Importance and Understanding of Bio-Statistics among Post Graduate Students at King Edward Medical University Lahore - Pakistan

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Background: The research in medicine has caused concern among both doctors and bio-statistician for many years 1. Fundamental concepts of statistics are dire need for medical doctors. If medical doctors do not understand fully the primary concepts of Biostatistics, then the scientific conclusions they reach will be more likely to be wrong 2.

Methodology

Study Design: Cross-sectional descriptive study design was used. Total number of respondents: The study was conducted at King Edward Medical University (KEMU) Lahore - Pakistan. A questionnaire was e-mailed to 332 post-graduate medical students (doctors, dentists and physiotherapist) in which only 227 responded. The questionnaire was also manually distributed to 110 medical post-graduate students. Consequently, the total number of respondents was 327 (response rate = 74%).

Results: The mean age of respondents was 31 ± 0.37 years along with the S.D = 6.67 years. There were 198 (60.55%) male and 129 (39.44%) female respondents. The basic knowledge of biostatistics among students was not satisfactory. The proportion of students was significant (p-value= 0.00) who were agreed that this course is useful for them and every medical institute should start regular courses on Biostatistics during M.B.B.S.

Conclusion: Our medical institutes should take a daring step towards the education of Research Methodology and Biostatistics. This subject should be taught in graduation so that the doctors of future may get a significant understanding for exploring, implementing the research and make evidence based decisions.

Key Words: Medical-statistics, Research Methods and Medical Research.

Words Count: 238.

Introduction

Statistics has attained gratitude as an important component of many disciplines including medical and related sciences. Biostatistics is an applied science for biology, medical and health sciences 3. Health care provider need to be aware of the progression of statistical investigations and be able to plan statistical inquest in medical and health related decisions.4

Biostatistics has been accepted as a discipline since less than 6 decade and the expansion of science is observed with the growth of systematic medical research in different countries of the world.5,6 Unfortunately in Pakistan Biostatistics has not been accepted as an independent subject in the medical institutes. At the medical schools without Biostatistics Departments, the minor courses are taught by the instructors who are not biostatisticians and consultation is provided by non-professionals.5,6

Medical students must learn the principles of epidemiology and biostatistics to critically evaluate the medical literature so it should be taught early in the graduation, however this subject has traditionally been difficult to teach.7,8

It is well known fact that medical statistics are not particularly popular among the medical students. It is a general thought that there are some grim difficulties in the biostatistics education which may include:

- As medical students are very well motivated about study of medicine, in minor branch of basic sciences, they are not well motivated about studying of research methodology, epidemiology and bio-statistics.
- There is a wide variety on mathematical knowledge, ability and curiosity among the students. That kind of difficulties causes the decline of output and perma-

nency of the bio-statistical knowledge 5 etc.

Numerous bio statisticians have been witnessed during the statistical consultancy many doctors argue that they didn't give ample importance on statistics when they were undergraduate students. Consequently from the beginning of the undergraduate education the education of biostatistics and epidemiology should be given to the medical students. As undergraduates their main aim is to pass the course, but for post graduate students conducting their own research the motivation is to obtain sufficient understanding of basic statistical methodology. The depth of understanding that they will require may not be obvious initially but will boost the longer they stay in research.1

Hence the main purpose of this study was to find out the importance of research methods, biostatistics and epidemiology among post graduate medical students. We also focused their opinions at which level these subjects should be taught. Obviously, these findings will help to decide at
which semester of medical education the biostatistics educa-
tion should be given.

Objectives
1. The aims of this study were to assess knowledge, atti-
tudes and professional behavior of post graduate medi-
cal students towards basic knowledge of Biostatistics to
evaluate the usefulness of health interventions, particu-
larly hypothesis testing and interpretation of the results.
2. To see the importance of biostatistics in their opinion
and to inquire when this subject should be taught.

Methodology
The respondents were asked very basic questions and under-
standing, like the concepts of: data collection methods,
study design, measure of central tendency, measure of dis-

dispersion, proportions, rates, ratios, and sampling techniques
and its types, probability and probability distributions,
regression, correlation, concepts of hypothesis and analysis
of data, difference between parametric and non-parametric
statistics. Moreover we also asked some sophisticated con-
cepts such as, survival analysis, Diagnostic tests (Sensi-
tivity, Specificity, Positive predictive value (PPV), Negative
Predictive value (NPV)), receiver operating curve (ROC)
analysis and time series analysis.

Study Design: Cross-sectional descriptive study design
was used.

Total Number of Respondents: The study was con-
ducted at King Edward Medical University (KEMU)
Lahore- Pakistan. A questionnaire was e-mailed to 332 post-
graduate medical students (doctors, dentists and physio-
therapists) in which only 227 responded (response rate
68.37%). The questionnaire was also manually distributed
to 110 medical post-graduate students (response rate was
100%). Consequently, the total number of respondents
was 327 with over all response rate = 74%.

Duration of Study: This study was concluded in five (5)
months.

Statistical Analysis: The data was analyzed using SPSS
16 and results were presented as: Age of respondents was
presented as mean ± S.E; we also used Standard Deviation
(S.D). All other qualitative variables were presented in form
of Frequency tables and percentages. Chi-Square test for
proportion was used, p-value less than 0.05 was taken as
significant.

Results
The mean age of respondents was 31± 0.37 years along with
the S.D = 6.67 years. The minimum and maximum age was
25-51 years respectively. There were 198 (60.55%) male
and 129 (39.4%) female students. The ratio of married to
un-married students was 1:0.80. Among all respondents
there were 228(69.72%) students who attended the course
on Biostatistics and Research Methods during their study
period; the rest of 30.27% students never attended that
course.

The proportion of candidates was significant (p-value
= 0.000) who could understand the term study design i.e.
221 (67.58%). There were 217(66.36%) candidates who
could comprehend and define data collection methods, the
rate of recurrence with positive answers for data collection
was significant (p-value =0.000). There were 63.9% respon-
dents who were aware about the methods of data presenta-
tion (graphical and tabulation) that was also significant. In
addition, 319 (97.55%) were known with measures of cen-
tral tendency (mean, median and mode only) and measure of
dispersion (range, standard deviation and variance only).
The knowledge of central tendency and measures of dis-
persion was statistically significant (p-value=0.000). The
proportion of candidates who did not have the knowledge
of birth rate, mortality and morbidity rate was significant
(p-value= 0.000) i.e. 54 (16.5%) candidates.

Regression and correlation analysis was famous to 221
(67.58%) students which was also significant (p-value=
0.000). Only 8 (2.4%) students could understand about the
terms “sampling techniques and probability distributions
(Bi-nomial and Poisson)”, the frequency of those who did
did not know about these terms were more prevalent (p-value=
0.000). Other probability distributions like Z-test and t-test
were known to 12 students only. The students without the
knowledge of Z-test and t-test were also statistically signi-
ficant (p-value = 0.000). The proportion of students without
the knowledge of Analysis of Variance (ANOVA) was too
significant (p-value = 0.000). The term chi-square test was
much familiar to the students and the understanding of this
term was more prevalent (p-value =0.000). In addition,
tere were 284 (86.85%) students who could not differenti-
bate between the “Parametric and Non-Parametric tests”
which was what’s more significant (p-value = 0.000). Last-
ly, on asking them about Survival Analysis, Diagnostic
tests, Receiver Operating Characteristic analysis (ROC) and
Time Series, we received very interesting comments; so
many students asked that “what is this”? Minimum number
of students said that “yes we can understand and interpret
these terms”.

Over all, the basic knowledge was seen in fresh gradu-
ates than older students (p-value = 0.043). The male’s
knowledge was comparable with female, female signifi-
cantly responded than males (p-value = 0.046).

Finally, 98.16% students were agreed that this course
is useful for them and 318 (97.24%) candidates were in
favor that every medical institute must have a separate
department of Biostatistics. We also took their opinions
that in which year of graduation the course on Biostatistics and
Research methods should be taught. 54 (16.51%) students
suggested that this course should be taught in first year, 76
(23.24) told in 2nd year, 103 students suggested that in 3rd
literature on the assessment of biostatistical knowledge of
Table 1: Response to questions evaluating basic concepts and applications of Biostatistical terms.

<table>
<thead>
<tr>
<th>Basic terms which were asked</th>
<th>Yes (%)</th>
<th>No (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study design and its types</td>
<td>221 (67.58)</td>
<td>106 (32.41)</td>
<td>0.000</td>
</tr>
<tr>
<td>Writing report</td>
<td>26 (7.95)</td>
<td>301 (92.05)</td>
<td>0.000</td>
</tr>
<tr>
<td>Data collection methods</td>
<td>217 (66.36)</td>
<td>110 (33.64)</td>
<td>0.000</td>
</tr>
<tr>
<td>Presenting and summarizing the data</td>
<td>209 (63.9)</td>
<td>118 (36.1)</td>
<td>0.000</td>
</tr>
<tr>
<td>Measures of locations: means/ median/ mode etc.</td>
<td>319 (97.5)</td>
<td>8 (2.5)</td>
<td>0.000</td>
</tr>
<tr>
<td>Measures of variations: S.D/ variance/ range etc.</td>
<td>319 (97.5)</td>
<td>8 (2.5)</td>
<td>0.000</td>
</tr>
<tr>
<td>Birth rate, mortality, morbidity</td>
<td>54 (16.5)</td>
<td>273 (83.5)</td>
<td>0.000</td>
</tr>
<tr>
<td>Sampling techniques and sample size calculation</td>
<td>8 (2.4)</td>
<td>319 (97.5)</td>
<td>0.000</td>
</tr>
<tr>
<td>Regression and correlation</td>
<td>221 (67.6)</td>
<td>106 (32.4)</td>
<td>0.000</td>
</tr>
<tr>
<td>Hypothesis testing</td>
<td>12 (3.7)</td>
<td>315 (96.3)</td>
<td>0.000</td>
</tr>
<tr>
<td>Probability and probability distributions</td>
<td>9 (2.7)</td>
<td>318 (97.3)</td>
<td>0.000</td>
</tr>
<tr>
<td>Z-test (Normal distribution)</td>
<td>12 (3.7)</td>
<td>315 (96.3)</td>
<td>0.000</td>
</tr>
<tr>
<td>T-test / distribution</td>
<td>12 (3.7)</td>
<td>315 (96.3)</td>
<td>0.000</td>
</tr>
<tr>
<td>Analysis of variance</td>
<td>12 (3.7)</td>
<td>315 (96.3)</td>
<td>0.000</td>
</tr>
<tr>
<td>Binomial distribution and its probability</td>
<td>8 (2.4)</td>
<td>319 (97.5)</td>
<td>0.000</td>
</tr>
<tr>
<td>Poisson distribution and its probability</td>
<td>8 (2.4)</td>
<td>319 (97.5)</td>
<td>0.000</td>
</tr>
<tr>
<td>Chi-square test / distribution</td>
<td>198 (60.5)</td>
<td>129 (39.5)</td>
<td>0.000</td>
</tr>
<tr>
<td>Diagnostic tests (Sensitivity, Specificity, PPV, NPV)</td>
<td>20 (6.11)</td>
<td>307 (93.89)</td>
<td>0.000</td>
</tr>
<tr>
<td>Differentiating parametric &amp; non-parametric tests</td>
<td>43 (13.15)</td>
<td>284 (86.85)</td>
<td>0.000</td>
</tr>
<tr>
<td>Survival analysis</td>
<td>7 (2.14)</td>
<td>320 (97.86)</td>
<td>0.000</td>
</tr>
<tr>
<td>Roc analysis</td>
<td>20 (6.12)</td>
<td>307 (93.88)</td>
<td>0.000</td>
</tr>
<tr>
<td>Time series analysis</td>
<td>3 (0.91)</td>
<td>324 (99.1)</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Discussion

Teaching Biostatistics is often considered a difficult task to medical students. However, no one can deny the need of statistics in the medical curriculum. In modern time, there has been a rising label for coaching only statistical concepts in medical institutes. It is general compromise regarding the use of basic statistics in medical research and practice. The aims of most medical institutes are to produce the clinicians not the researchers. But for those students who prefer a livelihood in research, there is a need to offer in-depth instructions in biostatistical philosophy and procedures.9-10

There is a very week findings it has been also assessed that clinicians during their trainings, have low superficial knowledge of biostatistical concepts even with a clear acknowledgment of the importance of these issues, which is also published by other researchers.11,12

Medical education must contain a more evidence-based approach.13,14 To attain this, the students must have the year, 50 recommended in final years while rest of 44 respondents replied that “we don’t know”.

Discussion

Teaching Biostatistics is often considered a difficult task to medical students. However, no one can deny the need of statistics in the medical curriculum. In modern time, there has been a rising label for coaching only statistical concepts in medical institutes. It is general compromise regarding the use of basic statistics in medical research and practice. The aims of most medical institutes are to produce the clinicians not the researchers. But for those students who prefer a livelihood in research, there is a need to offer in-depth instructions in biostatistical philosophy and procedures.9-10

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Medical education must contain a more evidence-based approach.13,14 To attain this, the students must have the
knowledge and skills in developing, analyzing and interpreting the output as part of their erudite work. Effective development and evaluation require a fundamental knowledge of study design and statistical methods. In this study all students had a significant lack to define probability distribution, sampling techniques, hypothesis testing, diagnostic tests, different rates and ratios etc. According to a cross-sectional survey carried out on Italian physicians, a good knowledge was seen regarding randomized clinical trials and Meta analysis that was due to their frequent practice and basic knowledge of Biostatistics. Our residents can also define all these terms if we start to give them a proper understanding regarding biostatistics.

Our findings have identified a series of positive response about the existence of biostatistics in medical education. We strongly agree with Butt AK et al that medical institutions should improve their curriculum with better prominence on bio-statistical thinking and logistics. We can motivate the clinicians and produce more health researchers by introducing computerized methods and a greater focus on concepts instead of mathematical calculations through formulas.

Acknowledgement
The authors are highly thankful to the students who responded our questionnaire and we are also appreciative to Dr. Ashiq Hussain and Muhammad Khaild for their assistance in data collection from King Edward Medical University Lahore Pakistan and Medical Hostels.

Conclusion and Suggestions
Our medical institutes should take a daring step towards the education of Research Methodology and Biostatistics. This subject should be taught in graduation so that the doctors of future may get a significant understanding for exploring, implementing the research and make evidence based decisions. According this study it is concluded that students have not an essential knowledge of conducting research and analysis of their problems. They really desire to learn biostatics and research methods so that they can play a pivotal role in the progress of new knowledge.

We can achieve all these goals if we revise the curriculum and introduce biostatistics as a discipline in their graduation. It is essentials to provide them conceptual knowledge and it is also important to introduce some computerized statistical packages like SPSS, Excel or SAS etc to avoid the difficult mathematical calculations and formulae which threat them to learn Biostatistics. Lastly, every medical institute must have the experts of Biostatistics and research methodologies.

References