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KNOWLEDGE, ATTITUDES TOWARDS STATISTICS, AND SKILLS OF BIOSTATISTICS AMONG NURSING STUDENTS: A QUASI EXPERIMENTAL STUDY

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Abstract

Background: *Biostatistics is recognized as a powerful tool to interpret scientific results. There has been an increased use of statistical methods in recent decades, as documented in a wide range of medical journals. A proper understanding of biostatistics and clinical research among Nurses is also important for evidence-based medicine (EBM) practice, for designing medical research, to interpret, and report results obtained from these studies. Therefore, it is essential for medical researchers to understand biostatistics.*

H_1: *There is Positive association between pre-test Knowledge and Post-test knowledge Score of Biostatistics.*

Methodology: *The Quasi Experimental study was conducted in the Begum Bilquees Sultana Institute of Nursing (BBS-ION) Nawabshah, Thar Institute of Nursing & Health Sciences (TINHAS) Umerkot and Rana Liaquat College of Nursing (RLCON) Khairpur Mir's from 4th may 2023 to 21st July 2023. Total Sample size was 150 Depends on all the students of 3rd Year 6th semester students of BSN(Generic), Data was collected through a structured Survey of Attitudes Toward Statistics (SATS©). A confidence level of 95% was used for the study. P value of <0.05 was considered statistically significant. Paired sampled t test was applied for the association between pre & post results.*

Results: *The recent conducted study showed that the pre knowledge regarding the biostatistics of participants showed that very poor 13(8.7%), poor 32(21.3%), Good 42(28%), very good 51(24%) and excellent 12(8%) and post test result showed that poor 2(1.3%), Good 3(2%), very Good 28(18.7%) and Excellent Knowledge 117 (78%),*

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with highly significant p value (<0.001) between pre knowledge and post knowledge.

Conclusion: *Biostatistics plays a central role in planning, conducting, analyzing the results and reporting of important data. Hence, a better understanding of biostatistics is necessary for clinical nurse as well as academicians. Attitudes towards biostatistics were negative among nursing students and knowledge was poor, particularly concerning bio statistical concepts. It is also contribution in terms of revising higher education nursing curricula by including frequently used statistical methods as a part of nursing research to enable nursing professionals.*

INTRODUCTION

Biostatistics is recognized as a powerful tool to interpret scientific results.[1] There has been an increased use of statistical methods in recent decades, as documented in a wide range of medical journals.[2] It has been estimated that the use of statistical methods per article published in the journal Annals of Rehabilitation Medicine raised from 1.9 in the year 2005 to 2.6 in 2015. Further, in the same duration, these numbers increased from 2.7 to 3.1 for the papers published in the journal Archives of Physical Medicine and Rehabilitation. Therefore, it is essential for medical researchers to understand biostatistics.[3] A proper understanding of biostatistics and clinical research among physicians is also important for evidence-based medicine (EBM) practice, for designing medical research, to interpret, and report results obtained from these studies. However, physicians find biostatistics complicated and they encounter difficulties in understanding and interpreting results[2,4]. Thus, there is a raised risk of poor reporting, methodological errors, misinterpretation of the statistical results, and selective conclusion .[5,6] Previously conducted surveys report that many clinicians have poor skills to analyze the study outcomes and have a low level of understanding in the statistical inference, especially the ones who lack basic knowledge of epidemiology and biostatistics.[7,8] Okoro, in their questionnaire-based study at the University of Port Harcourt Teaching Hospital, reported poor and inadequate knowledge and biostatistics use among resident doctors.[9] Since complicated bio statistical methods are reported in medical literature, critical evaluation of original report may be difficult for many physicians. Although there are many statistical course books and articles that may help in interpreting the validity of statistics, most of the time, these references are very detailed for individuals to comprehend these statistical concepts quickly and to apply them to statistical parts of articles.[10] In a study by Polychronopoulou et al. (18), 83.5% evaluated themselves as fairly to highly confident in interpreting p value, while 65.3% evaluated themselves as fairly to highly confident in understanding statistical methods and 78.7% evaluated themselves as fairly to highly confident in interpreting statistical analysis results in articles.[11] In a survey study conducted on 201 clinicians in a research hospital in North Malaysia, it was found that 79.1% could interpret p value and 91.5% could interpret the statistical method used, 87.1% could identify the factors affecting the power of the study, while only 6% could evaluate the correct statistical procedure to be used in the study (20). The most regularly encountered statistical concept was inferential statistics with 63.7%, which was followed by data organization with 58.7%, correlation and dispersion with 53.7%, measures of central tendency with 45.8%, measures of dispersion with 43.3%, and measuring scales with 33.8%. In this sample, nearly 75% of the clinicians stated that they understood bio statistical results.[12] In Belgrade University Public Health postgraduate program, it was evaluated whether blended learning was a more effective method than traditional method in students' gaining bio statistical competence. Course program for blended learning included statistical definition, parameter, probability, normal distribution, sample and methods, statistical power, point and range estimation, confidence limit, statistical significance and statistical test, parametric and nonparametric statistics, t test, Chi-square test, correlation,

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regression and linear regression. The program was evaluated according to final score. Both the final statistics score (89.65 ±6.93 vs. 78.21±13.26; p<0.001) and knowledge test score (35.89±3.66 vs. 22.56±7.12; p; <0.001) of the blended learning group were higher than for the on-site group.[13] The mean of correct answers given to 10 multiple choice questions in the survey study conducted to evaluate pharmacists' understanding and assessing statistical information in literature was 2.8±2.0. The rate of correct answers given to the questions in the survey which included the most common statistical terms and tests was 77.7% for definition of assumptions related with statistical techniques, 62.5% for statistical test characteristics, 50.8% for statistical and clinical significance, 50.8% for statistical and clinical significance, 22.9% for confidence limit, 18.2% for hypotheses, 13% for p value, 10% for student t test, 17.8% for test power, 5.1% for Chi-square and 2% for ANOVA.[14] A six-stage training program was implemented on endodontic first year residents to develop an initiative curriculum in postgraduate health education. At the end of the curriculum, all residents were found to show competency. 36.9% pre-test correct answer rate increased to 79.8% in the post-test.[15]

The aim of this study is to identify the biostatistics knowledge, attitude and practice or skills and effect levels of students before and after receiving basic biostatistics training provided to nursing students, to compare these and to evaluate the efficacy of biostatistics training program.

Hypothesis

Null Hypothesis H0: There is no association between pre and post Knowledge and Attitude of Biostatistics

Alternative Hypothesis H1: There is association between pre and post Knowledge and Attitude of Biostatistics

MATERIAL & METHODS

The Quasi Experimental study was conducted in the Begum Bilquees Sultana Institute of Nursing (BBS-ION) Nawabshah, Thar Institute of Nursing & Health Sciences (TINHAS) Umerkot and Rana Liaquat College of Nursing (RLCON) Khairpur Mir's from 4th may 2023 to 21st July 2023. Total Sample size was 150 Depends on all the students of 3rd Year 6th semester students of BSN(Generic), 50 Students from each Institute, non-probability convenient sampling was used. Unwilling, non-consenting and those who are not studying in the 3rd Year 6th semester students of BSN(Generic) were excluded from this study. Data was collected through a structured questionnaire containing inquiries about study variables such as name, age, sex, Survey of Attitudes Toward Statistics (SATS©) Question, Knowledge related question, skills or practice and effect of Biostatistics questions through structured questionnaire. Data was analyzed by statistical package for social sciences version (SPSS) version 25. Quantitative data has been presented in mean, standard Deviation. Qualitative data was presented in numbers and frequencies. A confidence level of 95% was used for the study. P value of <0.05 was considered statistically significant. Paired sampled t test was applied for the association between pre & post results. Permission was taken from Director of PNS LUMHS Jamshoro, Director of BBS-ION Nawabshah SBA. Principal of TINHAS Umerkot & Principal of RLCON Khairpur Mir's Confidentiality of the participant's information was ensured during data collection, analysis and interpretation. Patricia Benner's theory of skill acquisition, also known as the Novice to Expert model, can be applied to understanding the attitude, knowledge, and practice of biostatistics among nursing students. Benner's theory suggests that individuals progress through five stages of skill acquisition: novice, advanced beginner, competent, proficient, and expert.

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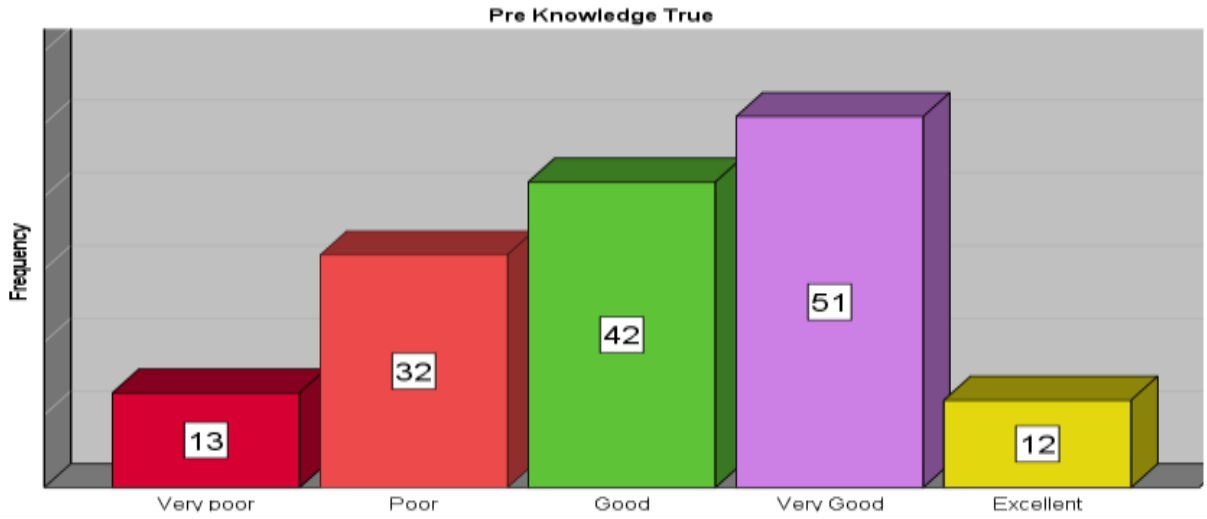
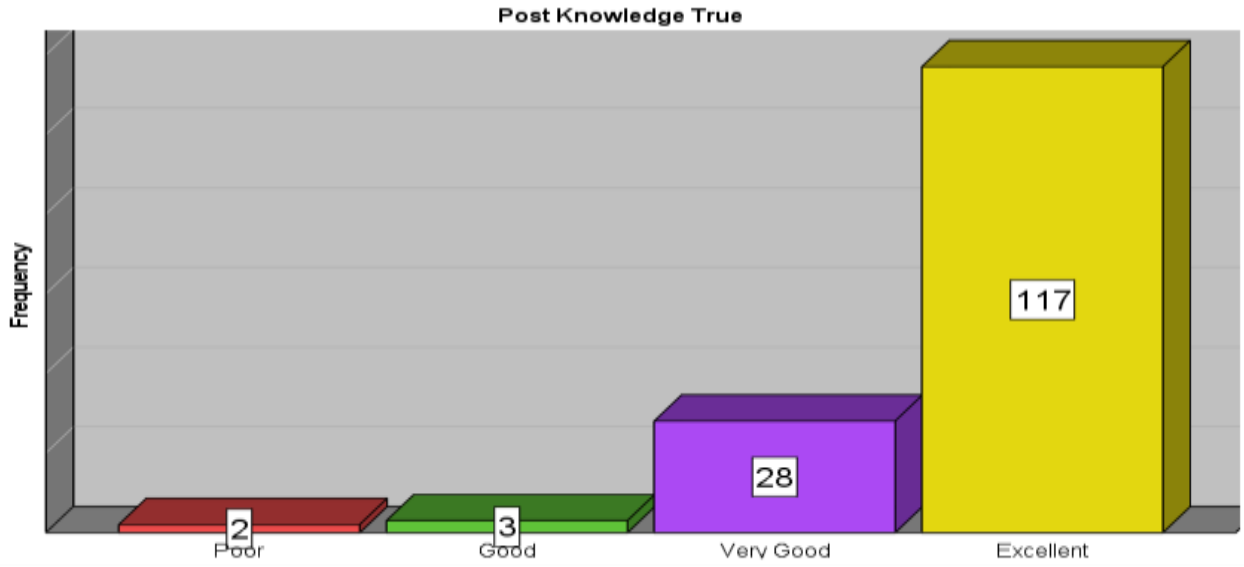
RESULTS



Graph: 1: Pre Knowledge of the Participants



Graph: 2: Post Knowledge of the Participants

Table: 1: Attitude

Questions	Pre-Result	Post-Result	Mean	Std. Dev	t	df	P Value
I will like statistics	Yes=135(90 %) No=15(10%)	Yes=146(97.3%) No=4(2.7%)	.073	.349	2.570	149	0.011
I will feel insecure when I have to do statistics problems	Yes=69(46%) No=81(54%)	Yes=74(49.3%) No=76(50.7%)	.33	.649	.629	149	.531

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I will get frustrated going over statistics tests in class	Yes=69(46%) No=81(54%)	Yes=67(44.7%) No=83(55.3%)	-.013	.591	-.276	149	.783
I will be under stress during statistics class	Yes=63(42%) No=87(58%)	Yes=38(25.3%) No=112(74.7%)	-.167	.680	-3.003	149	0.003
I will enjoy taking statistics courses	Yes=115(76.7%) No=35(23.3%)	Yes=130(86.7%) No=20(13.3%)	.100	.488	2.509	149	0.13
I am scared by statistics	Yes=67(44.7%) No=83(55.3%)	Yes=56(37.3%) No=94(62.7%)	-.073	.677	-1.328	149	.186
I will have trouble understanding statistics because of how I think	Yes=88(58.7%) No=62(41.3%)	Yes=78(52%) No=72(48%)	-.067	.739	-1.105	149	.271
I will have no idea of what's going on in this statistics course	Yes=76(50.7%) No=74(49.3%)	Yes=43(28.7%) No=107(71.3%)	-.220	.664	-4.056	149	< 0.001
I will make a lot of math errors in statistics	Yes=92(61.3%) No=58(38.7%)	Yes=91(60.7%) No=59(39.3%)	-.007	.650	-.126	149	.900
I can learn statistics	Yes=142(94.7%) No=8(5.3%)	Yes=148(98.7%) No=2(1.3%)	.040	.256	1.914	149	.058
I will understand statistics equations	Yes=125(83.3%) No=25(16.7%)	Yes=138(92%) No=12(8%)	.087	.491	2.163	149	.032
I will find it difficult to understand statistical concepts	Yes=105(70%) No=45(30%)	Yes=94(62.7%) No=56(37.3%)	-.073	.656	-1.368	149	.173
Statistics is worthless	Yes=66(44%) No=84(56%)	Yes=80(53.3%) No=70(46.7%)	.093	.617	1.853	149	.066

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Statistics should be a required part of my professiona l training	Yes=132(88 %) No=18(12%)	Yes=135(90%) No=15(10%)	.020	.409	.599	149	.550
Statistical skills will make me more employable	Yes=128(85. 3%) No=22(14.7 %)	Yes=137(91.3%) No=13(8.7%)	.060	.452	1.625	149	.106
Statistics is not useful to the typical professiona l	Yes=39(26%) No=111(74 %)	Yes=56(37.3%) No=94(62.3%)	.113	.562	2.469	149	.015
Statistical thinking is not applicable in my life outside my job	Yes=61(40.7 %) No=89(59.3 %)	Yes=61(40.7%) No=89(59.3%)	.000	.635	.000	149	1.000
I use statistics in my everyday life	Yes=108(72 %) No=42(28%)	Yes=131(87.3%) No=19(12.7%)	.153	.488	3.849	149	< 0.001
Statistics conclusions are rarely presented in everyday life	Yes=108(72 %) No=42(28%)	Yes=124(82.7%) No=26(17.3%)	.107	.581	2.249	149	.026
I will have no application for statistics in my profession	Yes=53(35.3 %) No=97(64.7 %)	Yes=62(41.3%) No=88(58.7%)	.060	.647	1.135	149	.258
Statistics is irrelevant in my life	Yes=58(38.7 %) No=92(61.3 %)	Yes=65(43.3%) No=85(56.7%)	.047	.649	.881	149	.380
Statistics formulas are easy to understand	Yes=81(54%) No=69(46%)	Yes=113(75.3%) No=37(24.7%)	.213	.619	4.218	149	< 0.001
Statistics is a	Yes=111(74 %)	Yes=98(65.3%) No=52(34.7%)	-.087	.623	-1.703	149	.091

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complicated subject	No=39(26%)						
Statistics is a subject quickly learned by most people	Yes=98(65.3%) No=52(34.7%)	Yes=96(64%) No=54(36%)	-.013	.645	-.253	149	.800
Learning statistics requires a great deal of discipline	Yes=135(90%) No=15(10%)	Yes=144(96%) No=6(4%)	.060	.352	2.088	149	.039
Statistics involves massive computations	Yes=111(74%) No=39(26%)	Yes=117(78%) No=33(22%)	.040	.601	.816	149	.416
Statistics is highly technical	Yes=135(90%) No=15(10%)	Yes=146(97.3%) No=4(2.7%)	.073	.349	2.570	149	.011
Most people have to learn a new way of thinking to do statistics	Yes=143(95.3%) No=7(4.7%)	Yes=144(96%) No=6(4%)	.007	.295	.276	149	.783
I am interested in being able to communicate statistical information to others	Yes=127(84.7%) No=23(15.3%)	Yes=142(94.7%) No=8(5.3%)	.100	.445	2.753	149	.007
I am interested in using statistics	Yes=133(88.7%) No=17(11.3%)	Yes=142(94.7%) No=8(5.3%)	.060	.371	1.983	149	.049
I am interested in understanding statistical information	Yes=138(92%) No=12(8%)	Yes=148(98.7%) No=2(1.3%)	.067	.276	2.961	149	.004
I am interested	Yes=136(90.7%)	Yes=147(98%) No=3(2%)	.073	.309	2.910	149	.004

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in learning statistics	No=14(9.3%)						
I plan to complete all of my statistics assignments	Yes=140(93.3%) No=10(6.7%)	Yes=144(96%) No=6(4%)	.027	.305	1.070	149	.287
I plan to work hard in my statistics course	Yes=142(94.7%) No=8(5.3%)	Yes=148(98.7%) No=2(1.3%)	.040	.256	1.914	149	.058
I plan to study hard for every statistics test	Yes=141(94%) No=9(6%)	Yes=143(95.3%) No=7(4.7%)	.013	.327	.499	149	.619
I plan to attend every statistics class session	Yes=142(94.7%) No=8(5.3%)	Yes=146(97.3%) No=4(2.7%)	.027	.283	1.156	149	.250

DISCUSSION

The recent conducted study showed that the pre knowledge regarding the biostatistics of participants showed that very poor 13(8.7%), poor 32(21.3%), Good 42(28%), very good 51(24%) and excellent 12(8%) and post test result showed that poor 2(1.3%), Good 3(2%), very Good 28(18.7%) and Excellent Knowledge 117 (78%), with highly significant p value (<0.001) between pre knowledge and post knowledge. As like comparison a study results showed that The knowledge scores were significantly higher in participants who underwent previous training that those who did not (51.9 vs. 39.5%, p<0.001)[1,19,20]. Another study is also revealed that the physicians who studied postgraduate research, although they have high mean scores on the value subscale (5.53±0.76), it is not correlated to greater knowledge (p=0.244) and they consider it a difficult subject to learn and with neutral feelings towards statistics; on the other hand, in the study, medical students obtained few credits in biostatistics courses during their studies, but despite this, at the end of their undergraduate studies they had high value and motivation to learn.

Table shows the attitudes towards biostatistics attitude toward statistics has been measured in several studies using a survey of attitudes towards statistics (SATS) developed by Schau[37]. In this study, the overall attitude toward statistics was mostly positive. Engagement of student in biostatics course would improve their attitude toward statistics, and this fact was confirmed by researchers from Greece found that a biostatistics course significantly improved the attitude toward statistics among nursing students. This means that we can apply a similar biostatistics course and consequently, it will lead to an improvement in the attitude toward statistics among undergraduate medical students. In the comparison a study results showed the overall attitude towards statistics was 4.64±0.91. The mean attitude scores for the components of SATS-36 scale was higher for students who were using statistical analysis software demonstrating significant difference in affect (p=0.002), cognitive competence (p=0.002), value (p=0.002), Interest (p=0.004) and Effort (p=0.029)[16,17,18]. A study among

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nursing students indicated that attitudes towards statistics were not affected by background demographic factors. Persistence of statistical training among medical trainees was shown to improve and maintain attitudes towards biostatistics.

A recent study conducted in the Taif, Kingdom of Saudi Arabia showed that only 36 (31.9%) of the participating trainees expressed positive attitudes towards biostatistics. On the other hand, 30 (26.5%) participating trainees were found to have good biostatistics knowledge, compared to 83 (73.5%) trainees whose knowledge level was found to be poor.

Older age was associated with worsening of attitudes (adjusted odds = 0.9900, P = 0.00924), and so also was being a senior R4 trainee (adjusted odds = 0.9045, P = 0.01301). Publishing one paper (compared to publishing over three papers) was associated with poorer attitudes towards biostatistics (adjusted odds = 0.8857, P = 0.03525). Also, having published three papers (compared to publishing over three papers) was still associated with worse attitudes towards biostatistics (adjusted odds = 0.8528, P = 0.01318).

CONCLUSION

Biostatistics plays a central role in planning, conducting, analyzing the results and reporting of important data. Hence, a better understanding of biostatistics is necessary for clinical nurse as well as academicians. Attitudes towards biostatistics were negative among nursing students and knowledge was poor, particularly concerning bio statistical concepts. The main finding of our current study is the poor levels of knowledge about biostatistics that could be a function of poor research productivity among nursing students. Future research should evaluate educational and training interventions that could improve attitudes and knowledge of biostatics among nursing students. It is also an urgent need for the systematic teaching of biostatistics, especially in the nursing residency programs, which may include more specialized training so that the nurses can become more efficient in understanding biostatistics and clinical research thus, benefiting them for evidence-based practice. Our study provides information regarding self-reported levels of bio statistical knowledge of nursing professionals by research area, and provides guidance regarding the ideal semester for administering a biostatistics course. It is also contribution in terms of revising higher education nursing curricula by including frequently used statistical methods as a part of nursing research to enable nursing professionals to understand current research and contribute to its ongoing discussion. Lack of practical exercises and the need for data collection sessions are the major challenges faced by the students. Introducing data collection sessions and reading excerpts from published nursing or research articles will provide practical experience and emphasize the role of biostatistics in health care. The attitude toward statistics and low usage of statistical software among all participants. Students should participate in research to increase their usage of statistical software; because they need statistical software during analyzing their data.

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