TEACHING BIOSTATISTICS TO CLINICAL RESEARCH GROUPS

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The aim is to present a teaching model in biostatistics that provides a link between biostatistical theory and medical science. The course is designed for multi-professional research groups, consisting of a supervisor, at least one doctoral student or post-doctoral scientist and other individuals working on the same project. The course is interactive and all participants have to apply the biostatistical theories to the project throughout the course. Experience gained from running such courses indicates that application of the skills learnt should improve the quality of future medical research and the publication of results.

INTRODUCTION

Biostatistics is a relatively new field that is becoming increasingly important in medical research (Altman, 1991). Nowadays, statistical analysis can easily be performed using computer programs without consulting a statistician. This access increases the requirement for biostatistical understanding among applied scientists in order to be able to choose the appropriate statistical method and to interpret the result obtained by the computer. Also, many medical journals now require a high level of statistical sophistication by their authors (Altman, 1991; Altman, 1994; Gardner and Altman, 1989; Hand, 1996). There is an increasing awareness among scientists of the importance of understanding the methodological issues that underlie the statistical approaches used in medical research (Altman, 1991; Hand, 1994; Hand 1996)

Traditional courses in biostatistics are often intended for specific groups of students. Separate courses in applied biostatistics, for example, are provided for medical students, physiotherapists, laboratory technicians and nurses. As students with statistical knowledge may also participate in clinical research projects, there might be a risk of disagreement over the statistical approaches taken between a student, the supervisor and others involved in the same research project. In order to avoid communication problems and scientific conflicts within research groups, a new type of course in biostatistics was offered to medical research groups at the medical faculty in Göteborg.

The aim of this paper is to present a teaching model in scientific methodology and applied biostatistics for groups sharing the same clinical research problem.

DESCRIPTION OF THE TEACHING MODEL

The criterion for participation in a course was being in a group of at least four people who were participating in the same ongoing research project. Each group had to be multi-professional and to consist of a supervisor, at least one doctoral student or post-doctoral scientist and other individuals working on the project. Hence, several professions were represented in the same course in scientific methodology and biostatistics. A maximum of five different research groups was allowed in the same course.

The teaching was focused on statistical strategy (Hand, 1994) rather than on statistical technique. The statistical topics were: the research process including design, the measurement process, identification of variables, measurement properties and data screening. The choice of appropriate methods for both description and analysis of various types of research questions and data were discussed. The book, “Practical statistics for medical research” by Altman (1991)defines the main content of the course.
The use of various types of questionnaires and rating scales is very common in medical research (Svensson, 1993). Therefore, special attention was paid to the measurement properties of qualitative variables (Stevens, 1946; Svensson, 1998). Common statistical methods for ordered categorical data and the conditions on data for their use were presented (Svensson, 1993). Rank-invariant methods for quality assessment and analysis of ordered categorical data (Svensson, 1993) were also applied to research data from the participants.

The course was interactive and the methodological and statistical theories were applied to specific research problems of the participating groups throughout the course. Materials from ongoing projects were used by the teacher to illustrate and discuss statistical and methodological issues. Also, the participants had to give presentations concerning the progress of their project.

EXERCISES TO BE PERFORMED BY ALL MEMBERS OF THE RESEARCH GROUP

All exercises had to be discussed and documented within the group, keeping in mind the rules of scientific documentation. The results of each group were presented and discussed in the course.

A Map the research project.

Map / make a flow chart showing the breakdown of the overall research problem into specific research questions. The role of each group member in the research process must be evident.

B Formulate precise research questions

Formulate and reformulate appropriate research questions from the perspective of each profession represented in the research group. Discuss design issues.

C Report on the measurement process

Identify concepts to be measured and identify appropriate measurement instruments for the variables. Discuss the link between clearly defined research questions, the operationalisation process and properties of the data generated.

D Perform initial data analysis

Evaluate the distribution properties of quantitative continuous data, if present, for example by means of a normal probability plot.

Critically review the rating scales and questionnaires used in the ongoing studies and those that are planned to be used in future.

E Choose the appropriate statistical strategy

Suggest statistical methods for description and analysis of data. Discuss the link between the choice of design and measurement instruments and the consequences on the applicable statistical methods for description, analysis and conclusions.

F Review, by means of a check-list[1,3], a scientific paper, preferably from the research group or from the group´s department.

EVALUATION OF THE COURSE

Two courses using this model were run at the Paediatric Department, Göteborg University during 1994 and 1995. Six research groups, involving six supervisors, 14 doctoral students and an additional ten individuals participated in the first course. The course was evaluated by the university administrators. All participants were very satisfied with the teaching model, although some thought that the lectures dealing with parametric statistical tests were hard to follow. The most frequent comments about the pros and cons of the multi-occupational approach and with the involve-ment of their own research projects are listed in the table. The only drawback with the course, mentioned, was that one of the participants became aware of previous mistakes in his/her research.

Table. Evaluation of the teaching model.

Positive aspects of the multi-professional approach	*Positive aspects of the course in relation to the research project*
∗ Obtaining a comprehensive view of the project	∗ Applications to the project
∗ Discussing the project from different perspectives	∗ Repeated review of the projects
∗ Improved understanding of the importance of all professions for a successful research project	∗ Cooperation in formulating precise research questions together
∗ Improved collaboration between the various group members	∗ Improved teamwork
∗ Confidence and knowledge gained to proceed with my dissertation	∗ Improved understanding of the ability and knowledge of the various members of the research team
∗ Insight gained into the complexity of science	∗ All were involved in improving the project
	∗ Potential for improvement in future study designs
	∗ Improved unity of the research group

CONCLUSIONS

Multi-professional, interactive research courses in biostatistics, with application of statistical and methodological theories to actual research problems, offer educational challenges for a biostatistician. The first important educational task was to eliminate the hierarchical structure of a research group and to balance the different categories of participants, i.e. the supervising professor, the doctoral students and other individuals involved in the project. This was done by focusing on the joint scientific responsibility for the quality of the medical research project.

Evaluation of courses showed that some of the supervisors appreciated the opportunity to attend a course in order to update their knowledge of biostatistics. As one of the tutors wrote: “I do not want to confuse my doctoral students with old-fashioned, or even forgotten, statistics”. The requirement of multi-professional cooperation between group members was also appreciated, especially by those who worked on a project without being doctoral students. Some of them were not used to research courses, but they were strongly motivated and worked very hard to successfully complete the course. Collaboration of participants within and between projects was necessary during the methodological and statistical discussions and exercises. Several participants increased their self-confidence concerning critical evaluation of and performing research.

Another important educational strategy was the involvement of ongoing research projects in lectures and exercises. Hence, biostatistical knowledge, put in an educational

context, was transmitted directly to medical research. The course stimulated to discussion about scientific problems, and the exercises forced all participants to formulate precise questions. This led to an increased awareness of the importance of precise research questions, study design and the choice of the appropriate statistical methods. The involvement of a biostatistician in the scientific discussions and also for interpretation of the results obtained from the computer, became natural. The scientific quality of the ongoing projects was improved and some of the projects were considerably changed during the course.

By using this teaching model, the quality of future medical research and the publication of results should be improved.

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