Original article

LEARNING ANALYTICAL EPIDEMIOLOGY CONCEPTS THROUGH RESEARCH PROJECTS DURING COMMUNITY MEDICINE CLINICAL POSTINGS

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ABSTRACT

Background: Innovative methods are required to teach epidemiology to medical undergraduate students.

Aim: To assess the effect of research projects, as a part of community medicine clinical postings, in knowledge and skill attainment pertaining to analytical epidemiology.

Methods: Forty MBBS students were involved in conducting a hospital-based matched case-control study to determine the risk factors for hypertension. Faculty of Community Medicine facilitated the process. Students critically analyzed the study by comparing the concepts (taught in briefing and from the study material) with the actual study conducted by them. Pre-test questions were repeated as post-test; in addition, open ended questions were given in the form of a written test.

Results: We found that average post test score was 13.8 (max 20); an increase by 10.6 (0.95 CI: 9.3, 11.9). Of the 36 take home points (concepts), it was found that 13 of them were understood by ≥75% students, 13 by <75% (but ≥50%), and 10 by <50% students.

Conclusion: Our methodology of simultaneously conducting briefing sessions and data collection, with the aim of empowering MBBS students to critically analyze the research project, has enabled them to grasp various concepts of analytical epidemiology which, usually, are not taught to them.

Keywords: Epidemiology, research, community medicine, learning

INTRODUCTION

In medical undergraduate (UG) curriculum, focus is on clinical skills; yet care must be taken to explain why epidemiology and statistics are relevant[1]. Students have agreed to the fact that epidemiology and statistics were relevant in their first two years of curriculum[2], but there was difficulty in understanding the concepts[3]. When epidemiology is taught in classroom lectures it becomes monotonous; hence, innovative modes of teaching are needed[4]. Available literature indicates that this process has been initiated in India, Nepal and Kuwait[4-8].

Worldwide, research projects have been widely used as a practical tool to teach concepts of epidemiology to medical UGs[8]. There is a need to encourage medical student research[9]. There is also limited literature available on gain in analytical epidemiology concepts through research projects. In addition to measuring the relative improvement in epidemiology and statistics' skills (pre-post), there is a need to assess the absolute knowledge and skill level in analytical epidemiology at the end of research projects. We report our experience of using matched case-control study as a tool to teach epidemiology concepts in a teaching hospital setting for fourth

semester medical UGs. The aim was to assess the effect of research projects, as part of community medicine clinical postings, in knowledge and skill attainment pertaining to analytical epidemiology.

MATERIAL AND METHODS

The authors felt that institute ethics committee approval is not required for this manuscript as it involves reporting of innovations in routine undergraduate teaching. Approval from the Head of the Department and Head of the Institution was taken before conducting the clinical posting.

Medical UGs of Indira Gandhi Medical College and Research Institute at Puducherry have three clinical postings in Department of Community Medicine. Research projects are integral part of our clinical postings. Each clinical posting is divided into two halves: one for clinic-psycho-social case, and another for research project. In first clinical posting, students do a community-based descriptive study (3rd semester); in second, hospital / community-based analytical study (4th semester); and in third, health programme evaluation (6th semester).

The current research project was a hospital-based matched case-control study to ascertain the risk factors of hypertension in our setting for 4th semester students. We were intentionally conducting a non-ideal case-control study. We merely facilitated the process by giving a basic background of the study and the questionnaire for data collection. It was the students who planned and carried out the study. Students critically analyzed the study by comparing the concepts (taught in briefing and from the study material) with the actual study conducted by them; at the same time it was also a learning opportunity.

Study duration was for 2 weeks (23rd July – 4th Aug 2012). At the outset, a pre-test (multiple choice questions) was conducted which assessed students' background understanding of study designs, 2*2 tables, odds and odds ratio. Forty medical UGs were divided into 4 groups of 10 each: Introduction, Methodology, Results and Discussion. This distribution was made keeping final presentation in mind. Study material[10-15] was distributed to all. The following topics were taken on the first two days (10 AM – 1 PM) by a faculty of Community Medicine: odds, probability, rate, ratio, proportion, odds ratio – exposure, odds ratio –disease, relative risk, overview of clinical research, study designs in brief, and current study methodology. Next 4 days were used for data collection (10 AM – noon) on exposure status using a questionnaire. One hour (noon – 1 PM) was used to continue with the briefing sessions as follows: standard deviation, standard error, reference range, confidence interval, p value, sample size calculation, type I & II errors, power of a study, internal and external validity, bias, confounding, association and causation, randomization and random sampling, criteria for selecting controls, and sources of controls.

Day 7 and Day 8 were used for data entry and data analysis. SPSS v17 and Open Epi online software were used by students for data analysis. Day 9 was used for preparation of respective power point presentations by four groups and preparation of final project report. Power point presentations were made by the respective groups in front of the faculty of Community Medicine on Day 10.

Pre-test questions were repeated as post-test on the penultimate day. On the final day, to have an in depth assessment of the concepts gained by the students, they were given some open ended questions to answer in the form of a written test. In the written test we had given 18 questions with no word limit to the answers. In short they were expected to write whatever they knew pertaining to the question. The pre-test, post-test (multiple choice questions) and open ended questions in the form of a written test were conducted as a surprise test.

Statistical Analysis: SPSS v17 was used to compare pre-test and post-test scores using paired t test. Response given by students to the open ended questions was compared against the expected take home messages: a list of which was prepared well in advance before the clinical posting started. Results were analyzed in the form of number of students, out of 40, who understood the concept.

RESULTS

All the four student groups made satisfactory presentations; taking into account all the salient points that had to be incorporated in a project report. Certain salient points are being mentioned by us here. The 'Methodology' group presented the case / exposure definitions and standard measurement techniques that were

followed during data collection. They explained how one to one age and sex matching of cases and controls was done. 'Results' group presented the pair matched odds ratio (crude, unadjusted) with corresponding 0.95 CI for each exposure variable. They also performed stratified analysis and showed that in their data: smoking was not a confounder for lifestyle; whereas obesity was. Other variable like Diabetes Mellitus (which wasn't matched) was found to be unequally distributed among cases and controls. They also found that significantly more time was taken to interview cases.

Table 1: Paired t Test to Compare the Pre and Post Test Score of Clinical Posting Research Project

	Paired Differences (n=37)
Mean Difference	10.568
95% Confidence Interval	9.277-11.858
p value	<0.001

'Discussion' group summarized the results. They presented the fact that despite all factors being proven risk factors for hypertension, only family history of hypertension and sedentary lifestyle turned out to be significant risk factors. They presented the reasons for the same in their study as follows: poor quality assurance of data collection, as a result large selection bias and information bias was there; confounders needed to be adjusted by using regression analysis; and berkesonian bias couldn't be ruled out as it was a hospital-based study. Students couldn't identify that by not excluding controls with high BP reading, they were inducing a selection bias. This was pointed out during presentation by faculty.

Mean post-test score was 13.8 (max 20); an increase of 10.6 points from the pre-test score (3.2). This difference was statistically significant (Table 1). When the responses to the open ended questions were compared against the 36 take home messages (concepts), it was found that 13 of the concepts were understood by ≥75% students, 13 by <75% (but ≥50%), and 10 by <50% students (Table 2). Overall score for the group was 902 / 1440 (62.6%). Denominator (maximum possible score) was calculated by multiplying the number of students (40) with the number of concepts (36). Numerator (observed score) was calculated by adding the number of students who understood each concept.

Table 2: Summary of Responses of the Open Ended Questions at the End of the Clinical Posting (n=40)

Concepts: (total 36)		Students*(%)
p value	Definition	27 (67.5)
	Interpretation	24 (60)
0.95 CI	Definition	30 (75)
	Interpretation	25 (62.5)
Type I error	Definition	33 (82.5)
	Cut off:	21 (52.5)
Type II error	Definition	33 (82.5)
	Cut off:	25 (62.5)
Power	Definition	26 (65)
	Cut off	24 (60)
	Power and CI relation	34 (85)
	Power and SS relation	33 (82.5)
Study designs		
Classified into experimental and observational.		26 (65)
Best study design		28 (70)
Shortcoming of RCT		2 (5)
Cohort study (Strength)		18 (45)
Cohort study (Weakness)		34 (85)
CC study (Strength)		5 (12.5)
CC study (Weakness)		30 (75)
Cross sectional study (Weakness)		16 (40)
Randomization and random sampling: Difference between the two		12 (30)
Sample size: Importance		23 (57.5)
Table: matched & unmatched CC study		13 (32.5)

Matched CC study (individual matching)		Control E+	Control E-
Case	E+	a	b
	E-	c	d

Unmatched CC study		D+	D-
Case	E+	a	b
	E-	c	d

Odds Ratio		
Formula in an unmatched CC and one to one matched CC study		19 (47.5)
Odds Ratio – Exposure and Odds Ratio – Disease		32 (80)
When is OR = RR		32 (80)
Controls in CC study	Criteria	35 (87.5)
	Sources	11 (27.5)
Bias	Definition	27 (67.5)
	Types	39 (97.5)
Confounding	Definition	34 (85)
	Adjustment	20 (50)
Association#		17 (42.5)
Association v/s causation		
If Hill's criteria satisfied, then association becomes causation		27 (67.5)
Validity of a study	Internal validity	35 (87.5)
	External validity	32 (80)

*Students who understood this concept; # Rule out the following before concluding that association is present: Chance (p value or 0.95 CI), bias and confounding;
CI: Confidence Interval, SS: Sample Size, CC: Case Control, OR: Odds Ratio, RR: Relative Risk, D: Disease, E: Exposure

DISCUSSION

We found that at the end of Community Medicine clinical posting, there is significant increase in knowledge and skill pertaining to descriptive as well as analytical epidemiology. Our methodology of simultaneously conducting briefing session and data collection, with the aim of empowering MBBS students to critically analyze the study being planned and conducted by them, has been successful. As a result, they were able to grasp various concepts of analytical epidemiology which are usually not taught to them (Table 2). For example, the students' performance in the following concepts, to name a few, was very good: types of bias, criteria for controls, odds ratio – exposure, odds ratio – disease, relationship between confidence interval and sample size / power.

From past experience, we find that our teaching to medical UGs is restricted to descriptive epidemiology / statistics. It is time to bite the bullet. Limited literature is available that documents the skills gained in epidemiology as a result of Community Medicine clinical postings. A report from Jammu and Kashmir[7] indicated that there was significant improvement in skill pertaining to descriptive and basic epidemiology, and inferential biostatistics. Here, the intervention was a five day class room training using practical exercises from routine health care information.

Being a surprise test, the results obtained in this study may be attributed to the concepts learnt during the clinical posting rather than previous day preparation; which usually is the case with informed tests. The group score (62.7%) is an underestimate of the actual score as many students did admit that they were a bit laid back in writing answers for the open ended questions as it was the last day of clinical posting.

Based on our report, one may be tempted to conclude that analytical epidemiology concepts should be taught to medical UG students. Community Medicine departments must not limit themselves to teaching descriptive epidemiology. More such learning opportunities to address this untapped potential in medical UG students should be provided so that doctors are equipped with necessary knowledge and skill to handle, analyze medical data and conduct medical research. Further studies are required to determine long term retention of these concepts.

CONCLUSION

There is an untapped potential in medical UG students to learn epidemiology concepts. Students should be taught both descriptive and analytical epidemiology through research projects Community Medicine faculty can facilitate learning of epidemiology by empowering the student to critically analyze research projects

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