

ORIGINAL ARTICLE

The effectiveness of an accessibility-enhanced multimedia informational educational programme in reducing anxiety and increasing satisfaction of patients undergoing cardiac catheterisation

Ka-Lai Wu, Su-Ru Chen, Wen-Chin Ko, Shu-Yu Kuo, Ping-Ling Chen, Hui-Fang Su and Wen-Yin Chang

Aims and objectives. To evaluate the effectiveness of an accessibility-enhanced multimedia informational educational programme in reducing anxiety and increasing satisfaction with the information and materials received by patients undergoing cardiac catheterisation.

Background. Cardiac catheterisation is one of the most anxiety-provoking invasive procedures for patients. However, informational education using multimedia to inform patients undergoing cardiac catheterisation has not been extensively explored.

Design. A randomised experimental design with three-cohort prospective comparisons.

Methods. In total, 123 consecutive patients were randomly assigned to one of three groups: regular education; (group 1), accessibility-enhanced multimedia informational education (group 2) and instructional digital videodisc education (group 3). Anxiety was measured with Spielberger's State Anxiety Inventory, which was administered at four time intervals: before education (T0), immediately after education (T1), before cardiac catheterisation (T2) and one day after cardiac catheterisation (T3). A satisfaction questionnaire was administered one day after cardiac catheterisation. Data were collected from May 2009–September 2010 and analysed using descriptive statistics, chi-squared tests, one-way analysis of variance, Scheffe's *post hoc* test and generalised estimating equations.

Results. All patients experienced moderate anxiety at T0 to low anxiety at T3. Accessibility-enhanced multimedia informational education patients had significantly lower anxiety levels and felt the most satisfied with the information and materials received compared with patients in groups 1 and 3. A statistically significant difference in anxiety levels was only found at T2 among the three groups ($p = 0.004$).

What does this paper contribute to the wider global clinical community?

- Patients who were scheduled for cardiac catheterisation had moderate anxiety and required information to cope with stress.
- Patients in the accessibility-enhanced multimedia informational education group experienced significantly lower anxiety levels and felt the most satisfied with the information and materials received compared with patients in the regular education group and instructional digital videodisc education group; thus, it can be adapted to complement patient education in future regular cardiac care.

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Conclusions. The findings demonstrate that the accessibility-enhanced multimedia informational education was the most effective informational educational module for informing patients about their upcoming cardiac catheterisation, to reduce anxiety and improve satisfaction with the information and materials received compared with the regular education and instructional digital videodisc education.

Relevance to clinical practice. As the accessibility-enhanced multimedia informational education reduced patient anxiety and improved satisfaction with the information and materials received, it can be adapted to complement patient education in future regular cardiac care.

Key words: anxiety, informational education, instructional digital videodisc, multimedia, satisfaction

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Introduction

Cardiac catheterisation (CC) is one of the most anxiety-provoking invasive procedures for patients with coronary heart disease (CHD) due to uncertainty about the procedure itself, uncertainty about the outcome and possible complications and a lack of knowledge about expectations (Hamel 2001, Taylor-Piliae & Molassiotis 2001, Chair *et al.* 2012). McCaffrey and Taylor (2005) also stated several possible reasons why patients feel anxiety, including inadequate emotional support, long waiting times before the procedure begins and to receive CC results, and physical discomfort. Studies also reported that adequate information, tailored teaching aids, emotional support and instructions in relaxation techniques can be considered for patients who undergo a CC procedure to reduce their anxiety and stress (Garvin & Kim 2000, Ko & Lin 2011). Thus, appropriately educating patients before CC is necessary to assist them in managing their stress related to the CC procedure and produce better care outcomes.

Although a variety of psychological techniques and cognitive-behavioural skills were developed to prepare patients for CC, the results were not satisfactory. For example, Okvat *et al.* (2002) found that patients in a 10-minute massage group did not report satisfactory decreases in anxiety levels prior to CC compared with patients in the control group. Taylor-Piliae and Chair (2002) conducted a nursing interventional study to determine the effects of a music therapy intervention, a sensory information intervention and usual care on Chinese patients' anxiety levels before CC and found that there were no statistically significant differences in anxiety, mood state, uncertainty or heart or

respiratory rates between the three groups of patients. In addition, the combined use of an educational digital videodisc (DVD), a breathing relaxation technique, individual counselling and a written pamphlet to reduce anxiety in CC patients prior to surgery has not been previously studied. Therefore, the aims of the study were to develop and evaluate the effectiveness of an accessibility-enhanced multimedia informational education (AEMIE) in patients with CHD undergoing CC and to compare differences in anxiety levels and satisfaction with the information and materials received among AEMIE patients, patients receiving regular education (RE) and patients given instructional DVD education. Results of this study can serve as groundwork to help hospital nursing educators develop patient educational modules to improve the quality of education in future cardiac care.

Background

With advances in medical technology, CC has become a very common diagnostic procedure for adult patients with CHD (McCaffrey & Taylor 2005, Chair *et al.* 2012). In Taiwan, the number of CCs performed has risen steadily from 32,816 in 1998–60,282 in 2001, a utilisation growth rate of 22.47% (Tsai *et al.* 2005). Although CC can be performed in both outpatient and inpatient settings (Weld 1997), in Taiwan, CC is usually performed in a hospital setting. In general, the average length of hospital stay for patients with CHD undergoing CC is three days from admission to discharge. In such a relatively short hospital stay, it is not easy for clinical nurses to provide adequate information to patients undergoing CC. Consequently, development of an effective informational education module is essential to ensure that patients receive

sufficient and relevant CC information and promote active participation in their own care.

Diverse nursing intervention educational methods have been developed to reduce patients' anxiety prior to CC or when waiting for CC. However, results were inconsistent. Harkness *et al.* (2003) provided an early psychoeducational nursing intervention to patients during the waiting period for elective CC, and a significant difference was found in state anxiety levels between the intervention and control groups. In contrast, in a study conducted to teach patients about relaxation techniques through written instructions and an audio tape, Warner *et al.* (1992) found that there was no significant difference between the experimental and control groups in pre-CC state-trait anxiety inventory (STAI) scores, vital signs or procedure length. In addition, Zolfaghari *et al.* (2012) conducted a quasi-experimental study to determine the effects of therapeutic touch on anxiety, vital signs and cardiac dysrhythmia and found that therapeutic touch significantly reduced women's state anxiety, but there was no effect on trait anxiety. Hence, further research is required to find effective nursing interventional education to decrease patients' anxiety levels before CC procedures and improve the quality of CC nursing care.

Although the use of a DVD or videotape education was successfully reported as an educational method in the literature, such as for teaching medical professionals with paediatric intraosseous needle insertion to improve learning outcomes (Lee *et al.* 2007), for caregivers to obtain needed information and reduce stress levels (Sepulveda *et al.* 2008), for preparing patients undergoing chemotherapy to reduce their pretreatment anxiety and improve their self-efficacy in managing treatment side effects (Schofield *et al.* 2008), for patients undergoing surgery under regional anaesthesia to reduce their perioperative anxiety (Jlala *et al.* 2010) and for preparing Chinese patients for their first-time CC to reduce their state anxiety levels and uncertainty levels towards the procedures (Chair *et al.* 2012), studies on the use of multimedia DVD informational education combined with breathing relaxation instruction techniques and individual counselling for patients undergoing CC procedure are relatively scarce. Thus, it is essential to provide patient education using DVDs to improve information gained and reduce their anxiety levels.

Methods

Design

This study used a randomised experimental, three-cohort prospective comparison design. From May 2009–September

2010, consecutive patients who were scheduled to undergo their first CC were randomly assigned to one of the following three groups: RE (group 1), AEMIE (group 2) and instructional DVD education (group 3).

Samples

Study participants consisted of adult patients admitted to a teaching medical centre in Taipei and scheduled for their first CC. In general, nurses are chiefly responsible for providing CC information education to patients and their families during the hospital stay. Eligibility criteria required that patients: (1) be 20 years or older at the time of recruitment and thus classified as adults in Taiwan, (2) have previously been diagnosed with CHD (ICD-9-CM codes 414.9 or 411.89) or angina (413.9), (3) have undergone their first CC and (4) be able to read Chinese and speak Taiwanese or Mandarin. Patients were excluded if: (1) a CC was not scheduled, (2) they had a life-threatening illness or other disease, including psychological diseases, (3) they had auditory and/or visual disabilities that impeded communication and (4) their care necessitated admittance to intensive care units and/or emergency surgery. A flow chart of the recruitment processes for the study is given in Fig. 1.

The sample size calculation for the analysis of repeated measures to detect an effect size of 0.2 at 80% power and a 0.05 significance level required a sample size of 75 patients (according to G-POWER 3.1 analytical software, Franz Faul, Universitat Kiel, Germany). Based on these numbers, it was determined that a sample of 83 for the three groups was required, allowing for 10% attrition.

Group 1: RE

Patients in the RE group received ward-based care, including conventional information on CC and verbal instructions from cardiac nurses on admission day at the study hospital. Patients also received a written pamphlet with information on the CC procedure (Table 1). This pamphlet is a standard educational medium that has been used by the hospital for years. The written pamphlet contains 17 printed pages (B4 size) of information about CC processes, including the anatomy and physiology of the heart, and notices/precautions before and after CC. Illustrations with numerous pictures were also used to reinforce the CC information. Additionally, after the CC procedure, patients received regular post-CC education and care by ward nurses. Patients were free to ask questions of the research team, their nurses and physicians at any time during their hospitalisation.

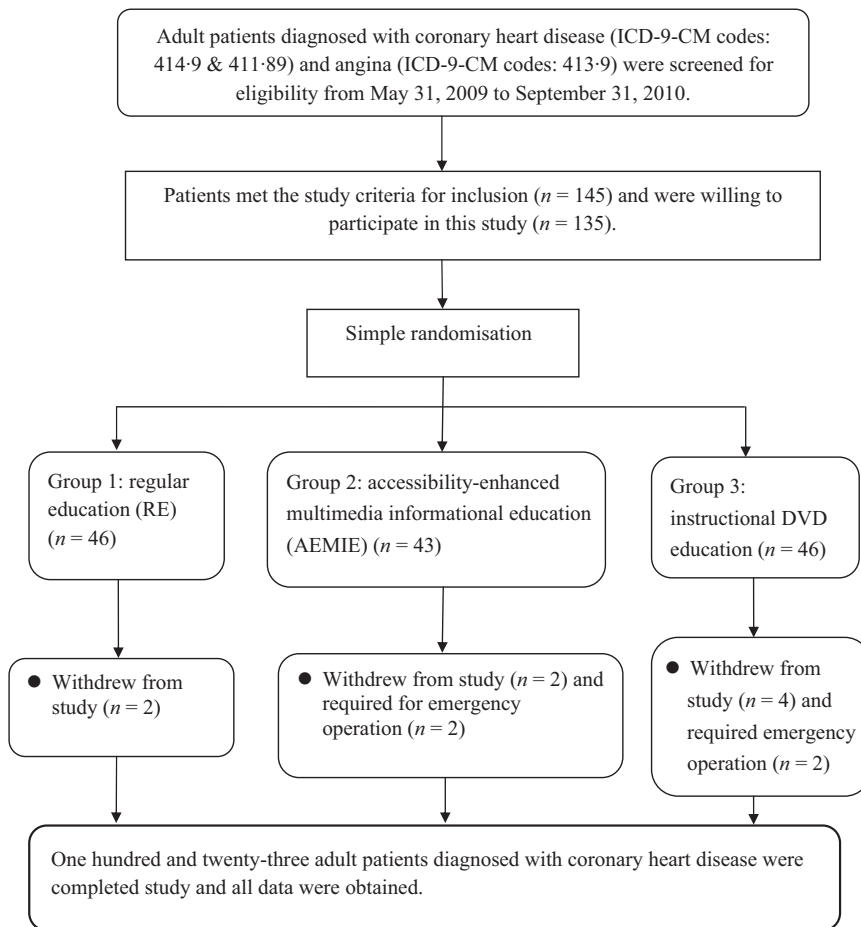


Figure 1 Flowchart of recruitment of subjects.

Group 2: AEMIE

The AEMIE was defined as an intervention aimed to provide information education for patients through multimedia use. The major contents of the AEMIE were produced by a cardiology team and researchers and included four parts: (1) the purposes and importance of CC, (2) notices and precautions before, during and after CC, (3) physical activities after CC and (4) a breathing relaxation technique. Contents of the final version of the AEMIE were then transformed into a 12-minute-long instructional DVD as visual information using CYBERLINK POWER DIRECTOR ULTRA, version 7 (CyberLink corporation, Taipei, Taiwan). The DVD was made available in dual dialects, Taiwanese and Mandarin, to enhance patient comprehension of the educational information. Upon completion of the instructional DVD recording, an expert in computer media communication conducted an interface review.

The AEMIE was delivered by a trained nurse and completed within the three days of a patient's hospital stay. On admission day, both the patient and primary researcher watched the instructional DVD together using a DVD

player connected to a projector that displayed the video onto a white screen. After watching the video, the patient could ask any questions that he or she felt necessary. Also on admission day, instructions on the breathing relaxation technique and individual counselling were given. Patients were reminded to practice the breathing relaxation as often as they wished prior to CC. Patients also received a written pamphlet with information regarding the CC procedure (the same as in group 1). On the day of CC, the primary researcher visited the patient prior to CC to enquire whether the patient required additional information. After the CC procedure, the primary researcher visited the patients again to provide patients with post-CC education and individual counselling. During each visit, the primary researcher encouraged patients to ask questions. The entire contents of the programme are listed in Table 1.

Group 3: instructional DVD education

Patients in the instructional DVD group watched the DVD with the nurse together on admission day, and she was available to answer questions. The contents of the DVD

Table 1 The contents of regular education, accessibility-enhanced multimedia informational education and instructional DVD education

Time schedule	RE group		AEMIE group		Instructional DVD education group	
	Themes (Times)	Teaching aids	Themes (Times)	Teaching aids	Themes (Times)	Teaching aids
On admission day	Received CC information	A written pamphlet	1. Received CC information 2. Taught breathing relaxation technique (20 minutes) 3. Provided individual counselling and Q&A (10 minutes)	1. Watched a DVD (12 minutes) 2. A written pamphlet	Received CC information	1. Watched DVD (12 minutes) 2. A written pamphlet
Prior to CC procedure			1. Practised breathing relaxation technique (10 minutes) 2. Provided individual counselling and Q&A (five minutes)	A written pamphlet		
After CC procedure	Provided post-CC education and care (10 minutes)	A written pamphlet	1. Provided post-CC education and care (10 minutes) 2. Provided individual counselling and Q&A (five minutes)	A written pamphlet	Provided post-CC education and care (10 minutes)	A written pamphlet

CC, cardiac catheterisation; RE, regular education; AEMIE, accessibility-enhanced multimedia informational education; DVD, digital videodisc.

and delivery methods were the same as for patients in the AEMIE group. After the CC procedure, patients received regular post-CC education and care by ward nurses (the same as in group 1).

Instruments

Two instruments, the STAI (Spielberger *et al.* 1970) and a self-administrated satisfaction questionnaire, were used to measure the effectiveness of this study. The survey also included information on demographics, including age, gender, highest educational level, a family history of CC (yes/no) and whether CC information was sought before the procedure (yes/no).

The STAI was developed by Spielberger *et al.* (1970) and designed to measure how a person feels at a particular moment in time. The STAI consists of 20 items with a four-point Likert-type scale, on which 1 means 'not at all' and 4 means 'very much'. Possible scores range from 20–80 points, with higher scores indicating higher anxiety (20–39 indicating low anxiety, 40–59 moderate anxiety and 60–80 high anxiety) (Taylor-Piliae & Chair 2002). The psychometric properties of the STAI are well documented (Spielberger 1983). In Taiwan, Ko and Lin (2011) used the Chinese version of the STAI (C-STAI) to measure patients' anxiety before surgery and reported the internal consistency of Cronbach's α as 0.89. In the present study, the C-STAI was used and pilot-tested for internal consistency of the reliability. In total, 123 patients participated in this study. Cronbach's α was 0.94, indicating that the C-STAI showed high internal consistency. The C-STAI was completed before education (T0), immediately after education (T1), before CC (T2) and one day after CC (T3).

The satisfaction questionnaire was developed by the primary investigator and measured using a four-point Likert-type scale, for which 1 means 'strongly dissatisfied' and 4 means 'strongly satisfied'. Designed to be completed in five minutes, the questionnaire consisted of 12 questions, including: (1) 'How did you feel about the usefulness of the information in the DVD and pamphlet, the font size of the words in the pamphlet and the delivery methods?' (three items), (2) 'How did you feel about the entire process of information delivery, important precautions during CC, physical activities after CC and urination notices after CC?' (four items), (3) 'How did you feel about the nurses' attitudes towards the information given such as listening to you patiently, providing emotional support and answering your questions?' (three items) and (4) overall satisfaction with the information received (one item). Five experts from several disciplines, including two cardiologists, two nurse

supervisors and one nursing professor in the cardiology field, assessed the questionnaire for content validity. The questionnaire was reviewed for clarity and appropriateness and revised based on experts' feedback and suggestions. The questionnaire was acceptable if the index of content validity (CVI) was >0.80 . Cronbach's α reliability of the scale in this study was 0.90.

Ethical considerations

The ethics review committee at the study hospital in Taipei approved the study (CT-9937) prior to patient recruitment. Those who met the criteria for inclusion received a formal letter containing information on the study's purposes, procedures and data management. Patients were also informed about their right to withdraw from the study at any time during the study period. Written consent was obtained from each participant. All information was confidential and only seen by researchers. After completing the study, patients received a small gift as a token of our appreciation.

Data collection procedures

Data were collected at three time points. On admission day, all patients who were preparing for CC were evaluated for inclusion and exclusion criteria. Then, eligible patients received information about the purpose of the study and were invited to participate. Patients indicating an interest in participating were asked to provide written informed consent to one of the researchers. After informed consent was obtained, consecutive patients were randomly assigned to one of following three groups by drawing lots: RE (group 1), AEMIE (group 2) and instructional DVD education (group 3) (Fig. 1). The C-STAI questionnaires and demographic data were administered and collected at the cardiovascular wards as baseline data (T0). Then, patients were educated based on the protocols of the study group. The C-STAI questionnaire was also administered at three time intervals T1, T2 and T3. Satisfaction with the information and materials received was determined before patients were discharged from the hospital. All demographic data and completed questionnaires were collected by the first author who was in charge of data collection, entry and analyses.

Data analysis

Descriptive analyses, including the percentage, number of cases, mean and standard deviation, were used to represent characteristics of the study patients. A chi-squared test was employed to compare differences in gender, educational

levels, family history of CC and whether CC information was sought before the procedure. A one-way analysis of variance (ANOVA) was used to compare differences in age and patient satisfaction with the information and materials received among the groups. A *post hoc* Scheffe's analysis was used. A generalised estimating equation (GEE) was used to compare differences in anxiety levels from T0–T3 among the three groups. Analysis of all data in this study was performed using the Statistical Package for the Social Sciences/PC+ (SPSS for Windows, version 19.0; SPSS, Chicago, IL, USA) with the level of significance for all statistical analyses set to $p < 0.05$.

Results

Participant characteristics

During the study period, 145 patients met the inclusion criteria and 135 patients agreed to participate. Of these, 12 patients (two in the RE group, four in the AEMIE group and six in the instructional DVD group) were excluded because of voluntary withdrawal from the study ($n = 8$) or because they required emergency surgery ($n = 4$). However, there were no significant differences in demographics between these nonparticipants and the remaining study cohort ($p > 0.05$). Finally, 123 patients completed the study, 44 in the RE group, 39 in the AEMIE group and 40 in the instructional DVD group. For full details, please see Fig. 1.

Overall, patients ranged in age from 40–82 years with mean age of 61.53 (SD = 9.28) years. Most patients were male ($n = 90$; 71.4%), had been educated beyond high school ($n = 83$; 65.9%), had no CC family history ($n = 90$; 71.4%) and had collected information before the CC procedure ($n = 73$; 57.9%).

Table 2 shows that significant demographic differences were not found between the three groups ($p > 0.05$) except for age ($p = 0.01$) and gender ($p = 0.031$). Overall, patients in the RE group were older on average (63.91 years) than patients in the AEMIE group (57.95 years) and in the instructional DVD group (62.41 years). In contrast, a relatively higher percentage of male patients (85%) were found in the instructional DVD group than the 75% in the RE group and 59% in the AEMIE group. A lower percentage of patients (59.0%) had an education of high school or greater in the AEMIE group compared with the 68.2% in the RE group and 75.0% in the instructional DVD group. A higher percentage of patients (28.2%) in the AEMIE group had a CC family history compared with the 27.3% in the RE group and 25.0% in the instructional DVD group. As also noted, patients in the RE group were more likely to have sought CC information

Table 2 Characteristics of study subjects ($N = 123$)

Variables	RE group ($n = 44$) n (%)	AEMIE group ($n = 39$) n (%)	Instructional DVD education group ($n = 40$) n (%)	F/χ^2	p -value
Age in year [M (SD)]	63.91 (9.70)	57.95 (7.79)	62.41 (9.30)	4.810	0.010*
Gender					
Male	33 (75.0)	23 (59.0)	34 (85.0)	6.930	0.031*
Female	11 (25.0)	16 (41.0)	6 (15.0)		
Educational level					
Junior high school and below	14 (31.8)	16 (41.0)	10 (25.0)	2.326	0.312
High school and above	30 (68.2)	23 (59.0)	30 (75.0)		
Had a CC family history					
No	32 (72.7)	28 (71.8)	30 (75.0)	0.110	0.946
Yes	12 (27.3)	11 (28.2)	10 (25.0)		
Had sought CC information before hospital admission					
No	15 (34.1)	18 (46.2)	17 (42.5)	1.331	0.514
Yes	29 (65.9)	21 (53.8)	23 (57.5)		

CC, cardiac catheterisation; RE, regular education; AEMIE, accessibility-enhanced multimedia informational education; DVD, digital video disc.

* $p < 0.05$.

before hospital admission than patients in the AEMIE group and instructional DVD group (65.9 and 53.8% vs. 57.5%, respectively).

State anxiety

Results of the reduction in anxiety levels among groups showed that state anxiety scores were the highest before CC education (T0) (with averages of 38.57 points in the RE group, 42.57 points in the AEMIE group and 42.05 points in the instructional DVD group) and the lowest one day after CC (T3) (with averages of 28.41 points in the RE group, 26.18 points in the AEMIE group and 28.8 points in the instructional DVD group) (Fig. 2). A significantly greater reduction in the anxiety scores from T0–T3 was noted in AEMIE group patients (a difference of 16.33 points) compared with patients in the RE group (a difference of 10.16 points) and the instructional DVD group (a difference of 13.25 points). However, the GEE analysis only showed a statistically significant difference at T2 among the groups ($p = 0.004$). It was also interesting to find that anxiety scores of T2 of patients in the RE group and instructional DVD group were more likely to rebound. In contrast, anxiety scores consistently declined from T0–T3 in the AEMIE group.

Satisfaction with information and materials received

As shown in Table 3, patients in the AEMIE group reported a higher mean score of satisfaction with the

information and materials received than the RE group and the instructional DVD group (3.85, 3.75 and 3.75, respectively). For each item, patients in the AEMIE group felt more satisfied with the font size in the pamphlet ($p = 0.001$), the delivery method ($p = 0.017$), the instructions for physical activity after the CC procedure ($p = 0.018$), the instructions for urination notices after CC procedure ($p = 0.001$), nurses' attitudes towards the information given ($p = 0.001$), emotional support provided by nurses ($p = 0.006$) and questions appropriately answered by nurses ($p = 0.024$) than patients in the RE and instructional DVD groups. Scheffe's *post hoc* test also showed that patients in the AEMIE group overall felt the most satisfaction with the information and materials received than patients in the RE and instructional DVD groups.

Discussion

This study revealed that the use of the AEMIE for patient education appeared to be an effective educational module to inform patients about the CC procedure. Although patients' anxiety levels were generally reduced in each group, the reduction in anxiety from T0–T3 was significantly greater in the AEMIE group than in the RE and instructional DVD groups. Several other studies reported similar findings. Chan and Cheung (2003) clearly indicated that Chinese patients undergoing CC required health professionals' assistance to obtain CC information and also their anxiety level reached the highest at the time just prior

to CC and was the lowest immediately following the CC. Chair *et al.* (2012) also demonstrated that 132 Hong Kong Chinese patients undergoing their first-time CC who had received videotape education were less anxious and experienced higher satisfaction with care and knowledge gained than were patients in the usual care group. Furthermore, Jlala *et al.* (2010) found that patients undergoing surgery

under regional anaesthesia who watched an informational video felt less anxious before the operation than those in the control group. However, neither Schofield *et al.* (2008) nor Salzwedel *et al.* (2008) supported the results and pointed out that the use of a video for informational education did not reduce patients' anxiety levels. Huber *et al.* (2013) also found that patients who received multimedia-supported preoperative education prior to a radical prostatectomy reportedly gained more knowledge compared with the standard education, but anxiety levels did not significantly differ between these two educational programmes. These differences may have been due to different types of education design or delivery methods. In this study, the AEMIE contents included an instructional DVD combined with instructions on a breathing relaxation technique and individual counselling; therefore, practicing the breathing relaxation technique may have enhanced the effectiveness of anxiety reduction in patients. Moreover, nurses always being there to provide individual counselling and answer questions may also have been a factor in successfully reducing patient anxiety. However, the number of patients who actually practised the breathing relaxation technique was not determined and was not observed by nurses in this study. Hence, we suggest that future investigators might examine the influences of the practised breathing relaxation

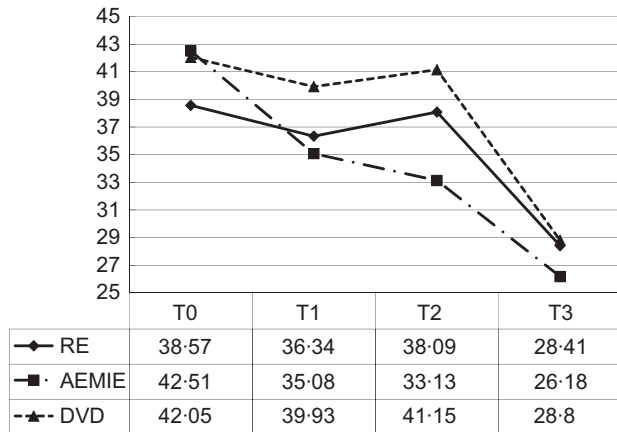


Figure 2 Comparison of patients' state anxiety scores between regular education (RE) group, accessibility-enhanced multimedia informational education (AEMIE) group and instructional digital videodisc (DVD) education (DVD) group from T0–T3.

Table 3 Comparison of scores of satisfaction with information and materials received among groups (N = 123)

Item	RE group (n = 44)	AEMIE group (n = 39)	Instructional DVD education group (n = 40)	F	p-value	Scheffe's post hoc test
	M (SD) ^①	M (SD) ^②	M (SD) ^③			
1. Usefulness of the information in the DVD and pamphlet	3.57 (0.50)	3.78 (0.42)	3.63 (0.49)	1.93	0.149	
2. Font size in the pamphlet	3.18 (0.69)	3.68 (0.47)	3.38 (0.54)	7.23	0.001*	① < ②
3. Delivery method	3.41 (0.58)	3.73 (0.45)	3.65 (0.48)	4.21	0.017*	① < ②
4. Instructions on the entire processes during the information given	3.66 (0.48)	3.83 (0.39)	3.65 (0.48)	1.78	0.173	
5. Instructions on important notices/precautions during the CC procedure	3.70 (0.46)	3.80 (0.41)	3.60 (0.50)	1.79	0.170	
6. Instructions on physical activities after the CC procedure	3.50 (0.51)	3.78 (0.42)	3.50 (0.51)	4.15	0.018*	① ③ < ②
7. Instructions on urination notices after the CC procedure	3.25 (0.62)	3.73 (0.45)	3.35 (0.54)	8.26	<0.001**	① ③ < ②
8. Nurses' attitude towards the information given	3.55 (0.51)	3.90 (0.30)	3.62 (0.49)	7.03	<0.001**	① < ②
9. Nurses listened patiently	3.70 (0.46)	3.80 (0.41)	3.62 (0.49)	1.38	0.257	
10. Nurses provided emotional support	3.73 (0.45)	3.88 (0.34)	3.55 (0.50)	5.36	0.006**	③ < ②
11. Nurses answered my questions appropriately	3.59 (0.50)	3.83 (0.39)	3.55 (0.50)	3.85	0.024*	③ < ②
12. Overall satisfaction with the information and materials received	3.75 (0.44)	3.85 (0.36)	3.75 (0.44)	0.71	0.494	

CC, cardiac catheterisation; RE, regular education; AEMIE, accessibility-enhanced multimedia informational education; DVD, digital videodisc.

*p < 0.05; **p < 0.01.

techniques on anxiety levels or focus on obtaining additional practice behavioural data and other physiological data such as the heart rate, blood pressure and respiration rate to demonstrate the effectiveness of the breathing relaxation techniques on patients prior to and during CC.

We also found that patients in the AEMIE group felt the greatest satisfaction with the information and materials received compared with patients in the RE and DVD instructional groups. The results may have been due to nurses' attendance, continuous emotional support and individual counselling covered by the AEMIE contents. Wihelm *et al.* (2009) supported the findings and indicated that although a DVD for preoperative patient education was proved to be positive informational education to improve patients' knowledge, it cannot be replaced by personal interactions. Additionally, a study by Snyder-Ramos *et al.* (2005) among patients undergoing general anaesthesia compared the level of satisfaction and information gained by a face-to-face interview when combined with a brochure or video. These authors found that the use of a documentary video to supplement a preoperative interview enhanced patient satisfaction and maximised information gained by patients. Thus, these factors may be considered important elements in future development of multimedia educational programmes for other invasive procedures.

Results of this study also revealed that patients viewing a DVD on a large screen and receiving more support from nurses in the AEMIE group had improved satisfaction with the information and materials received. The results might reflect the fact that as patients with CHD in this study had a mean age of 61.53 years, they required visual aids to enhance comprehension of the CC procedure. Powell-Jackson *et al.* (2010) found similar results and reported that the use of a DVD to provide information regarding abortion for women was more useful and clearer than written information at clinics. Women also commented that using a DVD left more time for them to discuss their concerns with the staff. However, in the AEMIE group, the primary researcher did not count as hospital manpower. The results might have differed if nurses had been considered part of the manpower in the hospital. Therefore, we suggest that future researchers might focus on the use of a DVD as informational education to understand the effects of nurses' time on patient satisfaction and nurse workload.

Limitations of the study

Several limitations of the study should be mentioned. First, because patients were recruited from only one teaching hospital in Taipei, findings should not be generalised beyond

the study sample. It is suggested that future studies assess patients across multiple hospitals in Taiwan. Second, although one expert evaluated the contents of the instructional DVD before our study began, patients' knowledge about CC was not evaluated in this study. Consequently, the outcomes could have been affected. Therefore, evaluation of patient knowledge of CC after an intervention is suggested for future researchers to ensure that patients actually understood all of the information and materials. Third, since the CC was arranged by cardiologists at the study hospital, the time they spent prior to CC varied, ranging from one to a few hours in a patient's room; thus, variability in waiting times might make it difficult to draw firm conclusions about the effects of the AEMIE, as patient anxiety may have increased while waiting for the procedure to take place. Therefore, careful interpretation of the study results is warranted. Finally, the Chinese versions of the instruments used, especially for the satisfaction questionnaire in this study, were not assessed by comprehensive psychometric property tests, such as test-retest reliability, or criterion and construct validity. Accordingly, these Chinese instruments should be further tested before they can be widely used in future studies.

Conclusions

In conclusion, although there was a reduction in anxiety levels noted for patients in all three groups who were scheduled to undergo the CC procedure, the AEMIE was demonstrated to be the most effective educational module in reducing patient anxiety compared with the RE and instructional DVD education. Patients in the AEMIE group also reported the highest satisfaction with the information and materials received compared with patients in the RE and instructional DVD groups. Given these facts, hospital administrators and nursing educators can use the AEMIE to complement traditional or regular cardiovascular care to enhance patients' understanding of CC procedures.

Relevance to clinical practice

As the AEMIE developed in this study was demonstrated to be effective in informing patients about the CC procedure, reducing their anxiety and increasing their satisfaction with the information and materials received, it can serve as good groundwork for future nursing educators to develop multimedia-based patient education programmes, improve the quality of the information provided and empower nurses in their role of assisting patients with information acquisition regarding CC procedures and other invasive examinations.

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Disclosure

The authors have confirmed that all authors meet the ICMJE criteria for authorship credit (www.icmje.org/ethical_1author.html), as follows: (1) substantial contributions to conception and design of, or acquisition of data or analysis and interpretation of data; (2) drafting the article or revising it critically for important intellectual content; and (3) final approval of the version to be published.

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