STRENGTHENING RESEARCH AND STATISTICAL SKILLS OF MEDICAL DOCTORS THROUGH A HANDS-ON APPROACH: A CASE STUDY FROM IRAN

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Students in medical and health-related fields as well as seasoned medical practitioners need to understand the issues related to the process of planning a scientific study, conducting the study, analysing data and reporting the findings. Recognizing this need, the Iranian medical education system (IMES) started to design and implement a series of workshops in research methodology and statistical data analysis during the past decade. The IMES includes more than 40 universities of medical sciences (UMS). Faculty members and students of the UMS participated in the aforementioned workshops. The workshops provided an opportunity for the participants to get hands-on experiences in the process of scientific research. Based on the above, in the first part of this paper the structure of the workshops, their content and instructional methods are described. Results from a survey to find out the effectiveness of one of the workshop are presented.

INTRODUCTION

Recent studies have indicated the need for revitalization of medical education curriculum (Hamilton, 1994; Ludmerer, 1999; Wojtczak and Schwarz, 1999). In this context, improved medical techniques or higher ethical standards, as part of medical professionalism, are emphasized (Latham, 2002). Statistical knowledge and skills are among the required subject matters. Such knowledge and skills cover statistical data collection and analysis (Riffenburgh, 2005). Therefore, medical doctors and health-related professionals are expected to be familiar with statistical thinking and understand the process of statistical investigations. Such familiarization requires a set of knowledge, skills and attitudes in not only analysing the impact of different treatments on patients, but also in applying statistical methods to improve the efficiency and effectiveness of medical and health services.

As Ladd (1985, p. 157) has emphasized, “whether or not [the faculty members] themselves do research or want to engage in original scholarship, most faculty seems to believe the most meritorious behavior of an academic man or woman is the performance of significant research.” Designing and conducting such research requires statistical knowledge and skills. In this regard, not only faculty members in the departments of medical sciences, but also other medical doctors and health-related professionals who completed their studies years ago, are expected to be familiar with statistical thinking and to understand the process of statistical investigations.

Based on the above, during the past decade the Iranian medical education system (IMES), recognizing the importance of research training in medical education and continuous professional development of doctors, designed and implemented a series of workshops in research methodology, statistical analysis and dissemination of research results.

In this paper, the structure of the workshops and their contents are briefly described. Then, effectiveness of one of the workshops is discussed by reporting on the data collection, analysis, and results from a survey of participants.

A GLANCE AT MEDICAL EDUCATION IN IRAN

The Iranian medical education system is comprised of more than 40 universities of medical sciences (UMS) which are scattered across the country. There is at least one UMS in each of the 28 provinces (SCI, 2004). The UMS are under the Ministry of Health, Treatment and Medical Education (MHTME) and deal with initial education and continuous professional development of human resources for the medical and health services. Furthermore, the MHTME

has delegated the responsibility of providing treatment and health services to the UMS at the provincial level.

A provincial university of medical sciences is in charge of needs assessment for continuous professional development (CPD) of medical and health service personnel at the provincial level. In brief, each university of medical sciences, officially called University of Medical Sciences and Health Services, is an integrated system of education, research and medical and health services.

Faculty members of the UMS and medical doctors in each province are expected to attend the CPD programs according to their needs. In other words, attendance at the CPD programs is considered as a requirement for promotion of faculty members at the UMS and renewal of professional work permits.

DEVELOPING STATISTICAL SKILLS THROUGH RESEARCH METHODS WORKSHOPS

Research methods workshops are designed as part of the CPD program. They are comprised of two levels: introductory and advanced. The objectives of the introductory workshop are to develop statistical thinking and to familiarize the participants with the applications of introductory statistics in medical and health services. These workshops are designed and developed through a problem-based teaching-learning approach. Problem-base learning (PBL) is defined as "the learning that results from the process of working toward the understanding or resolution of a problem" (Barrows and Tamblyn, 1980, p. 18). In this context, research problems are considered the focus of teaching-learning in the workshops.

The objectives of the advanced workshop are to familiarize the participants with analysis of research designs and applications of statistical data analysis in medical studies, especially in understanding and modelling variation. Participants who attend the research methods workshops, as a follow-up, may attend a workshop on dissemination of research results (WDR).

The emphasis of the introductory workshop on statistical thinking is based on the fact that the MHTME has embarked on research-based policy-making in a "health for all" program. Such a program intends to provide health services at the Health Houses, an administrative unit which provides health services at the smallest geographical/administrative unit in the country. In this regard, as Bryce (2005) indicates, "statistical thinking is a philosophy of learning and action that comprehends that all work is a series of interconnected processes, that variation is pervasive in all such processes, and that understanding and reducing variation are keys to improvement." Therefore, through attending the introductory research methods workshop and other relevant CPD programs, the participants are expected to understand the importance of statistical data not only for research purposes, but also in decision making for the purpose of improving health services quality.

Content of the introductory workshop includes 12 steps in designing and implementing a research project. These steps are as follows: 1) selecting a research topic, 2) statement of research problem, 3) review of literature, 4) identifying hypothesis or research questions, 5) identifying variables under study, 6) selecting or constructing measurement instruments, 7) selecting a research design, 8) identifying population under study, sampling scheme, and sample size, 9) collecting data, 10) data processing, 11) statistical analysis of data, and 12) preparing a research report. Each of these steps is covered as a topic with a view towards information-based decision-making in providing health services. It is clear that steps 5, 7, 8, 9, 10 and 11 are specifically concerned with statistical methods. The concepts which are covered for these steps in the introductory workshop include introductory statistical methods and the basics of inferential statistics.

In the advanced research methods workshop, the emphasis is on the research designs in medical research. It covers six topics. Each topic covers one of the designs from the following list: 1) cross-sectional, 2) case-control, 3) cohort/historical, 4) experimental, 5) quasi-experimental, 6) time series. In presenting each design, its characteristics with regard to controlling the variation are discussed. Then specific statistical methods for analysing data, which are collected through the design, are presented in detail.

The third workshop deals with how statistical analysis leads to drawing conclusions and constructing scientific knowledge. The content of this workshop is comprised of the process of

statistical reasoning, skills in scientific report writing, and skills in presentation of research results.

The process of conducting a workshop includes three steps for each topic under presentation: a) presentation of material on the topic at the plenary session for one hour followed by b) group discussion of the topic in a small group of participants (6-8 persons) for one hour. Then, there is a c) general discussion and question-answer session on the topic for one hour. In general, 24 to 30 participants attend a workshop.

EFFECTIVENESS OF THE WORKSHOPS

As an attempt to evaluate the impact of workshops on participants, the WDR workshop, held at Zanjan University of Medical Sciences in April, 2005, was considered for data collection for the purpose of the present study. In doing so, the Kirkpatrick learning evaluation model was used (Kirkpatrick, 1998). Application of this model to evaluate the training is comprised of 4 levels (http://www.businessballs.com/, 2005). The four levels essentially measure the following aspects of the workshop:

- Reaction of participants - what they thought and felt about the workshop
- Learning - the resulting increase in knowledge and skills through the workshop
- Behaviour – the extent of behaviour and capability improvement and implementation/application of the workshop
- Results - the effects on the medical and health services resulting from the participant's performance.

Level 2 of the model was applied to assess the resulting increase in knowledge of the participants. Therefore, an achievement test, comprised of multiple-choice questions, was administered to the participants. An informal interview with a few participants was also conducted to get an idea about the way they felt about the workshop (Patton, 1987).

The population under study included 28 medical doctors and other health-related professionals who participated in the WDR workshop. A pre-test was administered to the participants before the workshop started. Then, at the end of the workshop, a post-test was administered as well. The test is comprised of 30 items which measure knowledge and skills of participants related to the objectives of the workshop. The test was scored on a scale of 0 to 30. One of the participants did not appear for the post-test. Therefore, there were only 27 pairs of observations for the impact analysis.

Table 1 shows the mean and standard deviation of the pre-test and post-test scores and the result from a paired *t*-test.

Table 1: Achievement Test Results

Test	Mean	SEM	*t*- value
Pre-test Post-test	13.19 22.67	0.5294	*t*=17.9 2-tailed Df =26 p value=0.000

As Table 1 indicates, the results of the post-test are significantly different from the pre-test at the 0.0001 level of significance. Therefore, we may conclude that the resulting increase in knowledge and skills through the WDR is significant.

CONCLUSIONS

Studies about the use of statistics in medical research and practice indicate the need for familiarization of medical doctors with statistical knowledge and skills (Lam, 1986; Ozturk, Engin, Kisioglu, 1999). Although misuses of statistics in medical papers remained common in the 1980s (Altman, 1991), it is argued that this situation has improved due to statistical training. However, confirmation of this claim requires further studies.

A research methods workshop, with a hands-on approach, was offered to teach statistical methods in the CPD program in Iran. Based on the Kirkpatrick model, in order to evaluate the

impact of the three workshops, there is a need for collecting data about the reaction of participants, their learning, extent of improvement of their knowledge and skills, and participants' performance in applying their knowledge and skills to improve the quality of medical and health services. However, due to practical limitations, interview data and achievement test scores were collected from the dissemination of research results workshop (WDR) only.

Based on level 2 of the Kirkpatrick model and the collected data, we concluded that the WDR workshop is effective. However, there is need for further research to evaluate the other workshops on the bases of all 4 levels of this model.

As teaching consists not only of instruction, but also of the systematic promotion of learning by whatever means (O'Neill, 1988), it is concluded that the workshops have promoted learning of statistical knowledge and skills through the use of Problem-Based Learning approaches.

ACKNOWLEDGEMENT

The authors thank Dr. Reena Deutsch, University of California, San Diego, for help in preparation of the final version of this paper.

REFERENCES

Altman, D. G.(1991). Statistics in medical journals: Developments in the 1980's. *Statistics in Medicine*, 10(12), 1897-913.

Barrows, H. S. and Tamblyn, R. H. (1980). *Problem-based Learning: An Approach to Medical Education.* New York: Springer.

Bryce, G. R. (2005). Developing tomorrow's statisticians. *Journal of Statistics Education*, 13(1), www.amstat.org/publications/jse/v13n1/bryce.html.

businessballs, Kirkpatrick's training evaluation model, www.businessballs.com/kirkpatricklearningevaluationmodel.htm.

Hamilton, J. (1994). Establishing standards and measurement methods. WHO/ ECFMG Conference. Geneva, WHO. (Cited in Wojtczak and Schwarz, 1999.)

Kirkpatrick. D. L. (1998). *Evaluating Training Programs*. San Francisco: Berrett-Kohleer Publisher.

Ladd, E. C. Jr. (1985). The work experience of American professors: Some data and an argument. In M. J. Finkelstein (Ed.). *ASHE Reader on Faculty Issues in Colleges and Universities.* Lexington, MA: Ginn Press.

Lam, Y. M. (1986). Teaching statistics to medical students in the new medical school. *Journal of Hong Kong Medical Association*, 38(4), 196-198.

Latham, S. R.(2002). Medical professionalism: A Parsonian view. *The Mountsinai Journal of Medicine*, 69(6), 363-369.

Ludmerer, K. M. (1999). *Time to Heal: American Medical Education from the Turn of the Century to Era of Managed Care.* New York: Oxford University Press.

O'Neill, G. P. (1988). Teaching effectiveness: A review of the research. *Canadian Journal of Education*, 13(1), 162-185.

Ozturk, M., Engin, V. S., and Kisioglu, A. N. (1999). Opinions of assistant doctors in S.D.U. medical faculty about statistical knowledge. *Tr. J. of Med. Sc.* 29, 325-329.

Patton, M. Q. (1987). *How to Use Qualitative Methods in Evaluation.* Newbury Park, CA: Sage.

Riffenburgh, R. H. (2005). *Statistics in Medicine*. New York: Academic Press.

Statistical Center of Iran (SCI). (2004). *Iran Statistical Yearbook: 2003*. Tehran: SCI. (in Persian).

Wojtczak, A. and Schwarz, M. R. (1999). *Minimum Essential Requirements and Standards in Medical Education*. New York: Institute for International Medical Education.