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ORIGINAL ARTICLE

Bio-statistical Learning Needs: A Qualitative Study on Perceptions of Post Graduate Nursing Students and Experts

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ABSTRACT

Background: Statistics refers to numerical data and it also deals with description and inferences from small sample for a large population. Statistics is widely used in almost every discipline. In the last few years, there is an increase in publishing evidence based researches in nursing journals. Therefore, it is essential for nurses to fully equip with the knowledge to understand biostatistics and its implementation into practice.

Objectives: The study aims to explore biostatistical learning needs as perceived by post graduate nursing students and statistical experts.

Methodology: A qualitative exploratory study design was used. Data was collected from eight graduate nursing students and two subject experts using purposive sampling through semi-structured interviews. The participants were recruited from both public and private nursing institutions in Punjab, Pakistan. Data were analyzed using the Creswell (2013) analysis approach.

Findings: An in-depth analysis of the data was conducted from which three broad themes emerged including essential biostatistical learning needs, challenges in the subject, and way forward. The participants acknowledged command on Statistical software, knowledge of sample size calculation, analysis and interpretation of data as their basic learning needs. The major challenges perceived were inability to interpret test and lack of skills in using software effectively. Additionally, the participants believed that there is a need of practical sessions, help from peers, and need of feedback as a way forward.

Conclusion: The study findings suggest the need to recruit more biostatistician and their direct involvement in student researches and learning. Also, there is need to develop Statistical Services Unit (SSU) at organizational level.

INTRODUCTION

Statistics defined as to deal with data collection, organization, summarization, analysis and making inferences from small sample for a large population[(1)]**.** The knowledge of statistics enable the learners to provide conceptual frameworks and practical skills to the researchers and students to conduct research. Moreover, statistics deals with description and inferences from data[(2)]. Organizing, summarizing and presentation of data comes under umbrella of descriptive statistics while hypothesis testing is the part of inferential statistics[(3)]. In this era of scientific advancement, the role of biostatistics in scientific research is inevitable. Nursing knowledge based on experiential research plays a vital role in the development of evidence-based nursing practice[(4)].

Application of statistical knowledge is the need of almost every professional. With the advancement of scientific knowledge, health professionals are learning advanced methods to conduct researches, investigate new methods and to improve the nursing care. In last few decades, there is an increase in publishing evidence based researches in nursing journals[(5)]. It is challenging for nurses to justify clinical decisions without scientific evidences. Therefore, it is essential for nurses to fully equip with the knowledge of statistics to understand the published studies, conduct data analysis, interpret the data, and its implementation into practice.

Pakistan is in transitional phase from diploma in nursing to 4 years Bachelors of Science in Nursing degree program. Additionally, many institutions are offering Master of Science in Nursing (MSN) and Doctor of Philosophy (PhD) in nursing in Pakistan and research is mandatory to complete these nursing degree programs. According to Pakistan Nursing Council reported by World Health Organization, there is a difference in the number of nurses who admit in the training programs as compared to those who successfully graduate the program[(6)]. Other than Pakistan, passing rate of nursing students is less than admission and it is evidenced that more than 50% students are not able to complete their degree in stipulated time period due to poor knowledge and skills to conduct research[(7)].

Application of research findings to clinical problems is one of the outcome of nursing curriculum designed by The American Association of Colleges of Nursing[(8)]. Despite of having statistical knowledge, statistics is an anxiety provoking subject for many health sciences students[(9)]. There are multiple factors considered to be associated with anxiety including; poor mathematical knowledge, previously unfavorable experience of statistics, difficulty in comprehending the data and its analysis, and the limited application of teaching statistics to healthcare professionals[(10)].

Study conducted in Pakistan showed that anxiety associated with statistics hinders students' learning of statistical knowledge and skills, along with its poor application in their practice[(11)]. The results of another study reveal that nursing students' attitude is negative toward statistics as compared with non-nursing subjects[(12)].

Similarly in Pakistan, nursing students feel anxiety towards statistical course because of the curriculum limitations at intermediate level. When students are introduced to the subject of statistics in professional degree, they usually fail to understand and comprehend the knowledge because of the negative perceptions towards learning biostatistics[(13)]. In undergraduate degree, the student's main objective is to pass statistical courses, and therefore, they cannot gain a clear understanding of the importance of biostatistics[(14)]. if the students' needs at undergraduate level are identified at the time of entry to the degree program and then they are trained based on their need orientation, it will result in positive outcomes. Moreover, additional knowledge at post graduate

level will make them competent professionals in terms of using statistical data for clinical decisions[14].

The above discussion give raise to many questions such as: What method should be used to teach statistics?, what content to teach, when to teach statistics, and what statistical techniques are common in the literature based on the needs of degree program, which provide students with the understanding of basic statistical knowledge for interpretation and application of statics into research[15]. Statistical knowledge is very important for nurses but especially for those who pursue Master or Doctor of Philosophy in Nursing, as they have to conduct thesis research and or to publish their research findings[14].

Nursing students face challenges in every domain of biostatistics ranging from literature review till publication of research resulting in poor implementation of biostatistical concepts. Therefore, in depth assessment of biostatistical learning needs of undergraduate and post graduate nursing students is the need of the hour to design learner centered teaching strategies in order to promote excellence in nursing research. To best of author's knowledge, there is no comprehensive tool available to assess biostatistical learning needs of nursing students. Hence, it is essential to construct a comprehensive standardized tool to assess biostatistical learning needs of nursing students and explore methods to improve them.

The aim of this study was to identify and prioritize the learning needs related to statistical knowledge of post graduate nursing students and enable the academia management to understand the nursing students' biostatistical learning needs. The study findings also help the students to understand and comprehend the need to learn biostatistical competencies to complete their professional degree successfully.

METHODOLOGY

Study design and participants: This study used qualitative descriptive explorative study design. The study was conducted at three different settings including; Lahore School of Nursing, The University of Lahore, Multan College of Nursing, Multan Medical and Dental College, and Institute of Nursing, University of Health Sciences, Lahore. Initially, two (02) experts and eight (08) nursing students were enrolled for conducting qualitative interviews and data was collected till saturation was achieved. Participants were recruited by using purposive sampling technique.

Data Collection: Keeping in view the COVID 19 pandemic, the data was collected virtually through in-depth interviews. With the participants' consent, the interviews were conducted and recorded on the phone. A semi-structured interview guide was used for data collection. Interview questions focused on the learning needs of the students and then the students were narrowed down to their perceptions and learning needs related to biostatistics.

Each interview lasted for 25 to 30 minutes. The participants were asked to mention their names at the start of the interview to ensure verbal consent. These names were later replaced by pseudonyms for keeping the anonymity.

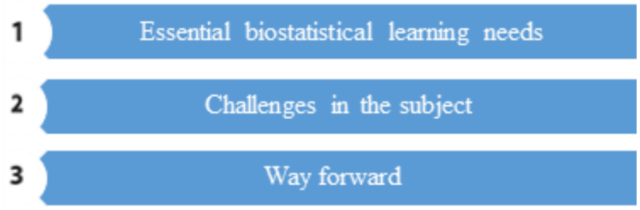
Ethical considerations: The rules and regulations set by the ethical committee of university of Lahore were followed in the research and the rights of the research participants were respected. Privacy of the participants were maintained by assigning pseudonyms to the responses. Informed consent taken from the participants. Study Rigor was maintained by Lincoln & Guba, 1985 criteria of trustworthiness.

Data Analysis: Data was analyzed using Creswell's (2014) criteria for qualitative data analysis. Qualitative research follows a systematic pattern of collecting, recording, and analyzing the data. Therefore, the texts with words, phrases, and ideas which were essential to the study were carefully highlighted in the first step. Next, similar words, phrases, or ideas were grouped together and arranged to form codes. After that, the codes were grouped to form themes and sub-themes.

Findings

Demographic Characteristics of the Study Participants: A total of 10 participants included in the study. The study population comprised of 08 graduate nursing students and 02 experts of biostatistics subject. Out of these study participants, 60% (n=6) were females and 40% (n=4) were males. The study participants were recruited from both government, 40% (n=4), and private, 60% (n=6) nursing institutions.

Results from the Participants' Interviews: The in-depth analysis of the interviews helped the researcher to identify three main themes and eight categories. The three main themes that emerged are;



Theme 1: Essential biostatistical learning needs: Both graduate students and expert perceived that basic statistical tests are essential need of the student, and it not only helpful in academic career but also clinical practice. One the student participant expressed,

"*I think for the academic journey these tests are extremely important and you even cannot carry a simple research without these basic statistic tests" (P-04)*.

The majority of the participants agreed with the statement that, usage and command of statistical software are fundamental for post-graduate students. The expert added that, it makes students work easy and give them much productive time. The students further explain that, we are not capable to conduct quantitative research without this software. One student participant said,

"To combat with the complex healthcare of 21st century, the use of technology is vital, so for the advanced academic journey, I think you should have strong command on various software operation like SPSS, PSPP, STATA, and Atlas etc." (P-01).

The majority of the participants agreed that, analysis and interpretation of the data and various statistical tests are essential for graduate students. The participants reported that, analysis and interpretation are the foundation and soul of statistics in research. They further stated that, through the sound knowledge of analysis and interpretation, you can transfer your claim and persuade your audiences of your research findings. One of the experts stated,

"Very interesting question. I think that, the great benefit of biostatistics to the graduate students is independently carrying quantitative research. Suppose during graduation if you don't have any subject of biostatistics so how to interpret or conduct any quantitative or experimental study. Moreover,

interpretation of various statistical test in clinical practice is possible because of this subject" (E-02).

Both the postgraduate students and expert shared that, knowledge of advanced biostatistical skills is essential for graduate students. Participants added that, to combat with advanced health care system of the 21st century the advanced statistical skills such as command on statistical software-independent operation, critical analysis and interpretation of the various parametric and non-parametric test are extremely important for the students.

Theme 2: Challenges in the subject: The second theme that emerged from the data was the perceived challenges of the graduate students. This theme emerged from codes which are direct statements from study participants. The students experienced various challenges related to the subject of biostatistics, which seems to be the main hindrance in students learning. The theme consists of four code detail of which mentioned below.

Challenges in data entry. The first challenge experienced by the students were difficulties while entering data into the software. The majority of them argued that data entry to statistical software was their initial exposure to such type of software in student life, therefore they are facing many issues in it. One student stated,

"When the first time I used SPSS, it was interesting but I cannot understand how I will enter the data. Because you cannot learn so quickly just from one exercise or tutorial with faculty". (P-01).

The experts have different views regarding this challenge for students. One expert expressed that,

"I don't think so the data entry is such a huge challenge as perceived by students because initially, every skill has some difficulties and hurdles which need attention. We have sometimes very brilliant students which already knows how to enter data and even run tests but the majority of students have a little difficulty in data entry which resolved with time when they practice" (E-01).

Capability of analyzing inferential statistics. The students face various challenges in biostatistics. They added that most of them unable to analyze inferential statistical tests such as hypothesis testing and estimation. The students perceived that interpretation and extracting meaning from these are challenging task, which needs teacher guidance and timing.

The expert expressed this challenge of students in this way,

"Appropriate learning of hypothesis testing and interpretation needs critical analysis skills along with statistical expertise. Interpretation also requires higher thinking order skills. Therefore initially, it remains a great challenge for all students but once they practice on it things become easy. So I believed that appropriate method of teaching, exercise and tutorial can make this challenge easy for many students" (E-02).

Incapability to run and interpret regression (linear and logistic) and correlation. It was the most common argument stated by the majority of the students. Participants expressed that using and operating various advance level statistical tests such as regression and correlation is a massive challenge for them. They added that using regression and correlation are their first experience in student's life. One student expressed that,

"I first time came across regression and correlation in biostatistics in my student life. So operating such difficult tests for a tough subject is a huge challenge for me. It requires a lot of practice, time and help from teachers and peers. Initially, I even not know the names of these advance level tests, because I do not come across these tests in undergraduate programs" (P-07).

Lack of skills in calculating validity and reliability of the tool. The participants perceived that calculating CVI and Cronbech Alpha for newly developed tool is a huge challenge for them. They explained that for a student having a medical background, testing of the developed instrument (tool) is a great issue, because, they are weak in mathematics and quantitative skills. The students added that, sometimes they are completely blind and unable to understand how to perform tests for the newly developed or adopted tools. One student communicated that,

"Calculating validity and reliability of the newly constructed or adopted tool is a huge challenge for me just like tests interpretation. I think it is very difficult to run tests for calculating CVI and Cronbech Alpha of the tool. Because, most of the time, we are even unable to find the option of Cronbech Alpha and CVI in the SPSS" (P-05).

Theme 3: Way Forward: The postgraduate students suggest that, they need more session for practice because they cannot get the whole concept in one or two sessions. The experts also argue that, they should give more opportunity to students to give their practice on various tests and software use. One expert described,

"Being an expert and teacher from last decades I believed that we should give students more assignments and more time for practice on various test under our supervision. Because the majority of our students have never in touch with mathematics and physics for many years so they need more tutorial and group work to become expert in these things" (E-01).

The study participants recommended to overcome the existing challenges, they need coordination and cooperation among them through an integrated approach. The expert suggests that, students need to work together and shared their ideas to overcome the challenges of the subject. The students also recommended group study and helping each other. A student suggested that,

"You know that every student has different abilities and talents in each class. I will suggest here that those students who have knowledge and understanding of biostatistics should work together with weak students. Because week students need help and little push from other students and faculty. So this culture should be promoted in our institutions" (P-02).

DISCUSSION

The study participants verbalized the importance of the basic statistical tests for carrying out the basic research. This finding of the current study is consistent with the study, which revealed that variability in the human subjects made the medical field more versatile compared to other fields. In medical sciences, different results have been yielded from the same measures of the repeated parameter. Since, these results requires major competencies to analyze these variations at data sciences level. Therefore, operating of the basic statistical tests are of keen importance. Similarly, another quantitative cross-sectional study identified that 86% of the study population were well aware of the importance of the basic statistical tests performing and interpretation in the research (16). However, majority of the population (53%) were unable to perform basic statistical tests i.e. parametric and non- parametric tests by their own in experimental study designs (16).

The current study identified that mainly challenges are in data entry, inability to interpret the test, limitations to use the

software effectively, and incapability in analyzing the data are the keen challenges while studying biostatistics. The findings of the current study are compatible with other study which reported that the inadequate resources such as lack of experts in the field, unavailability of various statistical software in the systems, and lack of well-equipped library resources are the most prevalent the challenges for the students while analyzing and interpreting various results evolved through data analysis (17).

Pakistani study revealed that there is need for resource allocation for the better understand and enhance the knowledge of graduate students studying biostatistics (18). Moreover, the study also found major resources such as availability of proper computer along with concerned biostatistical software, availability of experts, and utilization of proper teaching learning strategies (18). Similarly, a Serbian study identified the role of peer assistance, group work, and prompt and comprehensive feedback in the enhancement of graduates students' knowledge regarding biostatistics.

Recommendations: In light of the findings of the current study. The following recommendations can be made for nursing education, research, and policymakers.

1. The educational institutes should hire more biostatistician. This will aid to fulfill the existing shortage of the experts in the nursing departments to facilitate graduate nursing students. This would potentially in promoting research culture across the institution.
2. Biostatistician should involve the students in their grants projects. This strategy will potentially the motivation and satisfaction level regarding the subject.
3. At organizational level, there is need to develop Statistical Services Unit (SSU). The unit consisting biostatical experts with vast experience in statistical analysis and development of various statistical software.

CONCLUSION

According to the limited knowledge of the researcher, this is the first study in Pakistan, utilizing qualitative explorative descriptive design to explore the biostatistical learning needs of the graduate nursing students. The study concluded with identifying various learning needs including command on various statistical tests and their interpretation, sample size determination, and learning advance statistical skills. The study identified various challenges while fulfilling these learning needs such as lack of adequate resources in terms of, unavailability of biostatistics experts, and lack of basic facilities such as fully equipped computer and library resources.

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