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Science Attitudes and Knowledge among Preclinical Medical Students in Pokhara, Nepal

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A B S T R A C T

Knowledge of science and the scientific method are important in learning about and using evidence-based medicine in practice. Courses in research methodology have been introduced for both medical students and practicing doctors. In Pokhara, the basic science subjects are taught in an integrated manner during the first four semesters of the undergraduate medical course. Studies on students' attitudes towards and knowledge of science are lacking in medical colleges in Nepal. Hence the study was carried out to obtain information on students' attitude towards and knowledge of science and scientific methodology among preclinical medical students and note the association, if any, of students' attitudes and their demographic characteristics. The study was carried out in March 2005 among the students of the first four semesters at the Manipal College of Medical Sciences, Pokhara, Nepal using a questionnaire developed by Hren and coworkers. Two hundred and twenty students (overall response rate 73.3%) successfully completed the questionnaire. Seventy-five respondents were Nepalese, 115 were Indians, 27 were Sri Lankans and 3 belonged to other nationalities. The X±SD total attitude score was 147.4±10.8 (neutral score 135). The X±SD scores on the subscales, value of science to humanity, value of scientific methodology and value of science to medicine were 51.3±5.4, 39.6±3.7 and 58.5±5.9 (neutral scores were 36, 51 and 48 respectively). The knowledge score measured using a set of 8 multiple choice questions was 3.3±1.4. The attitude scores were lower and the knowledge score was comparable to that reported previously in a study in Croatia but higher than that reported from Southeast Europe.

Key words: *attitude, knowledge, Nepal, research methodology, questionnaires, students medical*

Introduction

Evidence based practice (EBP) has been defined as the »conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients«[1]. It requires understanding and use of scientific principles and methods[1]. It relies on randomized clinical trials as the 'gold standard' of finding evidence for the most adequate treatments in health care, or rather on meta-analyses or review studies of the best randomized clinical trials[2]. Evidence based medicine (EBM) is being taught in many medical schools all over the world[3,4]. Understanding and use of scientific methods is an important component of the medical profession[5]. Knowledge of science and the scientific methodology would be helpful in the practice of EBM by medical students and practitioners. In Sweden and Denmark, research methods have been used as a means of developing academic general practice[6].

Nepal is a developing country in South Asia. In Nepal, many medical colleges admit students from Nepal, India, Sri Lanka and other countries. The Manipal College of Medical Sciences (MCOMS) admits students of different nationalities and is affiliated to Kathmandu University for undergraduate medical (MBBS) teaching. The university aims to develop awareness of the role of science and its application in understanding the problems of present day society[7]. In our opinion positive attitudes towards science may contribute to the development of critical appraisal skills. Studies have been carried out to assess student attitudes towards science in many countries all over the world[8–12]. The studies were carried out in the Balkan countries, Southeast Europe and Mexico. Studies on the attitude towards and knowledge about science are lacking in medical colleges in Nepal. With Nepal beginning to take its first steps towards medical research,

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knowledge of attitudes towards science is important. The data obtained from such studies will be helpful in designing formal courses on scientific research in medicine.

Previous studies have been mainly conducted in Europe. The studies were carried out among medical students, engineering students and students of other disciplines. Our students differ in many aspects from the students in countries with published data. The per capita family income of Nepalese students is lower than that of the European students. There are obvious cultural differences and exposure to western scientific thought is recent in South Asia. Courses on scientific research are lacking in Nepal. The system of schooling and assessment are also different. Knowledge about students' attitudes will be helpful in planning and designing courses in research methodology in the social and cultural context of Nepal and South Asia.

At MCOMS students come from different social, cultural and economic backgrounds. The students could have done their schooling in English medium schools (where the subjects are taught in English) or in vernacular medium schools (where they are taught in local languages). Previous studies on various aspects of medical student education conducted at our institution had shown that demographic characteristics did influence student attitudes. Hence we decided to obtain detailed information on the demographic characteristics in the present study. The objectives of the study were to:

1) Obtain information on students' attitude towards science and the scientific methodology
2) Survey student knowledge of scientific methodology and
3) Note the association, if any, of attitude and knowledge with the demographic and personal characteristics of the respondents.

Materials and Methods

Setting

We surveyed the first, second, third and fourth semester undergraduate medical students at MCOMS, Pokhara, Nepal during the month of March 2005. The students were told the broad objectives of the study and were invited to participate. Verbal consent to participate was obtained but written informed consent was not obtained. The Director, Student affairs of the Institution was kept informed about the study. The questionnaire was distributed to the students attending the practical sessions in Pharmacology.

At MCOMS the basic science subjects (Anatomy, Physiology, Biochemistry, Pharmacology, Pathology, Microbiology and Community Medicine) are taught in an integrated manner during the first four semesters of the course. The clinical science subjects are taught during the last five semesters. EBM is emphasized by the department of Pharmacology and the basic principles of scientific research are covered by the departments of Pharmacology and Community Medicine.

MCOMS admits students from Nepal, India, Sri Lanka and a few non-resident Indians (NRIs) from other countries. The Nepalese scholarship students and the self-financing students are selected on the basis of their performance in entrance examinations. The Indian, Sri Lankan and other students are selected on the basis of their 12^{th} standard or A level marks. Laboratory experiments in science are started from the eight standard onwards and continue till the twelfth standard (last five years of school). However, education concentrates mainly on transfer of facts and rote learning and preparing students for the 10^{th} and 12^{th} standard examinations.

Practical teaching in Pharmacology emphasizes the development of critical appraisal skills. The students are taught about critical appraisal of medical literature. Knowledge of principles of scientific research will be helpful in developing critical appraisal skills and will be helpful in the students' future career in performing research and presenting their findings.

Parameters noted

The sex, nationality and semester of study were noted. The age in years, occupation of parents and subjects of study at the twelfth standard level in school were noted. The twelfth standard is the final year of study at school and for admission to the MBBS course students must have completed twelve years of schooling with the subjects of Physics, Chemistry and Biology in the final two years. Some students join the course after graduating in science (BSc degree). Some students study Mathematics as a subject during the last two years of school. Whether the respondent had completed a graduate course of study and the medium of instruction at school was noted. Involvement in research projects at school and the importance accorded to science teaching at school were explored. Quality of laboratory facilities at school was noted. The students were asked whether they intended to take up medical research as a career option.

Questionnaire used

The questionnaire developed by Hren and coworkers[8] was used to measure students' attitudes. The questionnaire contained 45 items (25 positive and 20 negative) distributed in 3 subscales. The subscales were value of science for humanity, value of scientific methodology and value of science for medicine. Hren and coworkers created an initial set of candidate items by organizing a brainstorming session with psychology students from the University of Zagreb, Croatia. Ninety-nine positive and 100 negative statements were collected. Eight independent raters selected 60 most relevant statements. We pre tested the instrument among six fifth semester students and studied the ability of the students to comprehend the questions. The questionnaire was administered in English, the medium of instruction for the MBBS course at MCOMS. The Cronbach's of the whole scale was 0.684, for the subscale 'Value of science for humanity the value was 0.628, for the subscales 'Value of Scientific methodology' and 'Value of Science for Medicine' the val-

ues were 0.702 and 0.698. The third part of the survey consisted of an 8-item knowledge test of principles of scientific research using multiple choice questions (MCQs) devised by Hren and coworkers. They chose the questions from a database of MCQs used during the tests of the second year course on 'The principles of scientific research in medicine'. The authors aimed to assess only basic knowledge of the students regarding this field. The MCQs were pretested among the same group of fifth semester students. We mainly concentrated on finding out whether the respondents were able to understand the statements without difficulty. The responses of the fifth semester students were not included in the final analysis. The Appendix gives a general idea of the questionnaire and examples of some of the statements used. The MCQs consisted of a stem and five distractors and the respondents selected the correct one. Previous studies had used different sets of questionnaires. We used the questionnaire devised by Hren and coworkers as it was more comprehensive and looked at the subject matter in greater detail. The questionnaire has been used in many previous studies and the methodological rigour was high. However, there may have been cultural differences between our students and the European students.

Statistical analysis

For the three subscales, the total score was calculated by adding the scores of the individual statements. Certain statements were negative and the scores of these statements were reversed while calculating the total score. For the MCQs, the number of correct responses was noted. Student's t-test (one sample) was used to compare the average attitude scores with the neutral value of attitude for the whole scale and the neutral values for each subscale. The association of demographic and personal factors with the attitude and knowledge scores was carried out using appropriate statistical tests. Independent samples t-test was used for dichotomous variables and ANOVA followed by Tukey HSD post hoc test for the others. A p value of less than 0.05 was taken as statistically significant. SPSS version 9.0 for Windows (SPSS, Inc., Chicago, IL, USA) was used to perform the statistical analysis.

Results

The respondents

A total of 220 students (overall response rate 73.3%) successfully completed the questionnaire. Each semester consisted of 75 students. Sixty-two of the 75 first semester (82.7%), 53 of the 75 second semester (70.7%), 46 of the 75 third semester (61.3%) and 59 of the 75 fourth semester students (78.7%) participated. One hundred and twenty students (54.5%) were male. Seventy-five respondents (34.1%) were Nepalese, 115 (52.3%) were Indians, 27 (12.3%) were Sri Lankans while 3 belonged to other Nationalities (Iranian, American and Australian). These demographics are representative of the entire student group.

Thirty students (13.6%) had both parents doctors, 49 (22.3%) had one doctor parent while 141 students (64.1%) did not have doctor parents. Ninety-five students (43%) had studied Mathematics as a subject in school at the 10 + 2 level. Fifty-two respondents were in the habit of reading popular science magazines. One hundred and five respondents (47.5%) were interested in pursuing a career in medical research. The respondents could be divided into various subgroups on the basis of their demographic and personal characteristics (Table 1).

TABLE 1
DEMOGRAPHIC AND PERSONAL CHARACTERISTICS OF STUDENT RESPONDENTS

Characteristic	Frequency (%)
Gender Male	120 (54.5)
Female	100 (45.5)
Nationality Nepalese	75 (34.1)
Indian	115 (52)
Sri Lankan	27 (12.3)
Others	3 (1.4)
Semester First	62 (28.2)
Second	53 (24.1)
Third	46 (20.9)
Fourth	59 (26.8)
Graduate Yes	5 (2.3)
No	208 (94.5)
Mode of financing Government-selected	40 (18.2)
Self-financing	180 (81.8)
Maths as a subject Yes	95 (43.2)
at twelfth No	122 (55.5)
standard level	
Involved in research Yes	35 (15.9)
at school No	177 (80.5)
Medium of instruction English	192 (87.3)
at school Vernacular	24 (10.9)
Importance of science Very important	153 (69.5)
at school Important	62 (28.2)
Not important	2 (0.9)
Medical research as a Yes	105 (47.7)
career option No	107 (48.6)

Attitude and knowledge scores

The X±SD total attitude score was 147.4±10.7. The X±SD scores of the subscales on Value of science to humanity, value of scientific methodology and value of science to medicine were 51.3±5.4, 39.6±3.7 and 58.5±5.9 respectively. The knowledge score was 3.3±1.4. The total attitude score differed significantly from the neutral score of 135 (mean difference 12.5, $t_{219}=17.1$, $p<0.001$). The score on the subscales value of science to humanity (neutral score 36; mean difference=15.3, $t_{219}=41.7$, p<

TABLE 2
MEAN TOTAL ATTITUDE SCORE, SUBSCALE SCORES AND KNOWLEDGE ABOUT RESEARCH METHODOLOGY AMONG DIFFERENT GROUPS OF PRECLINICAL STUDENTS AT THE MANIPAL COLLEGE OF MEDICAL SCIENCES, POKHARA DURING MARCH 2005

Characteristic	Total score (possible range 45–225)	Value of science			Knowledge score (possible range 0–8)
		For humanity (possible range 17–85)	Methods (possible range 12–60)	For medicine (possible range 16–80)	
Gender					
Male (N=120)	147 (145.1 to 149)†	51.3 (50.6 to 52.4)	39.4 (38.7 to 40.1)	56.2 (55.2 to 57.3)	3.3 (3.1 to 3.6)
Female (N=100)	147.9 (145.8 to 150.1)	51.3 (50.5 to 52.7)	39.8 (39 to 40.5)	56.9 (55.7 to 58.1)	3.3 (3.1 to 3.6)
Nationality					
Nepalese (N=75)	148.2 (145.9 to 150.4)	51.2 (50.1 to 52.3)	40.3 (39.5 to 40.1)	56.7 (55.5 to 57.9)	3.5 (3.2 to 3.9)
Indians (N=115)	148.9 (146.8 to 151)	51.8 (50.7 to 52.8)	39.9 (39.2 to 40.6)	57.2 (56 to 58.4)	3.3 (3 to 3.5)
Sri Lankans (N=27)	140.6* (137.2 to 144)	50.6 (48.4 to 52.8)	36.9** (35.6 to 38.2)	53.1 (51.5 to 54.7)	3 (2.5 to 3.5)
Mode of financing					
Government-selected (N=40)	149.1 (146.6 to 151.6)	51.6 (50.3 to 52.9)	40.3 (39.4 to 41.2)	57.2 (55.9 to 58.6)	3.6 (3 to 4.1)
Self-financing (N=180)	147.1 (145.4 to 148.7)	51.3 (50.4 to 52.1)	39.4 (38.9 to 40)	56.4 (55.5 to 57.3)	3.3 (3.1 to 3.5)
Semester of study					
First (N=62)	149.6 (146.2 to 152.9)	50.9 (49.3 to 52.5)	39.5 (38.4 to 40.7)	59.2 (56.8 to 61.5)	3.3 (2.9 to 3.7)
Second (N=53)	148.4 (145.1 to 151.7)	51.9 (50.3 to 53.4)	40 (39 to 41)	56.5 (55 to 58)	3.6 (3.1 to 4.1)
Third (N=46)	149.2 (146 to 152.4)	52.3 (50.6 to 53.9)	40.3 (39.2 to 41.5)	56.6 (54.6 to 58.5)	3.6 (3.1 to 4)
Fourth (N=59)	148.9 (146.4 to 151.3)	51.5 (50.2 to 52.8)	39.9 (39 to 40.9)	57.4 (58.2 to 58.7)	3.4 (3 to 3.8)
Medium of instruction at school					
English (N=192)	147.8 (146.3 to 149.3)	51.3 (50.6 to 52.1)	39.7 (39.2 to 40.2)	56.7 (55.9 to 57.5)	3.4 (3.2 to 3.6)
Vernacular (N=24)	144.9 (139.3 to 150.5)	51.2 (49.1 to 53.3)	38.4 (36.5 to 40.3)	55.2 (51.8 to 58.7)	3.1 (2.5 to 3.6)

*p=0.007 compared to Nepalese and p=0.001 compared to Indians, **p=0.032 compared to Nepalese and p=0.005 compared to Indians, †The 95 % confidence intervals are in brackets

0.001) and value of science to medicine (neutral score 51; mean difference=5.5, t_{219}=13.8, p<0.001) were significantly higher than the neutral scores. The subscale 'Value of scientific methodology' score was significantly lower than the neutral score (neutral score 48; mean difference=– 8.4, t_{219}=– 34, p<0.001).

Relation of score to demographic characteristics

The Sri Lankans had a lower total score compared to the Nepalese (p=0.007) and Indians (p=0.001). The X± SD attitude and knowledge score among selected subgroups of respondents showed differences (Table 2).

Discussion

Our students had a positive attitude towards value of science to humanity and value of science for medicine (on comparison with the neutral values). The values on different subscales except the value of scientific methodology were positive compared to neutral values. However, there may have been a positivity bias in the way that people respond to most scales. People in general are more likely to agree than to disagree and to answer positively rather than negatively. Also people who were more positive about the topic are more likely to complete the questionnaire. Our scores were lower than those reported in a previous study from Croatia[8]. Positive attitudes were also noted among first year medical students in a previous study[9]. A study had shown that students of Economics, Business and Electrical engineering had significantly less positive attitude towards science compared to medical students[10]. A study carried out at the National University of Mexico had found positive attitudes of medical students from the 1st and 4th/5th years[11].

Two previous studies had measured student attitude towards and knowledge of science using the same set of statements[9,12]. Another study had used a twenty item scale and 8 MCQs to measure student attitudes[9]. Our total score was lower than that reported in the Croatian study[8]. The scores on each of the subscales were also lower. Our knowledge scores were comparable. Our scores were higher than those reported in Southeast Europe[12]. The knowledge scores were however higher in our study. Our study was carried out among preclinical students in a single medical college. The Croatian study was carried out among medical students of all six years of study[8] while another study was carried out among only first year students[9]. The study in Southeast Europe was also carried out among all six years of study and was car-

ried out in five medical schools in different Balkan countries[12]. Cultural and demographic factors and differences in the years of study at medical school may have influenced the results.

The total score and the score for the subscale 'Value of science for medicine' were significantly lower among Sri Lankans compared to other Nationalities. The reasons for this were not analyzed in the present study. However, the number of Sri Lankans was low compared to the Nepalese and Indians. A large proportion of the Sri Lankan students [15 (55.5%)] were educated in vernacular medium schools. The median score on the subscale 'value of science for medicine' was significantly lower among vernacular medium students, the total score was also lower among vernacular students but the difference was not significant. The Sri Lankans do not perform as well academically compared to other nationalities. This may also have had an influence on their attitude towards and knowledge of science. This was again not explored in the present study. No significant influence of other variables on the student attitudes was noted. Type II error may have influenced the result. This was however, not estimated in the present study. This is similar to that observed in a previous study[9]. However, admission to medical school in South Asia is restricted to students from a science background. In the Croatian study[8] the highest attitude score was seen among 3rd year medical students. In our study the lowest total score was seen among 3rd semester students but the difference was not significant. The knowledge score reported in our study was slightly higher than that reported previously[8].

The attitude and knowledge scores of the first semester students was low compared to the second and fourth semester. This has been observed previously and has been suggested to be related to the students' low knowledge of science and scientific methodology and also to the stress of adapting to medical school[13]. However, the low score of the third semester students is difficult to explain. This may be a cohort difference as our data is cross sectional rather than longitudinal. A previous study had shown conflicting reports with the score at some institutions decreasing and at some others increasing with the years of study[12]. No significant association between the attitude and knowledge scores was seen.

Principles of Scientific research are taught during the sessions on Pharmacology and Community medicine and unlike Croatia there are no mandatory courses on the subject. The various types of study design, randomization, bias, interpretation of results are discussed. Critical appraisal skills are emphasized.

EBP is becoming increasingly important in medical teaching and practice. Problem solving skills and development of logical thinking are considered as an important transferable skill in Pharmacology in our institution[14]. Positive attitudes towards scientific research may be helpful in developing critical appraisal skills during the teaching of EBP[15]. Identification of students interested in research careers in medicine may be facilitated by assessing their attitudes[16,17].

Our study had many limitations. We could not obtain data on the academic performance and grades of the students and could not obtain information on the correlation, if any, between academic performance and attitudes towards science. The large number of demographic variables and items in the questionnaire (53) may have induced the student respondents to answer randomly without understanding the full implications of the questions. However, on going through the responses we found that the majority of the students had painstakingly and conscientiously filled their responses. The students in the clinical years of study were not included due to logistical difficulties.

Further studies involving the students of all semesters and in different medical colleges in Nepal are required. The data obtained may be a helpful first step in designing a formal course on Scientific Methodology for Nepalese medical colleges. The relationship, if any, between the academic performance and attitude towards research of student respondents can be studied in future.

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STAVOVI PREMA ZNANOSTI I POZNAVANJE ZNANOSTI KOD STUDENATA MEDICINE BEZ KLINIČKE PRAKSE U POKHARI, NEPAL

S A Ž E T A K

Poznavanje znanosti i znanstvenih metoda važni su prilikom učenja, kao i primjene znanstvenih rezultata medicine u praksi. Tečajevi istraživačke metodologije uvedeni su za studente medicine i doktore praktikante. U Pokhari, temeljni znanstveni predmeti podučavaju se na integrirani način tijekom prva četiri semestra dodiplomske nastave medicine. Istraživanja studentskih stavova prema znanosti i poznavanja znanosti nedostaju na medicinskim fakultetima u Nepalu. Stoga je provedeno istraživanje s ciljem dobivanja informacija o stavovima prema znanosti te poznavanju znanosti i znanstvene metodologije među studentima medicine bez kliničke prakse i utvrđivanja povezanosti, ako postoji, studentskih stavova i demografskih značajki. Istraživanje je provedeno u ožujku 2005.g. među studentima prva četiri semestra na Fakultetu Medicinskih Znanosti, Pokhara, Nepal primjenom upitnika kojeg su sastavili Hren i suradnici. Dvjesto dvadeset studenata (ukupan odaziv bio je 73,3%) uspješno je popunilo upitnik. Sedamdeset i pet ispitanika bilo je iz Nepala, 115 iz Indije, 27 iz Šri Lanke i 3 ostalih nacionalnosti. Aritmetička sredina ±SD ukupnog broja bodova o stavu iznosila je 147,4±10,8 (neutralni rezultat iznosio je 135). Aritmetička sredina ±SD zbroja bodova na podtestovima – vrijednost znanosti za čovječanstvo, vrijednost znanstvene metodologije i vrijednost znanosti u medicini, iznosili su 51,3±5,4, 39,6±3,7 i 58,5±5,9 (neutralni rezultati bili su 36, 51 i 48). Zbroj bodova na testu o poznavanju znanosti, dobiven pomoću seta od 8 pitanja sa višestrukim opcijama, iznosio je 3,3±1,4. Rezultati testova o stavovima bili su niži, a rezultat testa o znanju bio je u razini prije objavljenih rezultata iz Hrvatske, ali viši nego u objavljenih rezultata iz ostalih zemalja jugoistočne Europe.

Appendix

Questionnaire used for obtaining information on student attitudes towards science and knowledge of scientific methodology

For each of the following statements answer according to the following scale: 1 = totally disagree with the statement, 2 =disagree, 3= neutral, 4= agree and 5 = totally agree

Subscales

Value of Science for Humanity (16 items):

Examples of statements

1. Science has too rigid view about the world.
2. If science continues in the same direction it has so far, it will be the end of humanity.
3. Science is the main cause of the ecological catastrophe that threats us.

Value of Scientific Methodology (12 items):

Examples of statements

1. Sound discoveries are not possible without scientifically based research.
2. Only by scientific approach can one obtain objectively measurable and precise data.
3. Knowledge of scientific methodology is necessary for obtaining correct and objective data.

Value of Science for Medicine (17 items):

Examples of statements

1. Valid medical procedures are only those that have been verified by clinical research.
2. Science distracts physicians from natural ways of healing.
3. Science is indispensable if cure for cancer is to be found.

8-Item Knowledge Test:

Examples of statements

1. How would you define the scientific truth:
   a. the truth that will be reached through scientific research
   b. absolute truth
   c. consensus of competent experts*
   d. fact that can be found in the textbooks
   e. facts that your professors teach you

2. The essential characteristic of science is:
   a. all scientific conclusions are temporary*
   b. scientific theory cannot merely explain natural phenomena, but must somehow also exert influence upon them
   c. rather obvious scientific conclusion, does not have to be testable
   d. an experiment is not an objective model of the nature but serves as an introduction into real research of natural phenomena
   e. some natural phenomena need not be measured but it suffices that a researcher notices them on time

* Asterisk indicates the correct answer.'