

Self-instruction versus traditional training on cast application technique

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Objective: To test the null hypothesis that for nurses working in emergency department, there is no difference between self-instruction and traditional method of training cast application technique, with respect to cost-effectiveness. **Method:** This was a prospective, single-blind, randomised, controlled trial carried out at the Accident & Emergency Department of North District Hospital from 11 November 1998 to 16 May 2000. Thirty-three full-time emergency department nurses (9 nursing officers, 20 registered nurses and 4 enrolled nurses) were randomly assigned into two groups. Sixteen were given the self-instruction training program (intervention group) and 17 were instructed by traditional training program (control group). The primary outcome measure was cost-effectiveness analysis. The predetermined relative cost ratio was compared with the relative success ratio of the two methods. The secondary outcome measures were individual skill performance, knowledge scores and attitude ranks. **Results:** There was no statistically significant difference between self-instruction and traditional method of training. The relative cost ratio of self-instruction to traditional method was 0.80. The relative success ratio of self-instruction to traditional method was 0.82. All nurses showed improvement in their knowledge (mean knowledge score, 38 versus 89). Trainees in the traditional method had more confidence performing cast application. Subgroup analysis showed that trainee characteristics and attitude did not predict the outcome. **Conclusion:** Self-instruction method and traditional method may be equally cost-effective for training cast application technique. Both methods resulted in significant improvement in knowledge of cast application. Nurses trained with the traditional method had more confidence than those trained with self-instruction method. (*Hong Kong j.emerg.med.* 2001;8:9-15)

Keywords: Cast technique, training

Introduction

Close reduction and plaster fixation are important skills in emergency medicine practice. Emergency practitioners should know the techniques of cast application and the aftercare for their patients.¹⁻³ Many emergency medicine trainees learn cast application techniques with apprenticeship or workshops. Apprenticeship is not structured and lacks quality control. Scheduled workshops have

problems for the trainees, trainers and the emergency department. Trainees work in shifts. It is difficult to plan ahead for the workshops. Swapping duties may disturb their sleep cycle and social life. Those who are unable to participate in the scheduled sessions have to wait for the next session. For trainers, they have to repeat the same training materials many times in multiple sessions. For departments, too many staff granted study leaves would result in shortage of manpower for clinical service.

We tried to find out other cost-effective methods of training in emergency medicine. In North America, self-instruction video training program on cardiopulmonary resuscitation had been advocated as an effective alternative to traditional method for health care workers and the public.^{4,5} We wondered whether this could be applied to other skills in emergency medicine, such as cast application technique.

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Methods

Design

We conducted a prospective, single-blind, randomized, controlled trial to test the null hypothesis that for nurses working in emergency department, there is no difference between self-instruction versus traditional method of training in cast application technique. The primary outcome measure was cost-effectiveness. The secondary outcome measures were individual skill performance, knowledge scores and attitude ranks.

Traditional training method was defined as training conducted in classroom setting at scheduled time. There was direct interaction with the instructors. Teaching aids, such as handouts, slides and videos, were considered media of training.

Self-instruction training method was defined as training conducted in any environment and at any time the learner found convenient. The learner had an active role in pursuing knowledge while the instructor was not immediately available. Teaching aids were considered as media of training.

We performed a cost analysis to determine the absolute and relative cost ratio of the two methods. (Table 1) Cost was defined as the expenses of the community, in equivalent monetary units of dollars, required to train a nurse. Our target group was all the emergency nurses in Hong Kong. We expected 70% of them would learn the cast application technique.

Staff members at North District Hospital and Tuen Mun Hospital searched and reviewed existing literature and videos on different techniques and training methods of cast application.⁶⁻¹⁰ A one-hour Cantonese video, a Chinese manual, and a set of template for cast application were produced. (Figure 1) The materials had been subjected to validation by consultants and peer review. After twelve months and with multiple editions, the version was finalised in November 1999.

As the project did not involve patients and there was no direct benefit from sponsors to the volunteer staff members, ethics committee approval was deemed unnecessary.

Table 1. Cost analysis for self-instruction method and traditional method.

| | Self-instruction | Traditional |
|--|------------------|-------------|
| Production of training material | | |
| a. Film studio company charge | 8000 | 0 |
| b. Trainer time: actors and director | 10000 | 0 |
| c. Trainer: material preparation | 4000 | 4000 |
| Training material | | |
| d. Casting materials consumed | 180000 | 180000 |
| e. Manual and other accessory | 22500 | 25000 |
| f. Video tape | 22500 | 0 |
| Administration | | |
| g. Secretarial jobs | 1000 | 1000 |
| Workshop | | |
| h. Classroom facility | 0 | 30000 |
| i. Trainer time | 0 | 72000 |
| Total | \$248000 | \$309500 |
| Relative cost ratio | 0.80 | 1.00 |

Estimation is based on 70% of target population (450 nurses), trainer to trainee ratio of 1:15, workshop last 6 hrs, (b) 25 hrs at \$400/hr, (c) 10 hrs at \$400/hr, (d) at \$400/student, (e) at \$50/student, (f) at \$50/student, (h) at \$1000/workshop.



Figure 1. Video, manual and cast template.

Setting and participants

The study was conducted at the A&E department, North District Hospital between 1 December 1999 and 16 May 2000. Inclusion criteria for participants were nurses working at the emergency department of the hospital. There was no exclusion criteria.

Thirty-three nurses were enrolled into the study (65% of all the nurses). They were randomly allocated to self-instruction (16 nurses) or control group (17 nurses) with SPSS version 7.5. The participants completed a baseline characteristics data sheet, a multiple choice question set on knowledge of cast application, and a ranked attitude questionnaire on cast application and training method.

Training

In December 1999, a six hours course of lecture and workshop was conducted to the traditional group. In the workshop, the demonstration was conducted largely with video. All nurses were encouraged to follow the three steps of cast application we promoted: preparation, application and aftercare. The trainer gave comments throughout the practice. In the self-study group, the video together with the manual and assignments were given to the trainees two weeks before the workshop. The assignment consisted of an appraisal of the existing cast room facility and a design plan

for an ideal cast room. Students integrated the three steps of cast application to their daily practice with simple cast reports. Trainees were encouraged to make casts and returned to their trainer for comment. Appropriate feedback was given as necessary. They had to finish the material in 3 weeks.

Outcome measures

By four months after the completion of training, a single-blind assessor tested their overall performance (Table 2) together with individual skill performance, knowledge scores and attitude ranks.

The primary outcome measure was the success of a training method with respect to cost-effectiveness. This was an intention-to-treat analysis. A successful candidate was defined as a nurse who had completed the training and assessed to have an excellent score or pass in overall performance. An unsuccessful candidate was defined as a nurse who, after enrollment in the training, did not complete the training; or assessed to have failed or badly failed in overall performance. Relative success ratio is the ratio of percentage success in the self-study group compared with the percentage success in the traditional group. The secondary outcomes measures included overall performance ranks, individual skill performance, change in knowledge scores and attitudes.

Table 2. Overall performance.

| | Explicit criteria |
|-----------|---|
| Bad fail | The cast had potential limb threatening complication and must be removed. |
| Fail | The cast had potential complication that would cause functional disability and requires modification. |
| Pass | The cast served its purpose for limb immobilization without potential complication. |
| Excellent | The nurse showed additional skill that added to the quality of total patient care. |

Statistical analyses

Results were analyzed with SPSS version 7.5. The success of the training method and individual skill performance were analysed with Fisher's Exact test. The overall performance in ordinal rank was analyzed with Mann-Whitney U test. The knowledge scores were analysed with student's t test. The attitude ranks were analysed with Wilcoxon rank-sum test for pre and post training, and Mann-Whitney U test between the two groups. Since there

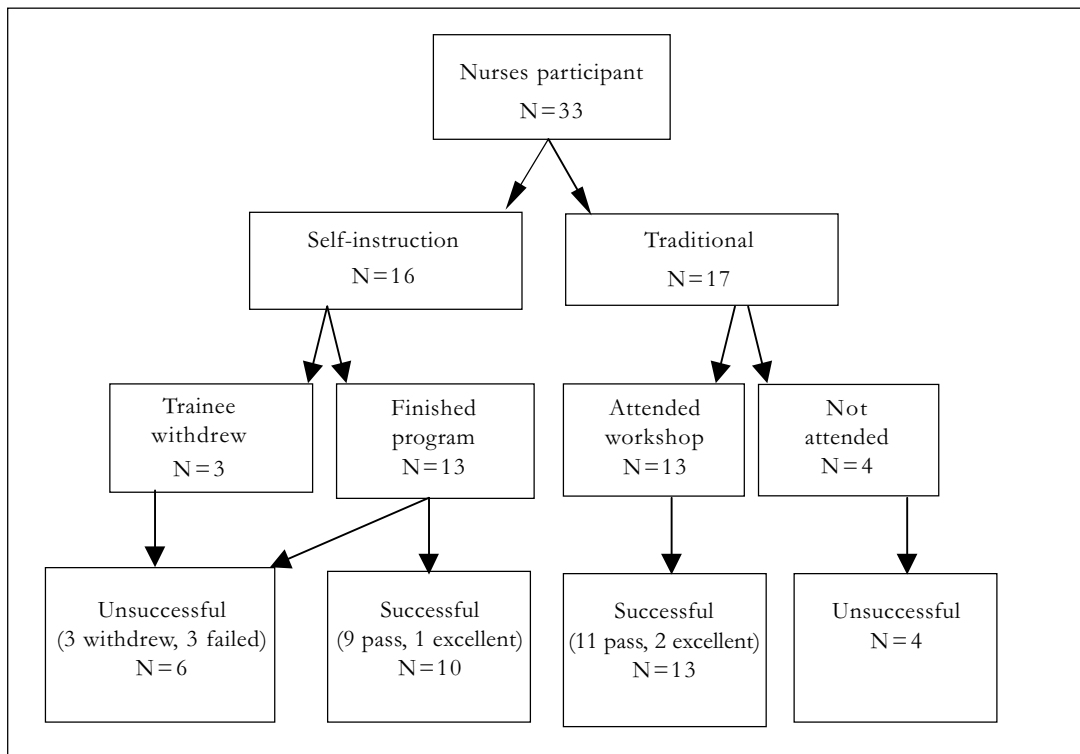
is a single assessor, no inter-observer variability test was needed.

Results

33 nurses volunteered for the study. Both groups were statistically similar with respect to their baseline characteristics. (Table 3) The trial and assessment flow profile is shown in Figure 2.

Table 3. Characteristics of the self-instruction and traditional group.

| | Self-instruction (n=16) | Traditional (n=17) |
|---------------------------------|-------------------------|--------------------|
| Female | 11 (69%) | 15 (88%) |
| Experience in years (SD) | 9 (4) | 9.6 (5) |
| Registered nurse | 9 (56%) | 11 (64%) |
| Enrolled nurse | 2 (13%) | 2 (12%) |
| Nursing officer | 5 (31%) | 4 (24%) |
| Training in the past | 1 (6%) | 2 (12%) |
| Applied >10 casts previously | 1 (6%) | 0 (0%) |
| Worked in O&T >6 months | 3 (19%) | 5 (29%) |
| Baseline knowledge score (SD) | 39 (16) | 37 (14) |
| Mean days training to test (SD) | 116 (31) | 102 (42) |



Figures 2. Trial and assessment flow profile.

The reason for all dropouts in the traditional group was due to job duty. In the self-instruction group, three nurses withdrew. The reasons consisted wrist pain in two of them, and one pregnancy.

Primary outcome

Sixty-three percent of nurses trained with the self-instruction method were regarded as successful compared with 76% in the traditional group. The relative success ratio was 0.82 (P=0.47, 95% confidence interval 0.52-1.30) compared with the predetermined relative cost ratio of 0.80.

Secondary outcomes

There was significant improvement in knowledge score from a mean score of 38 (95% confidence interval, 31-47) at the beginning of training to 89 (95% confidence interval, 82-97) after training.

The difference in overall performance and individual skill performance was statistically insignificant in both groups except for preparation of material. It was better in the traditional group (P=0.03). (Figure 3)

Before the training, all the nurses were eager to apply cast for patients. They regarded their knowledge and skills inadequate. They were not confident in applying cast and they preferred the traditional method of training. They felt that the department should compensate them for the time spent in either

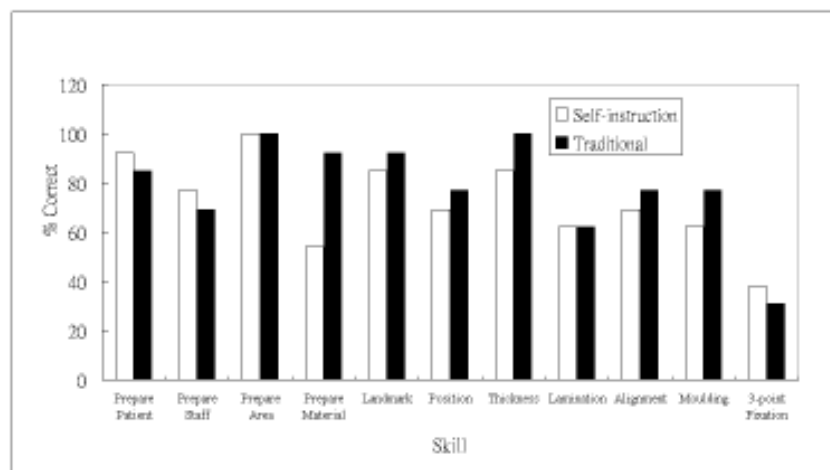
of the training method. These attitudes had no statistically significant difference between the two groups.

After the study, the attitude of the self-study group did not change. However, the traditional group perceived their knowledge and skills adequate. They were confident in applying cast for patients. These changes were statistically significant (all with P<0.05). The changes were also important because the mean ranks changed from a negative to a positive attitude rank. Despite the fact that both groups showed improvement in their knowledge scores, the self-instruction group was not aware of their improvement.

Subgroup analysis did not show any candidate characteristics or attitude that would identify the relation between performance with training method.

Discussion

Up to now, there has been no study reporting on the performance of training cast application techniques in Hong Kong. In our study, the success rate for traditional workshop was 76% compared with 63% in the self-instruction method, assessed at four months after training. There was no statistically significant difference between the two methods with respect to cost-effectiveness.



Figures 3. Individual skill performance.

In our study, we demonstrated a positive attitude significantly towards the traditional training method. Nurses in traditional training group felt more confident and perceived to have adequate knowledge and skill. Despite the fact that self-learners had significant objective improvement in the post-training assessment, this positive attitudinal change was absent. Our study also showed that the workshop conducted by video demonstration achieved 100% success for those attended ($P=0.02$). Therefore, the video might be a helpful teaching aid for training cast application technique in Hong Kong.

Self-instruction method might be comparable to traditional method. However, we cannot definitely reject our hypothesis because of the confidence interval. Our major limitation was the sample size. Before this study, we did not have local data to estimate the sample size. With the results in this study, to determine whether a new training method is cost-effective at a significance level of 0.05 with a power of 0.8 will require two groups, each with a minimum of 197 candidates. Although our study had potential drawbacks, it also had its strength.

Both self-instruction and workshop training methods have their merits and shortcomings. Scheduled workshop training provides a specific time and environment for the trainee to learn. However, trainees may be unable to swap their duties. Self-instruction training is flexible. If self-instruction method is proved to be cost-effective, it can be implemented at a cross sectional basis. In order to train the majority of the population, traditional method requires a longer time and greater manpower. Self-instruction requires the students to explore the knowledge and skill by themselves. Faults may perpetuate instead of being corrected immediately. The self-learners have to explore the knowledge proactively. Trainees who are not prepared with these additional learning skills will feel frustrated.

We analysed the result in terms of cost-effectiveness because we anticipated that new training programs would be developed for trainees in emergency medicine.¹¹⁻¹³ We provided pilot information to

consider whether a new training method might be worthy in a tight budget environment. We analysed the cost with respect to the community because the Hospital Authority, the College of Emergency Medicine, the Society for Emergency Medicine & Surgery, the trainers, the trainees, the patients and the pharmaceutical companies all have some financial contribution to our current training system.

In North America, self-instruction cardiopulmonary resuscitation video training was shown to be better than traditional CPR instruction.^{4,5} However, their definition of 'self-instruction' was different from ours. In their study, the self-instruction group (intervention group) attended a scheduled classroom to watch the video. There were staff members in the classroom repeatedly encouraging the students to practice. The traditional group (control) in their study involved a certified instructor demonstrating CPR to the trainee. Their concern was about the video versus certified instructors. After all, both groups of students had to be trained at classroom. Instead, we considered the practical benefits of learning at self-controlled time and environment.

We concluded that emergency nurses at our hospital favoured traditional training. On the individual trainee's point of view, training should be individualised. Each person should have his choice, however, on the population basis, we need to spend or explore our resource wisely.

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