THE PERCEPTION OF HEALTH SCIENCES POST-GRADUATE STUDENTS TOWARDS STATISTICS AND RESEARCH.

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Abstract:

Introduction: In the era of evidence-based medicine, statistics play a major role in guiding health professionals, to design a study, understand the literature, and make decisions for optimal patient care. Postgraduates from health sciences are expected to read scientific literature, to render the correct treatment to the patients. Postgraduates may experience difficulty in understanding scientific literature due to a lack of knowledge about statistics and its applications.

Objectives: To assess the perception of post-graduate students towards statistics and research among medical, dental, pharmacy, and nursing faculty from western Maharashtra.

Methodology: A specially designed pre-validated questionnaire, consisting of 20 questions on awareness, value, knowledge, and attitude toward statistics and research was used to collect the data. The questionnaire was disseminated through the electronic method as google forms amongst health institutions in western Maharashtra. Likert scale ranging from 0 to 5 was used to assess the responses.

Results: Three hundred responses of postgraduates from Western Maharashtra were recorded. Awareness and value of statistics, was better among dental and less among nursing and pharmacy faculty. Knowledge of statistics was equal among all the faculty. The attitude of nursing postgraduates was better towards statistics and research.

Conclusion: The postgraduates from all faculty had similar level of knowledge about statistics and research. Dental postgraduates were more aware and had better value towards statistics, and nursing postgraduates had more positive attitude towards statistics and research. Methods should be adopted to increase students' confidence through problem-based learning, enrichment programs, and e-learning methods.

Keywords: Biostatistics, Health science, Perception, Postgraduates, Research, Statistics.

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Introduction:

Statistics in scientific research plays a vital role in arriving at conclusions about the research question and its interpretations. Medical statistics is a subset of biology that uses facts and statistics to help understand bodily functions, diseases and treatment.[1,2,3] Statistics as a science is highly evolving and improving health practices through evidence. The application of statistics has evolved during the last century and is an important aspect of science.[4] Decision-making in medical science includes interpreting clinical evidence, comparing the results, and linking patient information to medical literature for optimal patient care.[5,6] A glimpse at any medical journal shows the extensive use of statistics, signifying the necessity to thoroughly understand statistics to interpret scientific literature.

The main aim of postgraduate students is to obtain sufficient knowledge of basic statistical methods to embark on the journey of research.[7] Understanding basic statistics is necessary, not only to evaluate the literature and understand the essence of information but also to judge the authenticity of the research and to reduce bias.[8] In medical education, statistics and biostatistics are taught at the undergraduate level, without much emphasis on their practical applications. Post-graduates aware of statistics are at more ease while understanding statistics and conducting research.[9,10] Appropriate knowledge of statistical methods will improve the research designs and quality of medical research. Statistical knowledge depends upon the perception and attitude towards the subject. Hence this survey was conducted with the objective to evaluate the perception of medical, dental, nursing, and pharmacy postgraduate students toward statistics and research.

Material and method:
Study design
This cross-sectional questionnaire-based study was carried out among 300 post-graduate students studying in different health science colleges like medical, dental, pharmacy, and nursing in Maharashtra state, India. The ethical clearance was obtained from the ethics review committee of Krishna Vishwa Vidyapeetha (ethical clearance protocol no. 393/2021-2022) before commencing the study. The participant information sheet was provided, and informed consent was obtained from all the participants before enrolling in the study. Post-graduate students willing to be part of the study and providing consent were included in the study. Postgraduate students not willing and not

completing the questionnaire were excluded from the study.

Sample size
The sample size of 300 was obtained based on the level of significance (alpha error of 5% and power of 80%) using the formula $[n=(Z1)^2[P(1-P)]/d^2]$.

Development of questionnaire
A specially designed close-ended Google form questionnaire was created, consisting of 20 questions. Questions were based on four domains as awareness, value, knowledge, and attitude, consisting of five questions each. The Google form questionnaire consisted of two sections; the first section included the participant information sheet, informed consent form, and socio-demographic details. The second section comprised a questionnaire to evaluate the perception of postgraduate students toward statistics and research. The questionnaire was formulated by reviewing the relevant literature on statistics and research.

Pilot study
A pilot study was conducted among 30 participants to check the authenticity of the results. The results of the pilot study determined the reliability and validity of the pretested questionnaire.

Distribution of questionnaire
The email addresses of postgraduate students were collected by approaching the health institutions in Western Maharashtra. The questionnaire was sent to the post-graduate students through email, with a Google form link to the questionnaire. The participants who filled out the consent form were only allowed to fill out the questionnaire from the second section.

Data collection
Data were collected from a total of 300 postgraduate students, 75 from each faculty i.e., medical, dental, pharmacy, and nursing. Only the first 75 responses from each faculty were considered. The response rate was obtained using a Likert scale ranging from zero to five for assessment.

Statistical analysis
Descriptive quantitative data were expressed in mean, standard deviation, and percentage/proportion. Kruskal Wallis one-way analysis of variance test was used to analyse the data. Statistical analysis was performed using Statistical Package for Social science (SPSS)

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version 21 for Windows (SPSS Inc, Chicago, IL). The P value <0.05 was considered significant.

Results:

The study aimed to assess the perception of post-graduate students towards statistics and research.

Total of 300 postgraduate students participated in the study, out of which 122 (40.67%) were males and 178 (59.33%) females with an average age of 26.11±+2.03 years. (Table 1)

Table 1: Demographic variables of the postgraduate students.

Demographic Variables	Frequency	Percent
Gender		
Male	122	40.67
Female	178	59.33
Age in years (Mean ± SD)	26.11±2.03	

The questions and responses used to assess the awareness of postgraduate students towards statistics. (Table 2)

Table 2: Questions and responses on awareness towards statistics and research.

Sl. No	Questions	Postgraduate faculties				
1	Biostatistics is a tough subject to perceive	Responses	Medical	Dental	Pharmacy	Nursing
		Strongly agree	31(10.3%)	26(8.7%)	41(13.7%)	47(15.7%)
		Agree	38(12.7%)	39(13.0%)	34(11.3%)	25(8.3%)
		Neutral	6(2.0%)	10(3.3%)	0(0%)	0(0%)
		Disagree	0(0%)	0(0%)	0(0%)	3(1.0%)
		Strongly disagree	0(0%)	0(0%)	0(0%)	0(0%)
2	I am aware of the importance of biostatistics.	Strongly agree	9(3.0%)	28(9.3%)	12(4.0%)	20(6.0%)
		Agree	32(10.7%)	45(15.0%)	31(10.3%)	48(16.0%)
		Neutral	34(11.2%)	2(7%)	32(10.7%)	7(2.3%)
		Disagree	0(0%)	0(0%)	0(0%)	0(0%)
		Strongly disagree	0(0%)	0(0%)	0(0%)	0(0%)
3	Biostatistics converts all the facts into figures & translates their significance into results.	Strongly agree	18(6.0%)	39(13.0%)	0(0%)	19(6.3%)
		Agree	37(12.3%)	31(10.3%)	52(17.3%)	22(7.3%)
		Neutral	20(6.7%)	5(1.7%)	5(1.7%)	34(11.3%)
		Disagree	0(0%)	0(0%)	18(6.0%)	0(0%)
		Strongly disagree	0(0%)	0(0%)	0(0%)	0(0%)
4	I will always consult a biostatistician for my study	Strongly agree	34(11.3%)	23(7.7%)	20(6.7%)	10(3.3%)
		Agree	28(9.3%)	45(15.0%)	14(4.7%)	45(15.0%)
		Neutral	13(4.3%)	5(1.7%)	9(3.0%)	0(0%)
		Disagree	0(0%)	2(7%)	32(10.7%)	13(4.3%)
		Strongly disagree	0(0%)	0(0%)	0(0%)	7(2.3%)
5	During my previous undergraduate education-biostatistics was taught effectively.	Strongly agree	6(2.0%)	4(1.3%)	9(3.0%)	0(0%)
		Agree	18(6.0%)	19(6.3%)	12(4.0%)	21(7.0%)
		Neutral	16(5.3%)	32(10.7%)	24(8.0%)	0(0%)
		Disagree	35(11.7%)	16(5.3%)	30(10%)	54(18%)
		Strongly disagree	0(0%)	0(0%)	0(0%)	0(0%)

The awareness of PG students towards biostatistics was more among dental compared to the medical, pharmacy, and nursing postgraduates. (p=0.0001). (Table 3)

Table 3: Awareness of biostatistics among postgraduate students.

Awareness	PG Students (N=300)			
	Dental (n=75)	Medical (n=75)	Nursing (n=75)	Pharmacy (n=75)
Mean	20.2	19.09	18.03	18.36
SD	2.25	2.45	1.76	2.37
Kruskal Wallis Test Value	36.39			
p-value	<0.0001*			

*Significant with p<0.05, postgraduate (PG), Standard deviation (SD).

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The questions and responses of the postgraduates towards the value of the statistics. (Table 4)

Table 4: Questions and responses on the value of statistics and research.

Sl. No	Questions	Postgraduate faculties				
1	I acknowledge the work & efforts of the biostatistician.	**Responses**	**Medical**	**Dental**	**Pharmacy**	**Nursing**
		Strongly agree	34(11.3%)	21(7%)	0(0%)	10(3.3%)
		Agree	29(9.7%)	52(17.3%)	66(22%)	58(19.3%)
		Neutral	12(4%)	2(7%)	9(3%)	0(0%)
		Disagree	0(0%)	0(0%)	0(0%)	7(2.3%)
		Strongly disagree	0(0%)	0(0%)	0(0%)	0(0%)
2	It would be beneficial for our career to better understand biostatistics.	Strongly agree	22(7.3%)	30(10%)	21(7%)	13(4.3%)
		Agree	29(9.7%)	34(11.3%)	45(15%)	55(18.3%)
		Neutral	24(8%)	11(3.7%)	9(3%)	0(0%)
		Disagree	0(0%)	0(0%)	0(0%)	7(2.3%)
		Strongly disagree	0(0%)	0(0%)	0(0%)	0(0%)
3	Within medical & paramedical fields biostatisticians have high status.	Strongly agree	8(2.7%)	10(3.3%)	9(3%)	0(0%)
		Agree	51(17%)	42(14%)	34(11.3%)	56(18.7%)
		Neutral	16(5.3%)	23(7.7%)	12(4%)	0(0%)
		Disagree	0(0%)	0(0%)	20(6.7%)	19(6.3%)
		Strongly disagree	0(0%)	0(0%)	0(0%)	0(0%)
4	I realize the applicability of statistics & epidemiological studies to actual health conditions.	Strongly agree	20(6.7%)	20(6.7%)	9(3%)	0(0%)
		Agree	39(13%)	46(15.3%)	54(18%)	68(22.7%)
		Neutral	16(5.3%)	7(2.3%)	12(4%)	7(2.3%)
		Disagree	0(0%)	0(0%)	0(0%)	0(0%)
		Strongly disagree	0(0%)	2(7%)	0(0%)	0(0%)
5	I am capable to design my own research studies	Strongly agree	10(3.3%)	6(2%)	20(6.7%)	0(0%)
		Agree	16(5.3%)	9(3%)	22(7.3%)	21(7%)
		Neutral	27(9%)	41(13.7%)	0(0%)	7(2.3%)
		Disagree	22(7.3%)	17(5.7%)	16(5.3%)	27(9.0%)
		Strongly disagree	0(0%)	2(7%)	17(5.7%)	20(6.7%)

The intra-group comparison revealed that the value of biostatistics was more among postgraduate students of dental compared to medical, nursing, and pharmacy faculty (p=0.0001). (Table 5)

Table 5: Value towards statistics and research among postgraduate students.

Value	PG Students (N=300)			
	Dental (n=75)	**Medical (n=75)**	**Nursing (n=75)**	**Pharmacy (n=75)**
Mean	19.48	19.42	18.59	17.73
SD	2.27	2.35	2.52	1.86
Kruskal Wallis Test Value	22.59			
p-value	<0.0001*			

*Significant with p<0.05, postgraduate (PG), Standard deviation (SD).

The questions and responses of postgraduates towards the knowledge of statistics. (Table 6)

Table 6: Questions and responses on knowledge of statistics and research.

Sl. No	Questions	Postgraduate faculties				
1	I generally use statistical knowledge for giving decisions or opinions regarding patient care	**Responses**	**Medical**	**Dental**	**Pharmacy**	**Nursing**
		Strongly agree	3 (1%)	10 (3.3%)	0 (0%)	0 (0%)
		Agree	23 (7.7%)	28 (9.3%)	46 (15.3%)	65 (21.7%)
		Neutral	30 (10%)	32(10.7%)	17 (5.7%)	3 (1%)
		Disagree	9 (3%)	3 (1%)	12 (4%)	7 (2.3%)
		Strongly disagree	10 (3.3%)	0 (0%)	0 (0%)	0 (0%)
2	My current level of training in biostatistics is adequate for my needs	Strongly agree	7 (2.3%)	11 (3.7%)	0 (0%)	0 (0%)
		Agree	16 (5.3%)	11 (3.7%)	27 (9%)	21 (7%)
		Neutral	25 (8.3%)	35 (11.7%)	0 (0%)	7 (2.3%)
		Disagree	27 (9%)	18 (6%)	39 (13%)	37 (12.3%)
		Strongly disagree	0 (0%)	0 (0%)	9 (3%)	10 (3.3%)
3	Biostatistics is not necessary for all research studies	Strongly agree	0 (0%)	2 (7%)	0 (0%)	0 (0%)
		Agree	3 (1%)	14 (4.7%)	4 (1.3%)	9 (3%)
		Neutral	29 (9.7%)	13 (4.3%)	20 (6.7%)	0 (0%)
		Disagree	37 12.3%)	38 (12.7%)	34 (11.3%)	46 (15.3%)

			Medical	Dental	Pharmacy	Nursing
		Strongly disagree	6 (2%)	8 (2.7%)	17 (5.7%)	20 (6.7%)
4	I am skilled enough to do basic statistical and epidemiological analysis	Strongly agree	6 (2%)	0 (0%)	0 (0%)	0 (0%)
		Agree	18 (6%)	14 (4.7%)	37 (12.3%)	48(16%)
		Neutral	32(10.7%)	32(10.7%)	9(3%)	7(2.3%)
		Disagree	19(6.3%)	29(9.7%)	29(9.7%)	10(2.3%)
		Strongly disagree	0(0%)	0(0%)	0(0%)	10(3.3%)
5	I can easily interpret the results of a statistical analysis reported in journal articles.	Strongly agree	2(7%)	3(1%)	0(0%)	0(0%)
		Agree	20(6.7%)	20(6.7%)	35(11.7%)	18(6%)
		Neutral	34(11.3%)	39(13%)	1(0.3%)	34(11.3%)
		Disagree	19(6.3%)	13(4.3%)	39(13%)	23(7.7%)
		Strongly disagree	0(0%)	0(0%)	0(0%)	0(0%)

The postgraduate students from dental, medical, pharmacy, and nursing faculty did not have any difference in the knowledge of statistics and research (p=0.094). (Table 7).

Table 7: Knowledge of statistics and research among postgraduate students.

Knowledge	PG Students (N=300)			
	Dental (n=75)	Medical (n=75)	Nursing (n=75)	Pharmacy (n=75)
Mean	15.38	14.27	14.24	14.47
SD	2.82	3.4	3.87	3.27
Kruskal Wallis Test Value	6.391			
p-value	0.094¶			

¶non-significant with p>0.05, postgraduate (PG), Standard deviation (SD).

The questions and responses used to assess the attitude of postgraduates towards statistics and research. (Table 8)

Table 8: Questions and responses on the attitude of postgraduate students towards statistics and research.

Sl. No	Questions	Postgraduate faculties			
1	Evidence-based practice is important in the medical field	**Responses**	**Medical**	**Dental**	**Pharmacy**	**Nursing**
		Strongly agree	18 (6%)	26 (8.7%)	8 (2.7%)	9 (3%)
		Agree	41 13.7%)	41 (13.7%)	67 (22.3%)	59 (19.7%)
		Neutral	16 (5.3%)	6 (2%)	0 (0%)	0 (0%)
		Disagree	0 (0%)	2 (0.7%)	0 (0%)	7 (2.3%)
		Strongly disagree	0 (0%)	0 (0%)	0 (0%)	0 (0%)
2	Biostatistics is necessary for a clinician involved in research.	Strongly agree	24 (8%)	32 (10.7%)	20 (6.7%)	0 (0%)
		Agree	32 (10.7%)	35 (11.7%)	46 (15.3%)	68 (22.7%)
		Neutral	17 (5.7%)	7 (2.3%)	9 (3%)	0 (0%)
		Disagree	2 (0.7%)	1 (0.3%)	0 (0%)	7 (2.3%)
		Strongly disagree	0 (0%)	0 (0%)	0 (0%)	0 (0%)
3	Knowledge about biostatistics is a must for a postgraduate student.	Strongly agree	34 (11.3%)	30 (10%)	57 (19%)	56 (18.7%)
		Agree	14 (4.7%)	32 (10.7%)	9 (3%)	12 (4%)
		Neutral	26 (8.7%)	10 (3.3%)	0 (0%)	7 (2.3%)
		Disagree	1 (0.3%)	1 (0.3%)	9 (3%)	0 (0%)
		Strongly disagree	0 (0%)	2 (0.7%)	0 (0%)	0 (0%)
4	My coaching in biostatistics till under graduation is sufficient for its use during post-graduation.	Strongly agree	2 (0.7%)	15 (5%)	18 (6%)	0 (0%)
		Agree	7 (2.3%)	9 (3%)	4 (1.3%)	21(7%)
		Neutral	30 (10%)	17 (5.7%)	1 (0.3%)	34 (11.3%)
		Disagree	26 (8.7%)	34 (11.3%)	43 (14.3%)	10 (3.3%)
		Strongly disagree	10 (3.3%)	0 (0%)	9 (3%)	10 (3.3%)
5	More workshops on biostatistics should be carried out during post-graduation.	Strongly agree	33 (11%)	33 (11%)	62 (20.7%)	50 (16.7%)
		Agree	32 (10.7%)	42 (14%)	13 (4.3%)	9 (3%)
		Neutral	10 (3.3%)	0 (0%)	0 (0%)	16 (5.3%)
		Disagree	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		Strongly disagree	0 (0%)	0 (0%)	0 (0%)	0 (0%)

The intra-group comparison revealed that the attitude towards statistics and research was more among postgraduate students of nursing than dental, medical, and pharmacy faculty. (p=0.0476). (Table 9)

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Table 9: Attitude toward statistics and research among postgraduate students.

Attitude/ Practices	PG Students (N=300)			
	Dental (n=75)	Medical (n=75)	Nursing (n=75)	Pharmacy (n=75)
Mean	20.13	18.85	20.43	19.8
SD	2.25	2.48	0.96	2.24
Kruskal Wallis Test Value	7.93			
p-value	0.0476*			

*Significant with $p<0.05$, postgraduate (PG), Standard deviation (SD).

Discussion:

To the best of our knowledge, our study is the first study to be conducted among postgraduate students of medical, dental, pharmacy, and nursing in western Maharashtra.

Statistical science has gone through a long road from being the epitome of footing numbers to becoming a management science. Biostatistics remains a critical methodological skill for researchers, as statistical methods are a necessary part of medical research. It is doubtful if one can adequately interpret the literature without adequate knowledge of biostatistics.[3] A basic familiarity with research methods is essential for competent practice, and the best way to gain familiarity is to take part in research projects. Hence, it is important for postgraduates to be aware of basic knowledge of biostatistics.

Butt and Khan et al found that in a critical review of over 4000 research studies, only 20% of those who reviewed statistics had correct study design, data collection, and statistical methods. Although it was reported two decades ago, the problem still persists. This extrapolation is the result of the inadequate focus on biostatistics given during undergraduate and postgraduate years.

A total of 300 postgraduate students from medical, dental, nursing, and pharmacy faculty participated in the study, out of which 122 (40.67%) were male and 178 (40.67%) female postgraduate students.

The current study showed that a total of 45.3% of all the practitioners agree of biostatistics as a tough subject. Manu Batra et al in their study on the perception of dental professionals towards biostatistics concluded that 50.4% of dental practitioners agree to this question.[11] Also, AD Gore in his study concluded that 53.87% of participants in his study agreed, which is also in correlation with our result.[12]

In our study, 52% of total postgraduate students agree that biostatistics is an important subject of which the majority (16%) of participants were from nursing faculty. Nayak et al (2020) in his study found that 19.9% of practitioners strongly agreed on biostatistics being an important subject.[13] If statistical techniques are applied from the planning stages of the research itself, research becomes scientific.

In the present study 15% of dental practitioners agreed on consulting a statistician for the research study. The respondents agreed that they would be capable of doing it themselves by referring to books and the internet and by discussion with colleagues. Harry Robinson *et al*. found in their study that students who preferred learning by self-instruction did as well or better in terms of exam grades than their colleagues' taking lectures. The respondents agreed that they would be capable of doing it themselves by referring to books and the internet and by discussion with colleagues.[14]

Our evidence showed that more than half of the respondents were in agreement that biostatistics could be beneficial for their career. L.swift et al reported that nearly two-third of the samples could identify activities in their professional life, that they would be able to do better, if they had an improved understanding of probability and statistics.[15] The results of our study showed that 60% of total postgraduates of which majority from pharmacy agreed that understanding of statistical concepts and methods is essential for the clinician who wishes to interpret the results of clinical studies. While publications such as these suggest that an understanding of probability and statistics should be valuable to the practising doctor, most of these authors are writing from the medical statisticians' perspective. Lewis RJ et al in his study also stated that understanding of statistical concepts and methods is necessary for the clinician involved in a study with total of 54% respondents agreeing to this fact.[16] In a question asked that biostatistics is necessary for a clinician involved in research, majority of the respondents agreed on the fact with 60.3% agreed and 25.3% strongly agreed. This was in accordance with Lewis RJ et al who concluded that an understanding of statistical concepts and methods

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is essential for the clinician who wishes to interpret the results of clinical studies.[16,17]

The results of present study indicated that utmost 27.3% and 12.0% respondents disagreed and strongly disagreed on the conception on capability to design their own research studies. The inference accords with Wulff et al.[18] The results were also in similarity with Manu Batra et al.[11]

In the present study, majorly 45% respondents felt their biostatistics coursework was not taught effectively during under graduation. Same inference was observed in a study conducted by west et al (2007) who highlighted that around 42.9% respondents disagreed that their biostatistics coursework was taught effectively previously.[19]

Evidence based practice plays crucial role in giving decisions for best optimum patient care. In the present study 69.3% respondents strongly agreed on it with maximum respondents from faculty of pharmacy (22.3%). Green ML published that GME curricula will cater decisive direction towards evidence-based practice and improve postgraduates' knowledge towards the same.[20]

In the present study, overall, 31.0% respondents overall agreed that they can interpret the results of statistical analysis from journals. But same number of respondents disagreed on the fact (31.3%). whereas 36 % respondents were neutral about the fact. This was in contrast with Windish et al (2007) who reported mean percentage on statistical knowledge and interpretation of results was 41.4% and 75% were not aware of the statistics they encountered in journal articles. This reflects poor knowledge of postgraduates towards statistics suggesting insufficient training during previous coursework.[21]

In the present study only 76(25.4%) postgraduate students felt their undergraduate biostatistics coursework was sufficient for their use during their postgraduation. These findings support with inference given by Miles et al (2010) that less than half of respondents 33 (40%) remembered it as seeming useful.[22]

Furthermore, in the present study, 59.3% of respondents strongly agreed and 32.0% agreed on conducting more workshops on statistics. The majority of the respondents agreeing were from dental faculty with 25%.

This projects the need for incorporating new methods and more workshops on statistics and research during post-graduation. Similar inferences were in line with recommendations from several authors regarding the agreement that statistical training will be useful and helpful in understanding medical research.[23]

Limitation:
The limitation of our study is that it was conducted among postgraduate students of western Maharashtra only, and the results of our study cannot be generalized to all other institutions. Further research is needed to identify effective methods that will transform post-graduates perception towards statistics and research.

Conclusion:
The postgraduates possessed sufficient knowledge about statistics, and its importance, and showed a positive attitude toward statistics and research methodology. But the postgraduates were not cognizant of the value, and the use of statistical methodology and research modalities. The knowledge and importance of statistics and research should be imparted at the undergraduate level for its application in their future research endeavors. Continuing educational programs and workshops should be conducted at the institutional level, to make the postgraduates more proponent in statistics and research.

Conflict of Interests:
No conflict of interest

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