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Review

# A systematic review of computer-based softwares for educating patients with coronary heart disease

Eva Beranova [a,1,*], Catherine Sykes [b]

[a] *Division of Health and Social Care Research, King's College London, Capital House, 42 Weston Street, London SE1 3QD, United Kingdom*

[b] *City University, London, United Kingdom*

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**Abstract**

*Objective:* To evaluate the use of computer-based softwares for educating patients with coronary heart disease.
*Methods:* A systematic electronic search for randomised controlled trials and comparison studies published from 1999 to the end of 2005 using the MEDLINE (1999–2005), EMBASE (1999–2005) and CINAHL (1999–2005) was carried out. Articles including the reference lists in the following journals were hand-searched: *Patient Education and Counselling* and *Patient Counselling and Health Education*.
*Results:* A total of 487 articles were identified. Based on a review of abstracts, five studies fulfilled the inclusion criteria of the review. A scoring sheet was used to assess the papers' quality. All studies reported significantly increased knowledge in patients using the educational software when compared to standard education. The difference in knowledge between the intervention and control groups remained high even at 6 months follow up. Furthermore, patients reported high satisfaction with the educational programs.
*Conclusion:* Despite there only being five studies that met the inclusion criteria, this review supports the successful use of computer software to increase knowledge in patients with coronary heart disease. The reviewed articles reveal that computer-based education has an important role in increasing patients' knowledge about their condition.
*Practical implications:* It is commonly reported that patients want more information about their illness. This study shows that computer-based education can be a useful, acceptable to patients and effective way to deliver education about coronary heart disease.


*Keywords:* Patient education; Software; Coronary heart disease

**Contents**



* Corresponding author. Tel.: +44 20 7848 6614; fax: +44 20 7848 6620.
*E-mail address:* Eva.Gordon@kcl.ac.uk (E. Beranova).
[1] Author is currently undertaking Stage 2 Training in Health Psychology at City University (London) whilst working at King's College London.

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## 1. Introduction

Patient education is a combination of learning experiences influencing behaviour changes, producing changes in knowledge, attitudes and skills needed to maintain and improve health [1].

There is an increasing pressure to provide more informed and standardized information resources to patients at less cost and the urgent need to provide structured educational interventions to enhance patients' health behaviour [2]. Improvement in patient knowledge about their illness and treatment could provide great benefits for both patients and their doctors.

Patient education is an important factor in doctor–patient communication. A patient with a greater knowledge is more likely to engage in an active communication with their doctor [3]. Research showed that patients continue to be relatively uninformed about their condition and the appropriate treatment [4]. Receiving information during a medical encounter, evidence suggests that patients do not understand what is being said to them. This has been explained by cultural and educational gaps that exist between clinicians and patients. Kaptein and Wienman [5] found that although patients want more information they ask fewer questions in the consultation room. Encounters between doctor and a patient could potentially be used as a "teachable moment" [6]. However, physicians have little time for health promotion or patient education.

During the last decade, there has been an increase in educational computer-based technology and its use [7]. The benefits for using interactive educational packages are that patients have greater understanding of their condition, which then leads to better communication with the doctor to solve patients' problems [8]. Computerized educational systems, therefore, seem as an ideal opportunity for efficient patient education. This could also be beneficial for both doctors and patients, protecting them from the consequences of poor communication [9].

Evidence shows that educational software can be beneficial for patients and also cost-effective than traditional means of education. Lewis [10] found that the use of technology is associated with improvements in patient satisfaction, better health outcomes, better compliance, more empowered patient decision making, and reduced medical malpractice as primary benefits. She identified 420 titles and 66 of those met inclusion criteria for further investigation. Lewis concluded that computer-based education could be used as an effective strategy for transferring of knowledge and skill development for patients. Favorable results from using computerized educational systems have been reported across a number of health areas.

Davis [11] found that patients with cystic fibrosis reported enhancement in knowledge and coping strategies after using educational CD-ROM.

Similarly, Wantland et al. [12] assessed the effectiveness of web-based versus non-web-based interventions. The web-based interventions compared to non-web-based interventions increased patients' knowledge and also led to behavioural change for outcomes variables, including increased exercise time, slower health decline and increased knowledge of asthma treatment.

### 1.1. Coronary heart disease

The number of people suffering from coronary heart disease (CHD) is on the increase in the industrialized countries. It is a preventable disease that kills more than 110,000 people in England every year. More than 1.4 million people suffer from angina and 275,000 people have a heart attack annually. CHD is the biggest killer in the country [13].

The risk factors for CHD have been well known for many years. The effects of changing the risk factors on the incidence of the disease are well documented. Secondary prevention in terms of the medical treatment of the disease has become effective. Healthy lifestyles and effective management of risk factors also contribute to a better management of CHD. Primary prevention also remains a very important factor in reducing some risk factors, such as healthier diet, smoking cessation and more exercise. Research shows that even a small reduction in cholesterol,



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smoking or blood pressure could have a dramatic effect on the number of deaths every year [14].

Patient education is an important component in the management and prevention of coronary heart disease. Past research shows that patients' beliefs and perceptions about their illness are key determinants of recovery after a myocardial infarction (MI) [15]. Patients who believed that their MI would have more long-lasting consequences had greater levels of illness-related disability and their return to work was slower. Similarly, patients who believed they had less control over their heart condition were found to be less likely to attend cardiac rehabilitation [16]. Education about CHD may be beneficial in changing health cognitions.

Research is beginning to show patient satisfaction for computerized education information. Stromberg et al. [19] found that heart failure patients aged 51–91 years were satisfied with the computer-based information and that they thought that it was a better way of receiving information than reading a booklet or watching a video about heart failure. The nurses reported that the patients were positive towards the computer and seemed to understand the information and that the patient education was less time-consuming, when the patients could seek knowledge on their own.

Given the fast-spreading usage and evaluation of computer-based educational programs, it is time to review the effectiveness of computerized educational software packages for coronary heart disease patients and their potential to increase knowledge in the long term. This will help service providers make decisions about computerized patient education delivery.

## 2. Methods

Computer software was defined as any interactive software that was used by patients for education about coronary heart disease, including CR-ROMs.

This review is based on searching the following databases from 1999 to 2005:

- MEDLINE (1999–2005).
- EMBASE (1999–2005).
- CINAHL (1999–2005).

The year 1999 was used to continue on from Lewis' [10] review of the computer-based approached to patient education.

The search strategy included the following terms:

(i) For the subject heading search, the term 'coronary heart disease' was exploded to include the following subject index terms—'cardiovascular diseases', 'heart diseases'. The subject heading of interactive learning included subject index term 'computer assisted instruction'.
(ii) For the free text search, terms of comput$, evalu$, assess$, effective$, efficacy$, cardiac$, CD-ROM, computer-based education, computer patient education.

Hand searches were carried out in key journals (*Patient Education and Counselling* and *Patient Counselling and Health Education*) and reference lists were also examined. Using this search technique, an article that was published in 1995 was identified [20]. As this article was not covered by Lewis' review [10] and it fulfilled the criteria for this review, it was decided that it should be included in the analysis. After identifying articles that fulfilled the criteria, the authors' names were re-entered into the search databases and crosschecked for any further studies.

Stromberg et al. [21] paper was also included despite it not being published yet. The author was unsuccessful in finding a particular full article that was eligible for this review. She, therefore, contacted the first author who kindly sent the updated version of the study and it was decided to include the most recent one.

The two authors assessed all selected studies independently for quality. A data extraction form was used to include studies in the review, with the maximum score of 20. The form assessed the following: (1) methodological quality of study including the study design (RCT versus comparison), study sample and selection and the measurement of the mode of delivery of a software; (2) intervention including type of comparison (comparison to standard material versus comparison to alternative material) and follow up duration; (3) analysis including the use of appropriate statistical analyses and drop out rates; (4) results and outcomes including the measurement of familiarity with computers, baselines measurements, patient outcomes (objective versus subjective), the measurement of satisfaction with the software and cost-effectiveness; (5) data analysis including analysis of confounding variables.

Abstracts of the 487 articles were read for relevance to the review. Full-text copies of five relevant articles were obtained.

### 2.1. Study selection

Studies were considered suitable for inclusion in the review if they met the following criteria.

#### 2.1.1. Participants

Patients with coronary heart disease involved in studies where software was used.

#### 2.1.2. Interventions

Computerized educational software, including CD-ROMs. The software could have been used by the patient alone or/and with a health professional. In order to be included in the study, the intervention had to be compared to either a standard or alternative materials.

Articles describing computer software that is aimed to educate health professional or students were excluded. Also



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excluded were studies that were descriptive of the functionality of the software and studies that included web-based, email based, or telemedicine based educational programs.

### 2.1.3. Outcomes

All objective measures, regarding the evaluation of the effectiveness of the software, were considered. The main measure for the review was the change in knowledge before and after using the educational software and its comparison to a standard education.

### 2.1.4. Study design

Randomised controlled trials and comparison studies were included. Studies that do not provide adequate information regarding either a change in outcomes or the validity/reliability to the tool were excluded from the review.

## 3. Results

Of the 487 articles, 5 studies fulfilled the inclusion criteria [20–24]. The majority of articles that were excluded concerned software for educating professionals such as nurses or doctors. Some articles used computerized software for collection of information about heart disease education but not for actual education of patients. Articles that concentrated on the description of a development of educational software were also excluded.

The two authors assessed the five articles that met the inclusion criteria. Table 1 gives details about each article.

A scoring sheet was used to assess the papers' quality (see Table 2). The papers were scored on the methodological quality, intervention, analysis, results or outcomes and data analysis. The possible maximum score was 20 points. The reviewers compared their scores. Score were averaged for papers with a difference less than 2. One paper differed by more than one point and the disagreements were resolved by discussion about the discrepancy and the score was adjusted accordingly.

The total quality scores for each paper are listed in Table 1. The highest score is 15 and the lowest one is 12 (out of maximum 20).

### 3.1. Participants

The participants were all adults with coronary heart disease. No differences in age, aetiology, educational level or time of diagnosis were reported by either of the study. Jenny and Fai [23] indicated that some patients were not randomised for the trial, as they were not eligible because they needed to be seen by a specialist nurse first.

Table 1
Summary of review studies

| | *n* | Time points of testing | Measurements | Age group (mean) | Control group education | Mode of delivery | Baselines measurement of knowledge | Drop out rates (intervention group) (%) | Quality scores |
|---|---|---|---|---|---|---|---|---|---|
| Jenny and Fai [23] | 96 | Pre- and post-testing; 2 months follow up | Written multiple choice quiz | 58.8 | Tutorial groups led by health-care professionals with transparency display of keywords and pictures | Group | Yes | 33.3 | 13.5 |
| Linne et al. [24] | 130 | 4 weeks; 6 months | Written questionnaire | 70.4 | Leaflets | Individual | No | 21.9 | 12 |
| Consoli et al. [20] | 158 | Pre- and post-testing; 2 months follow up | Questionnaire; telephone questionnaire | 50.4 | Dialog with health professionals and pamphlets | Individual | Yes | 12.7 | 13.5 |
| Enzenhofer et al. [22] | 112 | Pre- and post-testing; 3 days follow up | Multiple choice questionnaire | 56.9 | Standardized conversation with health professional | Individual | No | 12 | 14.5 |
| Stromberg et al. [21] | 154 | 1 month; 6 months | Knowledge and compliance questionnaires; quality of life questionnaire | 70 | Standard education received at a nurse-led heart failure clinic | Individual | Yes | 12.2 | 15 |

Table 2
The scoring sheet used to assess the quality of the papers

| | Maximum score |
|---|---|
| Methodological quality of study | |
| Study design (RCT = 2, comparison = 1) | 2 |
| Study sample and selection (good sample, well described = 2, good sample, not described = 1, low sample = 0) | 2 |
| The mode of delivery measured (yes = 1, no = 0) | 1 |
| Intervention | |
| Type of comparison (comparison to standard material = 1, comparison to alternative material = 0) | 1 |
| Follow up duration (6 months and more = 4, 3 months = 3, 1 month = 2, immediately after use = 1) | 4 |
| Analysis | |
| Statistical analyses used (appropriate yes = 1, no = 0) | 1 |
| Drop out rate (<25% = 1, >25% = 0) | 1 |
| Results/outcomes | |
| Familiarity with computers measured (yes = 1, no = 0) | 1 |
| Baseline measurements (yes = 1, no = 0) | 1 |
| Patient outcomes (objective = 2, subjective = 1) | 2 |
| Satisfaction with software measured (yes over 70% satisfied = 2, yes less than 70% satisfied = 1, not measured = 0) | 2 |
| Cost-effectiveness (yes = 1, no = 0) | 1 |
| Data analysis | |
| Discussed and analysed confounding variables? (yes = 1, no = 0) | 1 |
| Maximum total | 20 |

### 3.2. Control group

The control groups all used standard education. Jenny and Fai [23] used a 30 min educational session led by health-care professional, using transparency display of keywords and pictures to a patients' group of 8–10 participants. There was also a 5 min of questions and answers. Linne et al. [24] used leaflets for educating the control group. Consoli et al. [20] used standard education consisting of dialog with physicians, nurses and dieticians together with pamphlets. Similarly, Enzenhofer et al. [22] used standardized conversation and a brochure for the control group. Lastly, on follow up visit in a nurse-led heart failure clinic patient received standard education lasting approximately 1 h [21].

### 3.3. Learning

All studies commented on the fact that the computerized programs were easy to use even with elderly patients and with patients who had no previous knowledge of computers. Instructions given by the computer were described as short and easy to read and not containing scientific jargon. Jenny and Fai [23] reported that 85% of the adults in the intervention arm were computer illiterate.

To operate the CD-ROMs, patients used touch screen computers with large and clear buttons for easy handling [21,23], a computer mouse for which a nurse was available to help with its use [20] and a remote control [24].

The patients mainly used the software by themselves [21,23,24], or by themselves with a health professional available to help or answer any questions [20] or with a health professional [22] during which the patients were able to ask supplementary questions. When using the software alone, the patients were given test at the end of each chapter to check their own progress and were encouraged to repeat a chapter to answer all questions correctly [20,21,23,24].

### 3.4. Effect sizes

Effect sizes were computed on the available data (see Tables 3 and 4 for details) using the reported sample sizes, means and standard deviations. Effect sizes equal to or smaller than 0.50 were considered medium and effect sizes equal to or larger than 0.80 were considered large [25].

The overall effect size for the articles included in this review is 1.01. This is considered to be a large effect size. From the five research articles described in this review, four [21–24] had effect size larger than 0.50 and were therefore considered to achieve significant change in patients knowledge on coronary heart disease. This was true for studies that examined the knowledge change immediately after the procedure.

Effect sizes were calculated for the two studies that re-tested their subjects at 6 months after the intervention [21,24]. Even at 6 months follow up, the effect sizes of the two studies were larger than 0.50 and therefore considered to have a large effect (1.88 and 1.01, respectively).

Table 3
Change in the means and standard deviations in the intervention and control groups immediately before and after

| Study | Effect size | Intervention group | | Control group | |
|---|---|---|---|---|---|
| | | Before | After | Before | After |
| Jenny and Fai [23] | 1.13 | 7.25 (1.66) | 9.10 (1.08) | 6.96 (1.35) | 7.54 (1.38) |
| Linne et al. [24] | 0.56 | N/A | 17.2 | N/A | 14.3 |
| Consoli et al. [20] | 0.44 | 14.3 (4.2) | 18.1 (3.6) | 14.3 (4.2) | 16.7 (3.2) |
| Enzenhofer et al. [22] | 0.78 | N/A | 7.21 (1.6) | N/A | 5.04 (2.8) |
| Stromberg et al. [21] | 2.88 | 5.57 | 6.56 | 5.78 | 6.32 |



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Table 4
Change in the means and standard deviations in the intervention and control groups at 6 months follow up

| Study | Effect size | Intervention group | | Control group | |
|---|---|---|---|---|---|
| | | Before | After | Before | After |
| Linne et al. [24] | 1.01 | N/A | 17.6 | N/A | 12.9 |
| Stromberg et al. [21] | 1.88 | 5.57 | 6.34 | 5.78 | 6.07 |

### 3.5. Satisfaction with the software

Three authors reported that the patients preferred the software to standard education methods [21–23]. Patients reported that the use of the software made learning more interesting, it supported self-paced learning and that it allowed more in-depth understanding. Positive comments were also made about the design and illustrations of the software tools [23]. Patients in the intervention group scored high on the satisfaction scale [22].

### 3.6. Age

Although the mean age in two studies was over 70 years (and over 50 years in the others), all patients were able to handle the software. Jenny and Fai [23] concluded that their software was suitable for elderly subjects as they enjoyed using the touch screen instructions. Stromberg et al. [21] pointed out that the handling of their CR-ROM was specifically designed with elderly patients in mind.

### 3.7. Gender

Consoli et al. [20] reported that women improved more than men on the knowledge test but this could have been due to their lower knowledge at the initial. Both men and women in the intervention group reported to have gained knowledge at 1-month follow up and a small decline in knowledge was noticeable at 6 months [21].

### 3.8. Drop out rates

The drop out rates varied from 12 to 33%. Drop out rates are described in detail in Table 1.

Jenny and Fai [23] believe that people who were lost to follow up at 6 months, nevertheless benefited from the initial educational training (either computer or standard) and that this lead to positive changes in their health and that they felt that they did not need further follow ups.

### 3.9. Knowledge

All authors reported increased knowledge after using either standard or computer-based education. However, the difference in knowledge was significant in the intervention groups compared to the control groups.

The difference in knowledge between the intervention and control groups remained high even at 6 months after the intervention [24]. The knowledge compared to the baseline was significant only in the intervention group [21].

The impact of increased knowledge on hospital admissions is not known.

### 3.10. Confounding variables

Authors reported several confounding variables. Although there had been an increase in knowledge in both groups, it is difficult to know whether this difference existed at the beginning of education. Jenny and Fai [23] believe that randomisation should have minimized this discrepancy. They also argue that in the patients in a pilot study scored low on knowledge pre-test. Similarly, no great improvement in compliance could have been explained by already high baseline level [21].

There might have been an unintended influence on the patients in the control group by the staff [23]. The authors described that after the educational session for the control group, there was time for questions and answers. This could have increased the group knowledge in a non-standard manner. In contrast, in the study conducted by Stromberg et al. [21], all participants received the same nurse-led education after which the intervention group used the computer for further education. Consoli et al. [20] also reported that a nurse could have influenced patients in the intervention group simply by their high enthusiasm and motivation.

### 3.11. Patients' empowerment

The software was reported to improve the doctor–patient communication [22]. It was observed that patients from the intervention group were asking more questions. This was especially true for patients with little knowledge of medicine. Computers helped patients to clarify and express their values and preferences, and this was true even if the physicians' values and preferences were different [22]. This finding is an interesting one in terms of patient empowerment. Knowledge in this case has led to patients' courage to ask questions about their condition. Patients and physicians will be able to make informed decisions about health matters. Further research is needed to establish exactly what role can computers play in this development.

## 4. Discussion and conclusion

### 4.1. Discussion

Although we only have data from five studies, this review demonstrates that computer software has the potential to be successfully used to increase knowledge in patients with coronary heart disease. It seems that computer-based



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education has an important role in increasing patients knowledge about their condition. Increases in knowledge are important for several reasons. Past research shows that knowledge is an important in effective disease management and is associated with increased self-efficacy [26]. Knowledge alone is not sufficient to produce changes in behaviour, however it appears to be a necessary component in the change process [27,28]. Stromberg et al. [21] could not detect any improvement in compliance with self-care and treatment. They believe that there is need for the computer education to be repeated in order to achieve behavioural change. Keeping in line with the current research [10], they also suggested that patient-tailored education is needed for greater effectiveness.

There are several advantages of using the computerized educational programs. Patients are allowed to study at their own pace, which means that this type of education is suitable even for people with lower educational level. In some studies patients were able to repeat difficult parts and interact with the content of the program [21,23]. This is useful for patients with different learning pace. Patients reported satisfaction with the software and its easiness to use. Computers were not found to be an obstacle for the interaction between the professional and the patients. It is believed to have improved the communication [22].

Enzenhofer et al. [22] reported that the advantages of running the software from a laptop is great as it could be brought to patients' bedside and help them to get the necessary knowledge about their condition. This can then subsequently help with patients' empowerment. Some worries were raised concerning the fact that by visualization of their condition could lead to raise patient's anxiety [29] but this was not found to be the case but does warrant further investigation. Similar findings were reported by Stromberg et al. [21].

There are also advantages to the standard education. In particular tutorial groups can give patients peer support and interaction [23]. Patients may prefer to be able to meet and discuss their problems with people who suffered similar problems. They might exchange their personal views and opinions on the illness. In the tutorial group, there is also time for questions and answers and this could highlight areas that might not have been covered in the actual training and it was suggested that computer education should be used alongside the tutorial method [23].

One needs to be careful in interpreting the results of this study. Gender imbalance (inadequate representation of women in particular) in research is widely reported in previous research [30]. Also, well recognised is the under representation of people from ethnic minorities and from low socio-economic groups [31]. Therefore, the results of the above review might reflect this imbalance. The future use of educational software must ensure that there is a fair distribution to all those who need them in particular people from disadvantaged groups.

It is commonly recognised that patients want more information. However, increase in knowledge does not necessarily mean increase in issues that are important for successful management of a disease or a behavioural change.

### 4.2. Conclusion

There is strong evidence that the use of computer-based educational software improves knowledge in patients with coronary heart disease in the short term. The reviewed articles were very positive about using the computers for educating patients, given the patients' satisfaction and increase in knowledge about their condition. Only two papers reported outcomes at 6 months, therefore it is recommended that more research is needed to assess the longer-term impact of computerized education for CHD patients.

### 4.3. Practice implications

Computers are useful and well-received tool in coronary heart disease education. The age of the patient did not influence satisfaction in the studies in this review. Thus, suggesting that computerized education is appropriate for all age groups. Given that some patients may prefer the benefits of being able to ask questions or may become anxious by the visual graphics used by computer, patients should be given a choice about the usage of only receiving education from a computer. Future programmes should also consider adding a function to give patients immediate answers to their questions.

I confirm all patient/personal identifiers have been removed or disguised so the patient/person(s) described are not identifiable and cannot be identified through the details of the story.

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