Statistics is mainly used in biological research to verify the clinicians and researchers findings and feelings, and gives scientific validity for their inferences. In Pakistan, the educational curriculum is developed in such a way that the students who are interested in entering in the field of biological sciences do not study mathematics after grade 10. Therefore, due to their fragile background of mathematical skills, the Pakistani medical professionals feel that they do not have adequate base to understand the basic concepts of statistical techniques when they try to use it in their research or read a scientific article. The aim of the study was to assess the attitude of medical faculty towards statistics. **Methods**: A questionnaire containing 42 close-ended and 4 open-ended questions, related to the attitude and knowledge of statistics, was distributed among the teaching faculty of Dow University of Health Sciences (DUHS). One hundred and sixty-seven filled questionnaires were returned from 374 faculty members (response rate 44.7%). **Results:** Forty-three percent of the respondents claimed that they had 'introductive' level of statistics courses, 63% of the respondents strongly agreed that a good researcher must have some training in statistics, 82% of the faculty was in favour (strongly agreed or agreed) that statistics was really useful for research. Only 17% correctly stated that statistics is the science of uncertainty. Half of the respondents accepted that they have problem of writing the statistical section of the article. 64% of the subjects indicated that statistical teaching methods were the main reasons for the impression of its difficulties. 53% of the faculty indicated that the co-authorship of the statistician should depend upon his/her contribution in the study. Gender did not show any significant difference among the responses. However, senior faculty showed higher level of the importance for the use of statistics and difficulties of writing result section of articles as compared to junior faculty. **Conclusion**: The study showed a low level of knowledge, but high level of the awareness for the use of statistical techniques in research and exhibited a good level of motivation for further training.

Keywords: Attitude, statistics, knowledge of medical faculty, knowledge about SPSS.

INTRODUCTION

Statistics is mainly used in biological research to verify the clinicians and researchers findings and feelings, and gives scientific validity for their inferences. In Pakistan, the educational curriculum is developed in such a way that the students who are interested in entering in the field of biological sciences do not study mathematics after grade 10. Therefore, due to their fragile background of mathematical skills, the Pakistani medical professionals feel that they do not have adequate base to understand the basic concepts of statistical techniques when they try to use it in their research or read a scientific article. Hence, their attitude towards statistics shows differently as compared to other professionals who have better background of mathematics. Furthermore, in recent developments of systematic reviews in the form of meta analysis and evidence based medicine (EBM), advanced level of statistical methods are being employed in the literature. Despite these motivations to improve the knowledge and skill of epidemiological and statistical methods, the familiarity of statistical techniques of clinicians and medical faculty are still fragile as mentioned in the literature. Few of those citations are as follows: Reznick *et al*[1] indicated that residents of their survey showed suboptimal knowledge of statistics. Wulf *et al*[2] mentioned that the statistical knowledge of most of the doctors of their study were so limited that they could have difficulty to draw the right conclusions from those statistical analyses which are found in papers in medical journals. Altman & Bland[3] indicated that the state of statistical knowledge among doctors was inadequate. O'Donnel[4] reported that a significant minority of health care professionals have continued difficulty in understanding and explaining terms associated with randomized control trials, such as absolute risk, number needed to treat and odd ratio. West and Ficalora[5] stated that the even experienced researchers with statistical training report discomfort with biostatistical concepts. Horton[6] pointed out that researchers may be able to understand the statistical results and interpret the outcome in only 21% of research articles. Several studies have been conducted to address this issue and authors have indicated the importance to turn around this feeble situation.[3,7–9] However, no study has been conducted in Pakistan, as far as the authors' knowledge is concerned, to address this issue. Therefore, we do not know, if there is any change in the behaviour and knowledge among the Pakistani medical professionals after the improved statistical techniques in the literature and introduction of EBM. Therefore, this study was conducted to assess behaviour and attitude of medical

professionals towards statistics in a public medical university of Pakistan. Understanding the current level of perception, knowledge and behaviour of medical faculty towards statistics may help to revise the medical curriculum, teaching methods and continuing education programs, by incorporating this important field of research and data management.

The aim of the study was to assess the attitude of medical professionals towards statistics.

SUBJECTS AND METHODS

It is a cross-sectional study among the faculty of Dow University of Health Sciences. A questionnaire was developed to acquire the information related to the aim of the study. The questionnaire contained 42 close-ended and 4 open-ended questions. Twenty seven of these close-ended questions were tailored on 5-point Likert scales of 'strongly agree' to 'strongly disagree'. All these 27 questions were phrased in the positive direction with 'strongly agree' was coded as '1' and 'strongly disagree' as '5'. Questions addressed perceptions regarding statistics in general, knowledge and training and role of statistics and statistician in medical research. Demographic variables considered were gender, level of education, specialty, department and academic rank. The questionnaires were distributed among the teaching faculty of Dow University of Health Sciences (DUHS) in June 2007, after getting proper permission from the competent authority. DUHS integrated notices and mail distribution facility was utilized to distribute the questionnaires. Reminders to the non-respondents were sent two times in October 2007 and January 2008. Phone calls to Head of Departments were also made as reminder. DUHS is the largest public medical university in Karachi. In 2007–08, DUHS has 374 teaching faculty in its different campuses. After many follow-ups, we were able to get back 167 filled questionnaires. Initially, the data were analyzed descriptively using SPSS ver. 16.0. Chi-square test was used to determine the association between demographic variables (gender and academic ranks) and other responses. Academic ranks were categorized into senior faculty, included assistant professors and higher ranks; and junior faculty included the lecturers and other teaching faculty. In some questions, 'strongly agree' and 'agree' responses were merged together to make chi square a valid test. Two-tailed test with a level of 5% was utilised for statistical significance.

RESULTS

One hundred and sixty-seven questionnaires were received from 374 teaching staff of DUHS. The response rate was 44.7%. The response rate among male was 37.8% (95/281) and among female was 66.7% (82/123). The response rate of professors was the highest as compared to other academic ranks. The respond rates among different academic ranks were not statistically significant (p=0.149) (Table-1).

Surprisingly, the male and female respondents were almost the same (51% vs 49%). Sixty-one percent (n=102) of the respondents were having either Fellowship or MS / M. Phil. degrees. Forty-three percent (n=72) of the respondents claimed that they have had 'introductive' level of statistics courses during their professional life. About 40% (n=66) of the respondents were on the lecturer rank (Figure-1).

Table-1: Distribution of respondents and non-respondents

Academic Rank	No. of respondents	No. of non-respondents	Total
Professor	25 (58.1)	18 (41.9)	43
Associate Professor	19 (36.5)	33 (63.5)	52
Assistant Professor	48 (39.3)	74 (60.7)	122
Lecturer	66 (47.1)	74 (52.9)	140
Other	9 (52.9)	8 (47.1)	17
Total	167 (44.7)	207 (55.3)	374

p=0.149

Table-2 shows attitude toward statistics. It contains the percentages of 5-point Likert scales responses of 27 questions, along with p-values, comparing the gender and job-title. About two-third (63.3%, n=105) of the respondents strongly agreed that a good researcher must have some training in statistics. There was no significant difference among gender and job title regarding this question (p>0.05). Respondents were closely divided [(36.9%, n=60) in favour and (44.1%, n=72) for against) for the question that I can easily understand how statistics relates to my career. Junior faculty responded significantly more in favour than senior faculty (p<0.0001).

Eighty-two percent (n=136) of the faculty members were in favour (strongly agree or agree) for the question that statistics was really useful. In response to the question that statistics is worthwhile in part of my area of study, only 4% (n=7) of the faculty were against this opinion. The senior faculty members were significantly more in favour than junior ones (p<0.0001). Sixty-two percent (n=101) of the respondents were in favour that statistics is too much math-oriented. Neither gender nor job-title showed any statistical significance (p>0.05). Fifty-six percent (n=90) of the subjects indicated against the opinion that the statistics should be left to the 'expert'. Eighty-seven percent (n=145) of the respondents were in favour that statistics helped them in their research. About the same percentage (n=143) of the respondents were also in favour that training in statistics will make them better professionals. In both the above questions, neither the gender nor job-title showed any statistical significance (p>0.05).

Table-2: The attitude of medical sciences professionals in Pakistan towards the application of statistics

Questions	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total	Comparison among gender *p*-value	Comparison among job title *p*-value
Q1	105 (63.3)	53(31.9)	5(3.0)	1(.6)	2(1.2)	166	0.217	0.591
Q2	19 (11.7)	41(25.2)	31(19.0)	47(28.8)	25(15.3)	163	0.719	0.000
Q3	53 (32.1)	83(50.3)	22(13.3)	6(3.6)	1(.6)	165	0.900	0.163
Q4	49 (29.5)	81(48.8)	29(17.5)	6(3.6)	1(.6)	166	0.711	0.000
Q5	24 (14.7)	77(47.2)	37(22.7)	22(13.5)	3(1.8)	163	0.378	0.211
Q6	13 (8.1)	31(19.3)	27(16.8)	75(46.6)	15(9.3)	161	0.535	0.063
Q7	56 (33.7)	89(53.6)	19(11.4)	2(1.2)	0(0)	166	0.556	0.021
Q8	62 (37.6)	81(49.1)	16(9.7)	4(2.4)	2(1.2)	165	0.232	0.559
Q9	10 (6.2)	29(18.0)	48(29.8)	64(39.8)	10(6.2)	161	0.983	0.111
Q10	5 (3.1)	23(14.3)	36(22.4)	80(49.7)	17(10.6)	161	0.235	0.078
Q11	4 (2.6)	41(27.0)	45(29.6)	52(34.2)	10(6.6)	152	0.355	0.029
Q12	11 (6.7)	32(19.4)	23(13.9)	81(49.1)	18(10.9)	165	0.508	0.091
Q13	50 (30.1)	85(51.2)	21(12.7)	7(4.2)	3(1.8)	166	0.479	0.000
Q14	34 (20.4)	64(38.3)	47(28.1)	18(10.8)	4(2.4)	167	0.023	0.039
Q15	74 (44.6)	83(50.0)	6(3.6)	1(.6)	2(1.2)	166	0.859	0.107
Q16	68 (40.7)	65(38.9)	26(15.6)	6(3.6)	2(1.2)	167	0.798	0.005
Q17	63 (37.7)	60(35.9)	34(20.4)	8(4.8)	2(1.2)	167	0.396	0.014
Q18	47 (28.1)	90(53.9)	25(15.0)	5(3.0)	0(0)	167	0.678	0.000
Q19	3 (1.9)	25(15.4)	43(26.5)	69(42.6)	22(13.6)	162	0.461	0.066
Q20	6 (3.7)	25(15.2)	35(21.3)	83(50.6)	15(9.1)	164	0.760	0.647
Q21	1 (.6)	16(10.0)	41(25.6)	57(35.6)	45(28.1)	160	0.752	0.118
Q22	16 (10.1)	61(38.4)	38(23.9)	42(26.4)	2(1.3)	159	0.304	0.928
Q23	21 (13.5)	61(39.4)	19(12.3)	47(30.3)	7(4.5)	155	0.005	0.744
Q24	17 (10.4)	80(48.8)	31(18.9)	32(19.5)	4(2.4)	164	0.082	0.494
Q25	18 (11.2)	65(40.6)	31(19.4)	44(27.5)	2(1.2)	160	0.061	0.002
Q26	4 (2.5)	35(21.6)	54(33.3)	55(34.0)	14(8.6)	162	0.108	0.157
Q27	2 (1.2)	26(16.0)	50(30.7)	65(39.9)	20(12.3)	163	0.642	0.006

Q1: A good research must have training in statistics; **Q2:** I can easily understand how statistics relates to my career; **Q3:** Statistics is really useful; **Q4:** Statistics is a worthwhile part of my area of study; **Q5:** Statistics is too math-oriented; **Q6:** Statistics is best left to the 'experts'; **Q7:** Statistics helps me to understand research in my specialty; **Q8:** Training in Statistics will make me better professional; **Q9:** Enrolling in a Statistics training course make me anxious; **Q10:** Statistics is very mysterious to me; **Q11:** Statistics is too complicate for me; **Q12:** Dealing with numbers makes me feel uneasy; **Q13:** Statistics knowledge is relevant to my area of study; **Q14:** I am excited about actually using statistics in my job; **Q15:** Statistical thinking is an important characteristic of good research; **Q16:** I would like to take more statistical training; **Q17:** I wish I have taken more statistics classes; **Q18:** Statistics become more understandable and useful after applying it in my career; **Q19:** Statistics is the science of uncertainty; **Q20:** The logic behind statistics is not clear to me; **Q21:** Sometimes I feel a statistician is similar to a witch; **Q22:** It took me a long time to understand statistical concepts; **Q23:** It is unreasonable to expect the average professional to master and apply statistics; **Q24:** You should be good in mathematics before attempting statistics; **Q25:** Statistics is too theoretical to an average medical professional; **Q26:** It is not easy explain a statistics topic someone article; **Q27:** I feel difficult to write the statistical section of my articles.

One quarter (n=39) of the subjects were in favour that enrolling in a statistics training course makes them anxious. Forty-one percent (n=62) of the respondents were against to the opinion that statistics is too complicated to them. Junior faculty agreed to this statement significantly more than senior faculty members (p=0.029). Only 26.1% (n=43) of the respondents were in favour that dealing with numbers makes them uneasy. Eighty-one percent (n=135) of the respondents were in favour that statistics knowledge was relevant to their area of study. Senior faculty was significantly more in favour to this statement than junior ones (p<0.001).

Fifty-nine percent of the faculty indicated that they were excited of using statistics in their respective jobs. Significantly more senior faculty members indicated for the enthusiasm of using statistics in their fields than junior faculty members (p=0.039). Ninety-five percent (n=157) of the respondents were in favour that statistical thinking was an important characteristic of a good researcher. Only 5% (n=8) of the respondents did not want to take any further training in statistics. Significantly more junior faculty members showed this negative attitude (p=0.005).

Only 6% (n=10) of the respondents were against of the statement that they wish they have taken more statistical classes. Again, the junior faculty indicated negative position for this question (p=0.014). Eighty-two percent (n=137) of the respondents indicated favourable for the question that statistics became more understandable and useful after applying in their career. Senior faculty showed significantly higher favourable responses than junior faculty (p<0.0001). Only 17.3% (n=28) of the subjects correctly stated that statistics is the science of uncertainty. Sixty percent (n=98) of the responded showed positive response for the question that logic behind statistics was clear to them.

About half of the respondents (n=76) indicated that it took long time for them to understand the concepts of statistics. In all the above two questions, neither gender nor job title showed any statistically significant. Fifty-three percent (n=82) subjects were in favour that an average professional can not be a master for application of statistics. Female faculty members indicated significantly higher percentage that male ones (p=0.047). Fifty-nine percent (n=97) of the respondents were in favour that a person should be good in mathematics before attempting statistics. Half of the

subjects (51.9%, n=83) indicated that statistics was too theoretical for an average medical professional. In the last Likut scale question, only 17 (n=21) of the respondents indicated that they had problem of writing the statistical section of the articles. Senior faculty showed significantly more difficulties as compared to junior ones (p=0.006).

Table-3 showed some other questions asked in the questionnaire. Sixty-four percent (n=103) of the subjects indicated that statistical teaching methods were the main reasons for the impression of its difficulties. More than half (52.2%, n=84) of the faculty members mentioned that a statistician should be consulted if a medical professional needed any statistical help. Only 6.9% (n=11) of the respondents indicated that the teaching methods during their learning experience were 'excellent'. Thirty-eight percent (n=61) of the subjects were confident of using statistics on their research data. More than half (52.9%, n=83) of the faculty indicated that the co-authorship of the statistician should depend upon his/her contribution in the study. Seventy-three percent (n=121) of the respondents felt that they had either limited or no experience of using statistical software. However, 44.3% (n=74) indicated that they had some knowledge of using SPSS. More than half (53.8%, n=86) subjects correctly mentioned that a statistician should be involved at the initial stage of the research study.

Table-3: Percentage of responses regarding statistical teaching methods and knowledge of soft wares

Question	Response	No. (%)
Statistical teaching methods are the main reason for the impression of its difficulties	Yes	103 (63.6)
	No	59 (36.4)
When you need statistical help?	Consult a statistician	84 (52.2)
	Apply your statistical knowledge	28 (17.4)
	Search for answer in any source	48 (29.8)
Statistical teaching methods used during your learning experiences?	Poor	56 (35.0
	Acceptable	93 (58.1)
	Excellent	11 (6.9)
Level of confidence of statistics in research	Confident	61 (38.4)
	Apprehensive	53 (33.3)
	Not Confident	45 (28.31)
Should statistician be the co-investigator?	Yes	38 (24.2)
	No	36 (22.9)
	It depends on the study	83 (52.9)
When using a statistical software for analysis, I consider myself	Very experienced	8 (5.1)
	Some what experience	27 (17.3)
	With limited experience	52 (33.3)
	No experience	69 (44.2)
Knowledge of statistical software	SPSS	74 (44.3)
	Epi-Info	14 (8.4)
	Minitab Excel	3 (1.8)
	Excel	5 (3.0)
Statisticians should be involved in the study?	At the initial stage	86 (53.8)
	At the final stage	13 (8.1)
	When there is a need	59 (36.9)
	Supporting the study hypothesis	2 (1.2)

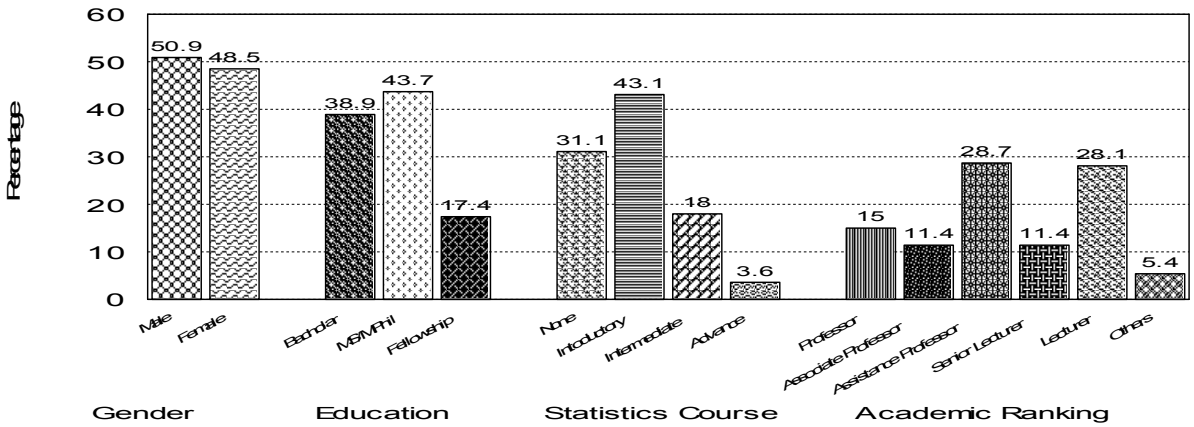

Figure-1: Percentage of respondents with respect to the gender, education, level of statistics course and academic ranking

DISCUSSION

This is the first study in any medical university/college of Pakistan to assess the attitude of faculty toward statistics. It was very important to evaluate the current behaviour and motivation among this population, especially after introduction of EBM in clinical research.

Even after many reminders, the response rate of this survey was only 44.7%, which was quite lower than the other studies conducted on medical professionals and faculty on the related topics in USA[5] and European countries[4,10]. The non-response bias could have affected the outcomes. However, there was no statistical significant difference among respondents and non-respondents between different academic categories, which implies that the bias due to academic ranks was inconsequential. This convenient survey clearly showed that the medical faculty was quite aware about the importance of statistics. More than 80% of the respondents were either strongly agreed or agreed for all such questions. These results were almost similar as showed by Windish *et al*[11] and West and Ficalora[5]. Even though, we did not ask too many questions related with knowledge, except only the definition of statistics and use of statistical software. The respondents showed very low knowledge. These results agreed with many other studies[5,11] conducted on these subjects. Nevertheless, the respondents showed keen interest to enhance their knowledge. About 80% of medical faculty showed their interest in the questions, related to statistical training. These results were also similar to the studies of Windish *et al*[11] and West and Ficalora[5]. Only about 17% of the respondents have indicated to have difficulty in writing the result section of the article. This result should be read with caution, because some of the respondents were junior faculty and probably, they never have chance to write any scientific article. Thirty five percent of this population blamed the poor teaching method for difficulty in biostatistics. West and Ficalora[5] also showed that 43% of the medical professionals had ineffective biostatistics training. Four out of ten respondents were confident in using statistics in research. Windish *et al*[11] mentioned that three-fourths of medical residents acknowledged low confidence in understanding the statistics they encounter in medical literature. Twenty four percent of the respondents were against of offering co-authorship to the statisticians. Altman *et al*[12] showed that 65% of the biostatisticians who significantly contributed at any stage in the research or writing of articles in BMJ or Annals of Internal Medicine in 2001 were included in the authorship, while 20% did not get the authorship nor the acknowledgement. In spite of these weak standing and poor training, there is genuine hope that medical professionals are trying to learn. About 40% of the respondents have some knowledge of statistical software SPSS. There was no significant difference of gender for the responses, except the question of excitement of using statistics. It showed that training of and attitude toward statistics were the same for male and female faculty. West and Ficalora[5] also did not find any significant difference among gender for the attitudes toward statistics. Some other studies[13,14] also indicated that there was no significance difference among gender for critical appraisal skills or use of online evidence databases.

There was significance difference among junior and senior faculty in 10 out of 27 Likut scale questions. Senior faculty showed higher awareness of use of statistics in their specialty and difficulties in writing statistical section in the articles. In the past, not too much attention was given to the statistics in the curriculum of medical education. For the academic promotions, the senior faculties have to do some research work and write articles. Now, they recognize the importance of statistics in their field of specialty and research writing. This study clearly showed that there was a general awareness of the importance of statistics among medical professionals. However, due to lack of training and unavailability of course of studies in the medical curriculum, the medical faculty has very low knowledge about statistical methods and skills. Furthermore, it is unfortunate that the faculty who is teaching statistics in the workshops and short courses are mostly having background of pure statistics and do not have the training of teaching methods of conveying statistical concepts to the medical professionals. The respondents of this study clearly proclaimed that the methods of teaching are the main problem of learning statistics. However, majority of the respondents showed a great need for learning statistics and motivation for further training. Therefore, there is a need of integrating biostatistics program in the undergraduate curriculum in the medical education with further re-enforcement in the postgraduate studies. The faculty who has sound background of statistics with the training of application of statistics in health sciences should teach those courses. While, reading this article the following limitations should be considered. First, the instrument used in this study showed good internal validity, as can be seen by the results, the psychometric properties like, content validity and discriminative validly, were not established in advance. Second, the questionnaire was purposely kept brief and limited for the attitude of medical faculty towards statistics with only few questions related to the definition of statistics and use of statistical software were included, and questions related to knowledge and methods used in statistics were not included. Third, the study is limited to the faculty of a public medical university and the teaching hospital attached with it. It is possible that the teaching faculty of other institutions, like private medical university, could respond differently. Furthermore, the faculty who did not respond by choice could also respond differently. Fourth,

even though our study was conducted among the faculty of different specialty of medical college, the faculty related to other health sciences, like dentistry, nursing or paramedical was not included, and hence they could show different attitudes. In spite of these limitations, the study has several strong points. First, the study institution is the biggest public medical university of Pakistan, staffing about 400 teaching faculty from almost all field of basic and clinical medicine. Second, even though the study was conducted in only one public institution situated at Karachi, it covers wide range of faculty from different part of the Sindh province with different academic background. Further research is needed to acquire the level of knowledge and basic concepts of statistical methods among the medical faculty.

CONCLUSIONS

The study showed a low level of knowledge, but high level of the awareness about the importance of statistics in research and indicated a great motivation for further training. Therefore, there is a need of incorporating biostatistics as a subject in the undergraduate curriculum of medical education.

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