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Original Research

Ways to strengthen research capacity in developing countries: effectiveness of a research training workshop in Pakistan

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Summary *Background:* Developing countries are currently facing the burden of both communicable and non-communicable diseases. Physician–scientists, trained in patient care and research skills, are crucial in performing cutting-edge clinical research in developing countries. A major, unmet challenge has been lack of local expertise and the increasing problem of 'brain drain'.
Objective: The objective of this study was to present and assess a model of research training for healthcare professionals in Pakistan in order to increase research skills.
Methods: A 9-day research training workshop was offered to healthcare professionals in Pakistan using face-to-face (F2F) and video-teleconferencing (VTC) methods. In total, 38 F2F and 18 VTC participants were included in the workshop, which was conducted by research faculty from the University of Pittsburgh. The study measured short- and long-term effectiveness of research training. The training included courses in basic epidemiology, biostatistics, genetic epidemiology and international health.
Results: A significant improvement in post-test scores was seen in both the F2F and VTC groups ($P<0.001$). In the F2F group, mean scores increased from 11.13 (pre-test) to 15.08 (post-test 1), and in the VTC group, mean scores increased from 10.67 (pre-test) to 13.22 (post-test 1). Two-sample *t*-tests indicated that these results were statistically significant ($P<0.001$). Two-way repeated measure analysis of variance in both groups showed significant changes in mean scores over time ($P<0.001$).
Conclusion: This model for training physicians in public health by providing in-house research training can be used to strengthen local capacity and reduce increasing problems of 'brain drain'.

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Background

Healthcare professionals are increasingly aware of their need for epidemiological research knowledge, not only in their role of researcher, but also if, as a clinical practitioner, they wish to keep abreast of advances in the field. For developing countries to build health systems, it is essential to build research capacity.[1] Although there has been remarkable progress over the past two decades in several health-related fields, increasing local research capacity in developing countries remains one of the world's unmet challenges.[2] This is especially true for South Asian countries, such as India, Pakistan, Bangladesh, Sri Lanka and Nepal. The biggest challenge is to train and continuously enhance the research environment to maintain the interest of researchers.[3]

The increased burden of chronic diseases in developing countries, in addition to the high infectious disease burden, is putting pressure on health services and leading to growing economic costs.[1,2,4–9] In most developing countries, inadequate financing and lack of manpower to address chronic diseases have been major impediments to the control of chronic diseases.[10] Industrialized countries with the largest number of highly trained scientists working in well-equipped laboratories have large funding resources, resulting in quality research. The same cannot be said for developing countries, which lack the appropriate self-sustained research capacities in both the number and the quality of trained researchers, as well as appropriate institutional capacities for high-level research. Although approximately 25% of all scientists live in developing countries, only 3% of publications in international journals are from developing countries.[11]

The total investment in health research and development by the public and private sectors amounts to approximately US$ 56 billion per year. A staggering 90% of this is spent on research into health problems that concern only 10% of the world's population.[12] As a result, only 10% of the funds available for health research are currently used to improve the health of 90% of the world's population. This grave disparity is widely referred to as the '$\frac{10}{90}$ disequilibrium'.

Many South Asian countries have achieved independence in the last 60 years, but scientific research is only just being developed.[12,13] Pakistan is a developing country with a current population of 150 million. It has approximately 48 medical institutions including five dental colleges but no school of public health.[14] Research in Pakistan has remained a low priority area in all fields. Only a few medical institutes (mostly private) provide some research training or offer workshops in public health.

The number of scientists and researchers is very low in Pakistan, even when compared with countries of equivalent socio-economic development. Due to epidemiological transition and the increasing burden of cardiovascular disease (CVD), there is considerable interest in and need for the development of strategies aimed at controlling CVD. Pakistan has been the recipient of several training programmes over the past decades to develop the intrinsic scientific capacity within the country. The majority of these programmes resulted in 'brain drain' with the loss of 90% of the country's intellectual asset.[15,16]

Since not every physician is either willing or able to attend and complete a full-time research training programme, it is desirable to increase the flexibility of research training in terms of content, form and outcome. Also, it is important for students to connect with leading scientists to begin to network. This flexible training approach will not only develop interest in physicians and nurses, but will also provide incentives for those who want to build their career as researchers and pursue additional training. Of all the strategies that have attempted to cope with shortages in research expertise, the effort that has gained the most ground in the past 20 years is to invite expertise from developed countries to conduct 'train-the-trainer' workshops.[17–19] However, although very useful, these arrangements are often very expensive and are concentrated at one particular institution. Such workshops may not be sufficient for heavily populated countries such as Pakistan. If such research training programmes are coupled with distance learning methods, broader participation from different parts of a country can be achieved cost-effectively.

The authors conducted a 9-day research training workshop in Pakistan in collaboration with the University of Pittsburgh to provide research training to Pakistani healthcare physicians, and to equip them with basic skills in epidemiological research methods. The short- and long-term effectiveness of the workshop was assessed objectively using knowledge assessment questionnaires.

Methods

A 9-day research training workshop was offered using two different methods: a traditional classroom method [the face-to face method (F2F)] at

the Aga Khan University (AKU), a private medical university; and video-teleconferencing (VTC) at the Dow University of Health Sciences (DUHS), a government medical university.

Video-teleconferencing

VTC is a two-way synchronous communication method, also called a 'remote classroom' as it closely replicates a traditional classroom environment. Students can see their instructors and remote classmates, and experience a feeling of interaction. The interaction occurs between the instructor and the participants at the origination or remote site. The teaching faculty has the ability to observe students' facial expressions and body language for signs of understanding, enthusiasm, confusion or frustration. The broadcast was originated from AKU and received in DUHS.

The choice of VTC over other common distance learning methods, such as online training using the Internet or webcasts, or audio telecast, was made for the following reasons: (a) VTC mimics traditional classroom teaching; (b) VTC is considered to be a virtual classroom; (c) interaction with teachers is possible and students can ask questions at the same time; (d) students can participate actively in discussions with traditional classroom participants; and (e) high speed Internet services are not widely available. Although VTC is more expensive than other modes of teaching, the effectiveness of VTC training is far greater than that of other distance learning methods.[20,21] Announcements about the workshop were made through all major physicians' associations and societies in Pakistan, 3 months prior to the workshop start dates. In addition, the AKU scientific committee contacted the main medical institutions in India and Bangladesh to gain regional involvement in the workshop. The senior administration of all Pakistani medical institutes were also contacted and informed about the workshop, and registration forms with selection criteria were distributed.

All postgraduate doctors (faculty, fellows or residents) who had received some form of research training and who were interested in pursuing research as their future career were included. A convenience sampling method was used to select participants. In total, 40 participants (36 from Pakistani medical institutions and four from Bangladesh) were selected for the F2F group and 40 participants (all from DUHS) were selected for the VTC group. Selection of the VTC group was made entirely from DUHS because this was the only institution that had all the facilities to conduct VTC. This was a homogenous group from an educational point of view but a heterogeneous group with diverse selection from all types of medical institution (private, public, non-governmental organization), so the majority of medical institutions in Pakistan were represented (Table 1).

Faculty from the University of Pittsburgh developed the workshop content, which included epidemiology, biostatistics, genetic epidemiology (1-h lecture/day), international health and cardiovascular epidemiology. Each module consisted of nine 1-h-long lectures. The workshop was divided into two parts: (a) teaching the basics of all five modules; and (b) hands-on experience on proposal/grant writing. Participants applied the knowledge and skills taught in the lectures to develop individual study proposals.

During the sessions, facilitators provided input on the individual projects with respect to research methods. Depending upon each participant's needs, additional information was also given on statistical analysis and critical appraisal of scientific research and design, if required. VTC sessions were carried out at DUHS at the same time as the F2F group, i.e. a lecture delivered at AKU with the F2F group was telecast through VTC on the same date at DUHS (synchronous distance education).

Assessment of knowledge gained

To assess the students' knowledge before and after the course, questionnaires (pre-test and post-tests 1 and 2) were developed. The questionnaires covered the basic topics of research methods taught in the workshop. As an objective method of testing knowledge, multiple choice questions were chosen; this is one of the common methods of knowledge testing used in many medical institutions in Pakistan as well as in Bangladesh. There were 20 multiple choice questions; each core question was followed by five statements, only one of which was correct. Each correct answer had a value of 1 point and the student could gain a maximum of 20 points. The complete questionnaires are available upon request.

Post-test 1 was administered on the last day (Day 9) of the workshop and post-test 2 was administered 1 year later. The students were not given feedback about their scores until the entire study was completed. The questionnaires were administered to both the F2F and VTC groups at the same time. All questionnaires were reviewed manually and the data were entered into a database for statistical analysis.

Table 1 Baseline demographic information of the face-to-face (F2F) and video-teleconferencing (VTC) participants.

Characteristics	F2F group ($n = 38$)		VTC group ($n = 18$)		*P-values (two-sided)*
	n	%	*n*	%	
Age, mean (standard deviation) (years)	7.11 (6.83)		30.56 (4.86)		0.001[a]
Gender					
Male	27	71.1	9	50	0.146[b]
Female	11	28.9	9	50	
Current job					
Research faculty/fellow	8	21.1	7	38.9	0.202[b]
Clinical faculty/fellow	30	78.9	11	61.1	
Working institute					
Private	17	44.7	0	0	<0.001[b]
Government	19	50	18	100	
Non-governmental organization	2	5.3	0	0	
Level of education					
MD and research degree	3	7.9	3	16.7	0.435
MBBS plus fellow	12	31.6	6	33.3	
MBBS and research degree	6	15.8	2	11.1	
MBBS	17	44.7	7	38.9	
Previous research experience					
Yes	33	86.8	18	55.6	0.017[b]
No	5	13.2	8	44.8	
Mean number of publications in the last year	1.14				
Yes	24	63.2	9	50	0.394[b]
No	4	36.8	9	50	
Type of research experience					
MS in EPI or MPH	17	39.5	6	14	1.00
Workshops/courses/research projects	8	18.6	2	20	
Research projects/published papers	8	18.6	2	20	
Research training after the workshop					
Yes	8	24.2	5	31.3	0.73[b]
No	25	75.8	11	68.8	
Type of research training					
MS in EPI or MPH	3	37.5	1	20	1.00[b]
MS in Health Management	2	25	2	40	
MS in International Health	2	25	2	40	
PhD in EPI	1	12.5	0	0	
Future plans					
PhD	3	7.9	0	0	0.015[b]
MPH	0	0	1	5.6	
MS in EPI	1	2.6	0	0	
MS in Health Management	1	2.6	0	0	
MS in Biostatistics	0	0	1	5.6	
Research projects	19	50	4	22.1	
Publish papers	10	26.3	10	55.6	
CVD research	1	2.6	0	0	
Develop research unit	3	7.9	0	0	
Clinical trials	0	0	2	11.1	

MBBS, Bachelor of Medicine and Bachelor of Surgery (5-year undergraduate medical training); CVD, cardiovascular disease.
[a]Two-sample *t*-test with equal variance not assumed.
[b]Fisher's exact test.

Statistical methods

The sample size of 40 per group was chosen on the basis of financial and administrative constraints. Some physicians did not complete the programme and were excluded from the analysis. Baseline characteristics were compared using two-sample *t*-tests and Fisher's exact tests. Paired *t*-tests were used to compare pre- and post-test scores within each group, and two-sample *t*-tests were used to compare pre- and post-test scores between groups. Two-way repeated measure analysis of variance was performed to assess a change in score with time in both groups. All the information obtained from participants in both groups (F2F and VTC) was entered and analysed using Windows based SAS Version 9.1.

Results

In the F2F group, all 40 participants attended the workshop and completed the pre-test questionnaires. However, two of the participants left on Day 9 without completing the post-test questionnaire. Therefore, 38 completed pre- and post-tests were obtained. Similarly, although 40 participants attended the VTC sessions, only 18 completed the pre- and post-test questionnaires. Thus, the total sample included 56 participants for assessment of the workshop's short-term effectiveness (F2F 38, VTC 18). Participants were contacted after 1 year for post-test 2, and 36 members of the F2F group and 16 members of the VTC group completed post-test 2.

Baseline characteristics of the F2F and VTC groups are presented in Table 1. Members of the F2F group were older than members of the VTC group ($P<0.001$). The mean age was 37.11 ($\pm$6.83) and 30.56 ($\pm$4.86) years for the F2F and VTC groups, respectively, and there was no significant gender difference between the two groups ($P=0.14$). Significant differences were noted between the two groups in: (a) type of institute at which participants were working at the time of the course ($P<0.001$); (b) previous research experience ($P=0.01$); and (c) future research plans ($P=0.01$). However, level of education ($P=0.43$) and type of previous research experience ($P=1.00$) were not statistically significant.

The mean pre-test scores were 11.13$\pm$1.96 and 10.67$\pm$2.35 in the F2F and VTC groups, respectively, whereas the post-test scores (Table 2) showed significant improvements in both groups (15.08$\pm$1.75 and 13.122$\pm$1.87, respectively). The improvements in mean scores were seen both within and between the groups ($P<0.0001$). When the post-test scores was assessed against the pre-test scores, the workshop was found to be very effective, with an increase in knowledge of up to 36% and 24% in the F2F and VTC groups, respectively.

When analysed using two-way repeated measure analysis of variance (Table 3), both groups showed

Table 2 Results of *t*-tests in the face-to-face (F2F) and video-teleconferencing (VTC) groups.

Test scores	Mean Δ scores	SD	95% CI levels		*P*-value (two-sided)[a]
			Lower	Upper	
Paired-sample t-test in F2F and VTC groups					
F2F group					
Post-test 1/pre-test	3.947	1.88	3.32	4.56	<0.0001
VTC group					
Post-test 1/pre-test	2.556	1.75	1.68	3.42	<0.0001
Two-sample t-test for comparison of test scores					
Scores (out of 20 points)	F2F ($n=38$)		VTC ($n=18$)		*P*-value (two-sided)[b]
	Mean	SD	Mean Δ scores	SD	
Pre-test (Day 1)	11.13	1.96	10.67	2.35	0.473
Post-test 1 (Day 9)	15.08	1.74	13.22	1.86	0.001
Post-test 2 (1 year later)[c]	13.42	2.61	12.31	2.08	0.117

CI, confidence intervals; SD, standard deviation.
[a]Paired *t*-test.
[b]Two-sample *t*-test with equal variance not assumed.
[c]$n=33$ for F2F group and $n=16$ for VTC group.

Table 3 Two-way repeated measure analysis of variance between the face-to-face (F2F) and video-teleconferencing (VTC) groups.

Effect (time)	*F*	DF	*P*-value
Maulchy's test for sphericity	0.861[a]	2	0.032
Within-subjects effect			
Time	42.272	1.75	<0.001
Time*group	42.272	1.75	0.318
Within-subjects contrast			
Time			
Linear	28.893	1	<0.001
Quadratic	56.039	1	<0.001
Time*group			
Linear	0.562	1	0.457
Quadratic	1.757	1	0.191
Between-subjects effect			
Intercept	2384.084	1	<0.001
Group	4.626	1	0.037

DF, degrees of freedom.
[a]Maulchy's test for sphericity.
[b]Greenhouse Geisser statistics.

significant changes in mean scores over time ($P<0.001$). However, no interaction was seen between time and groups ($P = 0.31$), meaning that the changes in mean test scores were seen at all levels in both groups with time and were not different between the groups. Both groups followed a similar trend, with increasing scores at post-test 1 followed by a reduction in scores at post-test 2. The between-subject effect showed that group was a significant factor ($P = 0.013$), and mean test score lines were not close to each other.

Univariate repeated measure analysis was performed to adjust for the effects of covariates on time (Table 4). Due to the small sample size and loss of power, multivariate analysis was not performed and each covariate was entered into the model individually. Three-way interactions were found between time*job type*group ($P = 0.02$) and time*education level*group ($P = 0.02$). In addition, interaction was also seen between time*type of institute ($P = 0.01$). It can be concluded that time and group interactions differ according to the job type of participants, as well as the level of education of participants in both the groups. Moreover, mean test scores with time also differed with the type of institute to which participants belonged at the time of the workshop (government, private or non-government organization). Age, gender, previous research experience and further research training after the workshop did not have any effect on scores in the two groups and were not found to be confounders.

Discussion

From the point of view of developing countries, building local research capacity has been the focus of several recent reviews and conceptual pieces.[17,19] Recent efforts initiated by the World Health Organization are defining tools to assess national health research systems, and tools will also be developed for evaluation of research capacity.[16] However, there is a relative dearth in the literature on evaluation of such efforts and programmes. This workshop was designed to teach research methods and to encourage and provide the tools to conduct high-quality research in Pakistan. This research training workshop is the first to attempt to maximize its yield by increasing the healthcare professional audience through VTC. The effectiveness of VTC on both short- and long-term knowledge gained from the workshop was evaluated.

This study demonstrated that knowledge gained from the workshop was sustained in both the short term and the long term. According to a recent audit in Pakistan,[22] a limited number of original research papers have been published, with the majority being review articles. Ninety percent of these were from two private institutes, with less than 7% coming from government medical institutions. Furthermore, in many of the private institutions, research experts (either local scientists or expatriates) were available to provide research training. AKU is the only private university where research is an integral part of undergraduate teaching, and 10% of the 5-year medical curriculum is allocated to research and community medicine. This is not the case in other private or government institutes. It was interesting to note that although 48% of participants in the F2F group came from private institutions, compared with the VTC participants who all came from a government medical university, both the groups had similar mean pre-test scores (Table 3). Although participants in the F2F group had more previous research experience (Table 2) and more publications before the workshop, the pre-test scores were not confounded and did not affect pre-test scores in the F2F group. In other words, although proper research training was not evident in the VTC group and participants did not have wide-ranging previous research experience, they still did well in the pre-test, equivalent to the F2F group. The VTC group also showed strong

Table 4 Adjusted two-way repeated measure analysis of variance between the two groups.

Effect (time)	Within-subjects effect			Between-subjects effect		
	F	DF	*P*-value	*F*	DF	*P*-value
Age						
Time∗age	1.154	30	0.34			
Time∗group∗age						
Group∗age[c]						
Sex						
Time∗sex	1.381[a]	2	0.257			
Time∗sex∗group	0.467[a]	2	0.628			
Group∗sex[c]				0.124	1	0.726
Type of job						
Time ∗job type	1.292[b]	2	0.280			
Time∗job type∗group	4.00[b]	2	0.022			
Group∗job type				0.523	1	0.473
Type of institute						
Time ∗institute type	3.118[a]	4	0.019			
Group∗ institute type[c]						
Level of education						
Time ∗education	0.484[b]	2	0.618			
Time∗group∗education	4.089[b]	2	0.020			
Group∗education				1.260	1	0.268
Previous research experience						
Time∗res exp	1.193[b]	2	0.308			
Time∗res exp∗group	1.443[b]	2	0.242			
Group∗res exp				0.571	1	0.454
Research programme enroll						
Time∗res prog	0.032[a]	2	0.968			
Time∗res prog∗group	2.916[a]	2	0.059			
Group∗res prog				0.190	1	0.665

DF, degrees of freedom.
[a]Greenhouse Geisser statistics are used as Maulchy's test for sphericity is significant.
[b]Sphericity assumed statistics used as Maulchys test for sphericity was not significant
[c]Not enough power to conduct analysis.

interest towards learning research methods. This became more obvious after the workshop, with significant improvements in post-test 1 scores in both groups; mean scores increased by 3.94 and 2.55 in the F2F and VTC groups, respectively. Several researchers[18,23] have studied retention of knowledge over a longer period of time for traditional classroom teaching. They reported knowledge retention of 35–75% after 1 year if the studied topics were not revised in the meantime. If the topics were repeated between the original study and the final test, the retention of knowledge was approximately 75%, even after several months.[24]

In the present study, in addition to the apparent short-term effectiveness of the workshop, long-term effectiveness with respect to knowledge gained and sustained showed improvements in scores from the pre-test. Even though the mean test scores for post-test 2 were less than those for post-test 1, the scores were still above the pre-test scores (Table 3). The course topics were not revised during the 1-year period, and to reduce bias, participants were not aware that their knowledge would be tested after 1 year. When compared with post-test 1 scores, the retention of knowledge was 89% in the F2F group and 93% in the VTC group. It is interesting to note that the VTC participants retained knowledge better than the F2F participants. The VTC group did not review the material and did not know that they would be tested again. However, knowledge retention of 93% after 1 year is

comparable with the scores gained in ordinary teaching, even with theme revision. The effectiveness and impact of the workshop were huge, even after 1 year when no additional teaching had been offered to either group. There could be several reasons for these results, including the training technique used in the workshop, and the level of activation of the student in the distance learning method. The role of the student is even more important in distance learning; the student's role changes from passive consumption of studied material as it is carried out in the classroom to an active approach, when the student becomes an active manager of his/her own study. This role is in comparison to ordinary teaching (e.g. F2F). The structure of the teaching process in traditional F2F education is based on the dominance of a teacher; on the contrary, in distance learning, the student is the central key point.[25]

For any country, certain indicators are used to assess research growth, e.g. the number of research projects, and publications in national and international peer-reviewed journals. For any healthcare professional, publication is an important factor in academic career building. A recent study by Hyder et al.[26] conducted bibliometric analysis in Pakistan for healthcare professionals with a PhD or equivalent. The study revealed that the average number of papers (international and national) published by Pakistani researchers was 15, and a significant positive association with age ($P<0.001$) was observed. Fifty percent of the respondents had an average of seven international publications, while one-third had no international publications. The average number of publications per year was 0.89.

In this study, although it was not possible to determine the extent of the research projects conducted by participants, information was obtained on the manuscripts published, written and submitted 1 year before and after the workshop. The total number of publications was 3.18 and 1.63 in the F2F and VTC groups, respectively, which is very low compared with the results of Hyder et al.[26] The main reason for this discrepancy could be the level of research experience. In the present study, there were no PhD-level participants and most of the research degrees were Masters or MPH. In the F2F group, level of education was significantly associated with total publications ($P = 0.01$) and publications 1 year after the workshop ($P = 0.01$), whereas in the VTC group, the total number of publications was associated with current job type ($P = 0.03$) and previous research experience ($P<0.001$). There were significantly more publications in the F2F group in the year before the workshop (1.34) compared with the VTC group (0.89). Although the VTC group was not an explicit group of researchers with significant research qualifications, the research output in terms of publications is the same as that of a Pakistani researcher with a PhD or equivalent degree. In short, the VTC group were highly motivated despite their lack of previous research experience and research qualifications. The number of publications after the workshop was not significant. This could be because: (a) participants were enrolled in further research training programmes after the workshop and did not have time to publish papers; or (b) 1 year is too short a period to reflect upon the effectiveness of any training course with respect to writing papers.

Interestingly, the future plans of both the groups were significant (Table 1). For example, 50% of the F2F group had plans for research projects and 26.3% wanted to publish. This was in contrast to the VTC group with 22.1% planning research and 55.6% inclined towards publishing papers. It could be concluded that there is a lack of understanding of the relationship between the concepts of 'research methods' and 'publishing papers'; however, taking into consideration that these are not 'doctorally prepared' researchers, the underlying motive for research skills may be an important component to consider when studying the recruitment, selection and retention of participants when using distance learning methods.

Although the results of this study are encouraging, the study did have several limitations. The selection of the F2F group was performed using strict eligibility criteria; however, due to late arrangements for VTC and last-minute announcements, the VTC group was selected at random without any eligibility criteria. All participants learned about the workshop through institutional announcements, flyers and notices on the bulletin boards. Participants who were interested in research attended the lectures. However, after the study results were analysed, age and previous research experience were the only differences seen between the two groups. It can be concluded that there was selection bias, but this did not result in a major difference in results. Secondly, the high attrition rate from the VTC group may have been due to the mode of training and the lack of the human element of F2F instruction. This may have introduced a potential bias; however, it was reassuring to see similar characteristics between the participants who completed the post-tests compared with those who did not, and it is thought that any bias would be minimal.

Lastly, due to time and funding constraints, the study was not designed as a randomized controlled study, which is the ideal design for these types of studies. The authors plan to conduct a similar study in the future as a randomized controlled trial and will take these limitations into account, especially the high attrition rate.

Conclusion

The epidemiological research training workshop was an attempt to observe the effectiveness of research training workshops as a method of teaching research skills to healthcare professionals with limited opportunities and local expertise. To expand the reach of classroom teaching, the first workshop was conducted in a developing country (Pakistan) using VTC. In addition, the study applied indicators to assess the research performance of healthcare professionals and their contributions to the development of health research in Pakistan.

Although a training workshop with special emphasis on research training, by its own definition, mandates a small number of students in each class to increase interaction and impact, the aim of this study was to increase interaction and impact of a workshop. This study is one of the few to examine the effectiveness of VTC as a method of teaching and training. The major policy issue in a country such as Pakistan is the balancing of limited resources. Pakistan spends large amounts on research training abroad, indicating the national commitment and interest in the development of a scientific base in the country. However, the country experiences major losses, not only of resources but also the local strength and product, as 90% of the researchers do not return but stay abroad for better career opportunities, resulting in 'brain drain'. With the current economic situation and financial constraints, Pakistan is very vulnerable with the burden of communicable and non-communicable diseases. Both the government and the public are stretched financially by spending huge amounts of the budget in tertiary curative services. There is an urgent and immediate need for prevention programmes and researchers who can provide the country with its own disease burden data. Prevention and public health programmes can not only focus on prevention strategies, e.g. prevention of CVDs by controlling risk factors, but can also help the country to conduct national health surveys. Training in public health and research is of prime importance to build prevention programmes. The findings of this study presented an innovative model of training and building research capacity in a cost-effective manner. The authors found that VTC is a very cost-effective method if students can be retained and complete the course. The results of this study can be used to develop large randomized controlled trials, and VTC can be a cost-effective method with careful planning and minimum attrition.

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Competing interests

None declared.

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