VIEWPOINT

Teaching Biostatistics to Medical Undergraduates in Integrated Curriculum

Waqas Sami*[1], Mohammed AlMansour[2], Tayyaba Waqas[3]

* For correspondence w.mahmood@mu.edu.sa

[1]Waqas Sami, Lecturer of Biostatistics, Department of Public Health & Community Medicine, College of Medicine, Majmaah University, Almajmaah, Saudi Arabia.

[2]Assistant Professor, Family Medicine, Department of Public Health & Community Medicine, College of Medicine, Majmaah University, Almajmaah, Saudi Arabia.

[3]Biostatistician, Department of Continuous Medical Education, Punjab Institute of Cardiology, Jail Road, Lahore, Pakistan.

Submitted on: 4th January 2015, Accepted on:6th September 2015

Abstract

As medicine has moved to become more evidence based, biostatistics has become ever more important in practicing medicine and for the education of tomorrow's doctors. The role of biostatistics in medical education is now well recognized, and the curricula in almost all the medical colleges and postgraduate institutions across globe has provision of teaching biostatistics. In an integrated curriculum biostatistics and research methods, course should be inducted in-combination from 1st year of study and its Curricula should be developed by content experts with taking care of the spiral approach. Integration is now considered the best way to teach so the tutors should get maximum benefit of teaching biostatistics under this system. The curriculum contents should be updated at the end of course every time based on feedbacks and recent advancements in the field. Computer based approach should be used to make the learning more interactive. Assessment must be aligned with teaching methods, curriculum outcomes and course objectives.

Key Words: Biostatistics, Research Methods, Integrated Curriculum, Computer Based Approach

الملخص

ما أن الطب أصبح يعتمد على البراهين فقد أصبح
الحصول على أحدث المعلومات من أهم ممارسة الطب وتعليم أطباء
الغد. ومن المسلم به الآن دور الحاسوب في التعليم الطبي وفي هذه
الدراسة قمنا بمراجعة الكليات الطبية والمؤسسات التي تدرس
التعليم في الطب في جميع أنحاء العالم في المناهج المكثفة، مقرر
الحصول على الحاسوب وفي هذه البحث ينبغي أن يدخل في
دراسة وفي هذه ينبغي أن توضع من قبل الخبراء المختص مع الأخذ
اعتبار المقاربة الحلزونية. التكامل الآن أفضل
الطريقة للتعليم لذلك المعلمين هذا النظام يجب أن يحصلوا على
من تدريس الحاسوب وفي ظل هذا النظام. يجب أن يتم تحديث
المناهج الدراسية في نهاية كل مقرر على أساس التغذية الراجعة
التطورات الأخيرة في هذا المجال. وينبغي استخدام الكمبيوتر لجعل
التعلم أكثر تفاعلية. التقييم يجب أن يكون وفقا مع طرق التدريس
ومخرجات المنهج وأهداف المقرر.

Introduction

Prior to the twentieth century, medical research was primarily based on empirical evidence and anecdotes. As the medicine has moved to become more evidence based, biostatistics has become ever more important in practicing medicine and for the education of tomorrow's doctors.[1] Biostatistical reasoning and modeling were of critical importance to the foundation theories of modern biology. In the early 1900s, after the rediscovery of Mendel's work, the gaps in understanding between genetics and evolutionary Darwinism led to vigorous debate among biometricians. Statisticians then built models on statistical reasoning that helped to resolve these debates.[2] The role of biostatistics in medical education is now well recognized, and the curricula in almost all the medical

colleges and postgraduate institutions across globe has provision of teaching biostatistics[3] irrespective they are following traditional curriculum or integrated curriculum. The concept of integrated curriculum is nothing new. It's been around, in fact, since the 1800s and was advocated by well-known educational theorists (John Dewey and Meredith Smith). It has gained recent attention and most modern medical educationists think that it is the best way to teach.[4-5]

Biostatistics is a branch of applied statistics that is concerned with the application of statistical methods to medicine, clinical trials, demography, epidemiology, population estimation, modeling, community diagnosis and surveys.[6] Biostatistics is now considered as an essential tool in planning and delivery of health care systems. Integration is defined as a way to teach students how to break down barriers between subjects and make learning more meaningful & attractive. Integrated curriculum is an effective way to teach and learn because it corresponds with the way our brain works physiologically. According to M. Markus,[7] integrated curriculum is a great gift for experienced teachers. It's like getting a new pair of lenses that make teaching a lot more exciting and help us look forward into the next century.

Biostatistics is now being taught as a major subject in the medical curriculum. In a traditional curriculum, generally the course of biostatistics is spread over one academic year study with formal final assessment. However, in an integrated curriculum it is generally taught as a longitudinal course spread over 4 – 6 months semester with either a formal final assessment or submitting a research project that depicts the knowledge of students. In this article, we will focus on "how biostatistics subject should be taught to undergraduate medical students in an integrated curriculum".

Biostatistics Course Induction Time in an Integrated Curriculum: At undergraduate level, there is a great difference in terms of organization of teaching and time allotted for biostatistics teaching in medical colleges globally. In United States, Canada, Australia and United Kingdom biostatistics is being taught in 1st and 2nd year of study.[8] In an integrated curriculum, the best time to start teaching biostatistics should be from 1st year of education, and biostatistical applications should be reinforced throughout during the basic sciences phase followed by a research project as course's final assessment. The core benefit of inducting biostatistics from 1st year level will strengthen the scientific reasoning of medical students and as they will reach the end of initial 2 ½ years of study their knowledge level will have increased unprecedentedly. Contra to it, if biostatistics is taught in one semester continuously it might bore the students because they are forced to grasp too much of knowledge in a limited time and will be tougher if it is followed by submitting a research project.

Secondly, with other parallel full time running courses the students might focus more on those subjects rather than learning biostatistics.

Course of Biostatistics at Undergraduate Level in Integrated System: In an integrated system biostatistics and research methods, subjects should be taught in-combination. Students should be imparted with the biostatistical and research methods knowledge throughout their first 2 ½ years of education. Learning the subject in-combination will not only help medical students to grasp necessary knowledge at undergraduate level but will also help them to develop research–oriented thinking at postgraduate level.

Teaching Biostatistics in Integrated Curriculum: In this section, some guidelines are given for teaching biostatistics in an integrated curriculum which may help to enhance the learning in this subject. The tutor must convince the medical students about the importance of learning biostatistics subject. As integration is a student-centered approach, one of the best ways of motivating the students is to expose them to the medical literature with examples of uses & abuses of biostatistics.[9]

In an integrated curriculum, the instructional method(s) should be problem-oriented instead of technique-oriented. The technique-oriented method is now old style which contains hand calculations, formulas and drawing critical regions etc.[10] Besides, problem-based approach should be introduced which focuses more on interpretation. A survey conducted on biostatistics teaching showed that the students ostracized the subject because it was taught in the traditional way.[11]

Hand calculations should be avoided and for making the teaching interactive Computer based approach should be introduced. Nowadays a variety of biostatistical software's (SPSS, STATA, STATISTICA, NCSS and OPEN-EPI) are available. Introducing Computer Based Learning (CBL) will also enhance the student's motivation for learning. The use of computers in the teaching should be encouraged to allow the students to concentrate on the interpretation of the analysis.[12]

Reviewing literature is a pre-requisite for designing research. In an integrated curriculum, the tutor should educate the students about the methodology in searching literature and designing the research (research design, sampling technique / data collection and sample size etc). Moreover, the tutor should emphasize upon how results are interpreted and reported in biostatistical language.[13] Furthermore, the tutor should give special emphasis upon; how to write a research proposal and its scientific presentation. One of the main goals of teaching biostatistics is to analyze and interpret the data. In an integrated curriculum, it is the prime responsibility of the tutor to make the students understand about using accurate data analyzing technique(s).[14] The inappropriate use of

biostatistical methods & techniques may mislead the students understanding at a stage when their minds are fresh to grasp knowledge. The tutor should also strive to present a well-balanced combination of lectures, tutorials and practicals.[15]

Conclusion

In an integrated curriculum biostatistics and research methods, course should be inducted in-combination from 1st year of study. Curricula should be developed by content experts with taking care of the spiral approach. Students should be encouraged to conduct a research project of their own. Integrated curriculum is now considered the best way to teach so the tutors should get maximum benefit of teaching biostatistics under this system. The curriculum contents should be updated at the end of course every time based on students' feedback and recent advancements in the field. The computer based approach should be used to make the learning more interactive. Assessment must be aligned with teaching methods, curriculum outcomes and course objectives.

References

1. Frank Emmert-Streib and Matthias Dehmer. Medical Biostatistics for Complex Diseases. Wiley-Blackwell 2010. ISBN 3-527-32585-9.
2. Terry Speed. Microarray Gene Expression Data Analysis: A Beginner's Guide 2003. Chapman & Hall/CRC.
3. Report of a Committee of the American Statistical Association Subsection on Teaching of Statistics in Health Sciences, Proposal for a core curriculum in medical biostatistics. Clinical Pharmacology and Therapeutics 1975;18:127-131.
4. Beane James A. Curriculum Integration: Designing the Core of Democratic Education. New York 1977: Teachers College Press.
5. Caine, Renate Nummela and Geoffrey Caine. Making Connections: Teaching and the Human Brain 1982.
6. Waqas Sami. Biostatistics Education for Medical Students Pakistan's Perspective. Problems, Changing Approaches & Perceptions. Biomedica 2010;26: 80-84.
7. M. Markus. Media specialist. Quoted in Shoemaker 1991, September, p. 797.
8. Jenny V Freeman, Steve Collier, David Staniforth and Kevin J Smith. Innovations in curriculum design: A multi-disciplinary approach to teaching statistics to undergraduate medical students BMC Medical Education 2008:8:28
9. Welch GE II, Gabbe SG. Review of statistics usage in the American Journal of Obstetrics and Gynecology. Am J Obstet Gynecol 1996;175(5):1138-41.
10. Boyle, C.R. "A Problem-Based Learning Approach to Teaching Biostatistics," Journal of Statistics Education,1997;secure/v7n1/boyle.cfm.
11. Moussa, M. A. A. Developments in the instruction of Biostatistics at the Kuwait University Health Science Centre in a decade. Teaching and Learning in Medicine, 2002;14(3),194-198.
12. Tae Rim Lee. Teaching Biostatistics to medical personnel with computer based supplement. International Association for Statistical Education and International Statistical Institute. 2001, Printed in Granada, Spain.
13. Sahai, H. and Ojeda, M. M. Teaching biostatistics to medical students and professionals: Problems and solutions. International Journal of Mathematical Education in Science and Technology. 1999;30(2), 187-196.
14. Garfield J: How students learn statistics. International Statistical Review 1995;63:25-34.
15. Y.M. Lam. Teaching Statistics to Medical Students in the New Medical School. Journal of the Hong Kong Medical Association. 1986:38(4),196-198