

Efficacy and Usability of an E-Learning Program for Fostering Qualified Disease Management Nurses

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Abstract

In order to train nurses to perform disease management and telenursing, we developed an e-learning education program, and assessed the efficacy. A single-group pre-test and post-test design was used. Nurses who worked at a medical institution or a disease management company were included, and the duration of the program was set 2 months. We developed the program so that it could grow attitude and improve knowledge and skills in disease management and patient education. Of 55 subjects, 48 who completed the program were analyzed. After the program, subjects increased knowledge and interests in disease management and patient education. Almost of the subjects answered that e-learning was a good learning method. Our program was effective at enhancing subject's interests in disease management and patient education, and considered to improve their skills in the future.

Keywords

E-Learning, Education Program, Disease Management, Telenursing

1. Introduction

With the change of disease composition, the healthcare system in the world has been required to change the targets from infectious diseases to non-infectious diseases (chronic diseases). However, since the structural reform has not caught up the change, there are unmet needs for chronic disease care, resulting in disease worsening and medical expense increase [1]–[3]. The situation is the same in Japan, and to solve this problem, in 2013, the government obligated all health insurers to carry out a data-health project aimed at improving health in their insured people and keeping reasonable medical expense [4]. Before this motion, we put into practice a new model that provided chronic disease care based on the disease management methodology in Japan. These programs were effective at preventing disease progression in patients with chronic illnesses and may contribute to the containment of medical costs [5]–[11]. Disease management was an outcome management method that was proposed early by the Disease Management Association of America, in order to properly allocate limited medical resources and provide high-quality healthcare with containing medical expense [12]. Disease management includes the following factors: 1) identification of a target population, 2) provision of standardized medical treatment and patient education based on evidence-based clinical practice guidelines, 3) interprofessional collaboration, 4) analysis and evaluation of outcomes and processes, 5) feedback to health care professionals and patients [13]. In disease management, we considered that nurses were the best players because they were good at arranging with professionals and services and specialized for patient education. Therefore, we have fostered disease management nurses (DM nurses) who perform disease management. Furthermore, we also considered that in order to provide care widely, the nurses should obtain the ability of practical telenursing that allowed them to communicate with people in remote areas and contain healthcare expense. Therefore, we set up a program for fostering disease management nurses using electronic learning (e-learning) on disease management and patient education for patients with a chronic disease (e-education for DM nurses). We developed our program using e-learning, because we considered that e-learning could be a good way for nurses to learn at their own pace at workplace or home and that it could ensure the number of disease management nurses nationwide and guarantee their quality. Regarding the efficacy of e-learning for students, several articles reporting e-learning education used in nurse training faculties and they mentioned that e-learning was not inferior to the traditional face-to-face education in improving subject's knowledge and their practical ability as well as their satisfaction [14] [15]. Also, for the registered nurses, there are many articles reporting that education using e-learning resulted in improvement of subject's knowledge and skills [16]–[18]. These reports used themes such as diseases and nursing skills, and there has been no study on the theme of acquiring comprehensive ability including disease management and patient education. In addition, although it has been reported that patient education that is structured based on theories and evidences can improve outcome [19]. However, no study has shown the process of developing e-learning on improving the ability of patient education, and incorporated theories.

Therefore, in this study, we developed the e-learning education program on nurses who implemented disease management in order to foster comprehensive ability integrating knowledge and skills of disease management, patient education, and behavior modification. Then, we assessed the efficacy and the operability. If we can assure the quality of disease management nurses above a certain standard, it would guarantee the quality of disease management project in Japan.

2. E-Education for DM Nurses

2.1. Program Structure, Themes, and Goal Setting

The program structure is shown in **Figure 1**. Based on the classification of educational objectives proposed by Bloom *et al.* [20], we incorporated three dimensions of attitude, knowledge and psychomotor skills as the frameworks. The goal of our program was to “train generalist nurses to perform chronic disease management and telenursing” and generalist nurses were defined as nurses who had graduated from a basic nursing education course (professional school or university undergraduate education) and had clinical experience.

For the program structure, we selected outlines of disease management (including health assessment/nursing process), knowledge about characteristics of chronic diseases that are keys for disease management, care coordination, communication and quality management as the 5 themes. As “disease management”, we included items such as definition and structure of disease management, program-developing process, evidence based medicine, patient education (including cognitive behavior therapy), and care triangulation (Emic: subjective

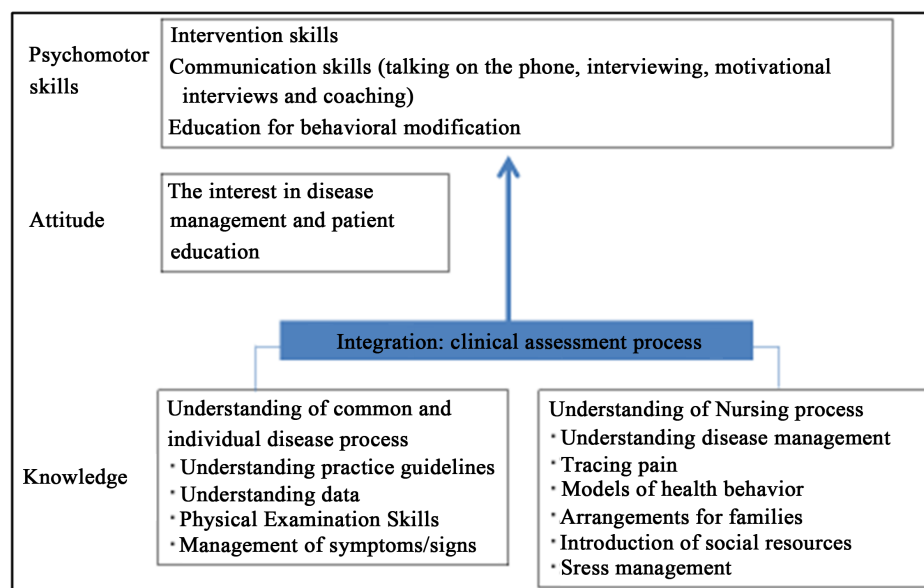


Figure 1. The structure of education program.

approach taking into account Illness Narrative and Etic: objective approach taking into account data based on evidence). For the developing process, we built it up to follow the same course as nursing process that goes thorough comprehensive health assessment on patient's disease and risk factors from the physical, mental and social aspects, intervention, evaluation and feedback. For "knowledge of disease characteristics", we included diseases with a high incidence, *i.e.* metabolic syndrome, diabetes, diabetic nephropathy, ischemic heart disease, heart failure and stroke, and constructed the contents for the disease, diagnosis, standard treatment, medical care management and management goals and patient education, based on practice guidelines [21]-[25]. Furthermore, we included detailed contents to support acquiring self-management skills. For "care coordination", we defined that it was to assess needs of medical resources, support the patient and their family's decision making, and coordinate multidisciplinary collaboration. Therefore, in addition to skill of stratification, we educated on methods to assess medical resources and create medical and local collaboration, methods and skills of care coordination, and methods to support families as a care unit. For "communication", we educated on skills required for patient education, communication with physicians and telenursing. As skills required for patient education, the motivation interview methods, coaching, cognitive behavior therapy and behavior change skills were included [26] [27]. For "quality management", knowledge and skills required as research nurses (mainly, data monitoring, data management and personal data protection) and utilization of IT systems were included. Finally, as a summary of these lectures, we used videos illustrating physical examination and patient education techniques, such as the techniques for actual interviewing and telenursing (role play with simulated patients), for motivation interview methods, for management of diseases.

2.2. Development of E-Learning

Characteristically, e-learning is a way to learn subjectively, individually and repeatedly at learner's own pace, with enjoyment and easy understanding using senses of vision and hearing as well as a way to acquire the decision-making ability by following thinking process of experts in special fields [28]. We prepared lectures of 20 to 80 minutes for each theme and if the duration was longer than 20 minute, we divided it by 20 minutes, so that subjects could learn easily and repeatedly at their own pace.

For each theme, physicians and nurses specialized in the field, nurses specialized for managing chronic diseases, nurses certified for motivation interview, specialists for behavior change, physical therapists for exercise therapy and nutritionists for diet therapy performed the lecture. In the part of role play, nurses specialized for chronic disease management actually demonstrated. The screen layout of e-learning consisted of movies showing teachers giving their lecture and learning materials simultaneously.

2.3. Evaluation Tests

For individual themes, we set 10 yes-no questions based on the lecture to evaluate acquisition levels of learning.

3. Methods

3.1. Subjects

Nurses who worked at an acute-care hospital or a disease management company, and agreed to participate in the study. Clinical experience should be at least 3 years and those who were during the postpartum period or the childcare leave could be included. We did not consider the specialized area of working and the level of basic education (university (undergraduate, graduate) or professional school). Exclusion criteria were assistant nurses, midwives, nurses in manager positions (director of nursing, assistant director, ward manager).

3.2. Period of Analysis

April-December, 2014.

3.3. Research Design

A single-group pre-test and post-test design was used.

3.4. Primary and Secondary Endpoint

Evaluation indicators were set with reference to the classification of education targets [20]. In the classification, it is considered that most behaviors that arise from learning results involve 3 domains, *i.e.* “the cognitive domain” associated with acquiring knowledge, understanding and developing intellectual abilities, “the emotional domain” associated with developing interests, attitude and sense of value as well as emotion, proper judgment and adaptability, and “the psychomotor domain” associated with technical skills and motor skills. In addition, it is also considered that the emotional domain is corresponding to results from developing the cognitive domain. Based on this, learning effects were measured for the 3 domains, while we operationally defined the cognitive domain as “subjective evaluation on acquiring knowledge about disease management/patient education”, the emotional domain as “interests in disease management and patient education” and the psychomotor domain as “acquiring skills in patient education” and used them as primary endpoints for education effects. The scales to measure achieved level of each domain were prepared as follows by researchers using Likert scale (Table 1).

Secondary endpoints were test scores evaluating acquired knowledge of each e-learning theme. For each subject, the average score was calculated for each theme.

In addition, for the program operability, subjects were asked to evaluate 1) the duration of e-learning (20-minutes sessions), 2) the numbers of themes and subthemes, 3) easiness of taking the program, 4) acceptance as a learning tool, in likert scale of 3 or 4 grades and also they could comment voluntary for the items.

3.5. Data Collection

Scores for the emotional domain, the cognitive domain and e-learning tests were obtained from subjects. The score for the psychomotor domain was obtained by research assistants who evaluated skills of subjects performing patient education on an actual setting. The research assistants only performed the evaluation and were not involved in analysis. As the schedule for data collection, scores for the emotional domain and the cognitive domain were collected at 2 time points before and after the program. Because we considered that it needed a lot of time to learn skills for disease management and patient education, scores for the psychomotor domain were collected at 1 time point after the program. Scores of e-learning tests were obtained when the subjects answered tests before and after completing each theme. Evaluation of the program was obtained at the end of the program.

3.6. Recruitment and Registration Procedures

Nurse managers who agreed to support this study introduced nurses who met the eligibility criteria. The researchers explained them about the objectives and contents of this program orally and in written form, after that obtained a written consent.

Table 1. Scales for evaluation of the emotional/cognitive/psychomotor domains.

Domain	Item	Point	Item number	Score range
Emotional domain (interest)	Interest in disease management			
	Challenges for disease management			
	Disease management is a skill that helps my career as a nurse	1: not interested - 4: interested	5	5 - 20
	Education for noncompliant/non-adherent patients			
	Confidence to change behavior of noncompliant/non-adherent patients			
Cognitive domain (knowledge)	Disease management			
	How to apply evidence-based medicine to clinical practice			
	Pathophysiology of diseases			
	Treatments for diseases			
	Examinations for diseases			
	Self-management education			
	Outline of care coordination	1: not understood - 4: understood	13	13 - 52
	Care coordination: stratification skills			
	Care coordination: healthcare collaboration/local cooperation			
	Care coordination: necessary healthcare resources			
	Patient education			
	Cognitive behavioral therapy/cognitive behavior theory			
	Study method: study design, data management			
Psychomotor domain (skills)	Health assessment (incl. physical examination): 18 items			
	Patient education in self-management for behavioral change: 11 items			
	Tele-communication skills: 7 items	1: not achieved - 4: achieved	46	46 - 184
	Communication with physicians: 5 items			
	Attitude and manner as a professional: 5 items			

3.7. Program Implementation

We gave URL of the e-learning education program to subjects who agreed, and explained how to take the program and that they should complete the program within about 2 months from the enrolled day. We also told that they could take the program at any time and any place they wanted. In addition, from the view point of protecting intellectual property, we obtained a written consent to promise proper handling of the program URL.

3.8. Method of Analysis

To compare indicators over time, we used the t-test or the Wilcoxon signed-rank test, and the significance level was set at $p < 0.05$. Comments answered voluntarily were summarized inductively.

3.9. Ethical Considerations

Approval was obtained from the ethics committees of Hiroshima University. The researchers explained to subjects about the purpose of this study, learning content, data collection, confidentiality, how the results would be published, and that they would be free to withdraw. Subjects gave a written consent.

4. Results

4.1. Outlines of Subjects

Among 55 nurses who agreed to participate in the study, 48 completed the e-education (the completion rate: 87.3%). Seven nurses dropped out the e-education because they were too busy with their work or care giving.

As basic characteristics of subjects, there were 45 females (93.8%) and 3 males (6.2%), and 30 subjects (62.5%) had graduated from a nursing school/a junior college (3-year course), 16 (33.3%) had graduated from a 4-year college, while 2 completed a graduate school as their last academic record.

4.2. Efficacy of E-Learning Program

1) Changes in scores for cognitive domain and emotional domain/ scores for psychomotor domain

Changes in scores for the emotional and the cognitive domains over time and scores for the psychomotor domain are shown in **Table 2**. Scores for the cognitive and the emotional domains were significantly increased after program ($p < 0.01$).

2) Changes in test scores for each theme of e-learning

Changes in scores for each e-learning theme before and after completing the theme are shown in **Table 3**. For all the items, scores were significantly increased after e-learning ($p < 0.001$). Especially, scores for knowledge about disease characteristics rose higher than else scores.

Table 2. Scores for the three domains.

		Mean \pm standard deviation		N = 48
	n	Before e-learning	After e-learning	p value
Cognitive domain	48	27.5 \pm 4.5	38.9 \pm 5.0	<0.001***
Emotional domain	48	15.6 \pm 2.5	16.7 \pm 1.9	0.001**
Psychomotor domain	19		128.0 \pm 17.9	
Wilcoxon signed-ranks test				

** $p < 0.01$, *** $p < 0.001$.

Table 3. Scores for each e-learning theme.

		Mean \pm standard deviation			n = 48
Theme	Sub themes	n	Before e-learning	After e-learning	p value
Disease management		44	7.2 \pm 0.9	8.6 \pm 1.0	<0.001***
	Metabolic syndrome	42	7.1 \pm 0.8	9.1 \pm 0.9	<0.001***
Knowledge about disease characteristics	Diabetes	41	6.9 \pm 0.8	9.1 \pm 0.8	<0.001***
	Diabetic nephropathy	40	6.8 \pm 1.1	9.0 \pm 0.7	<0.001***
	Ischemic heart disease	43	7.8 \pm 0.9	9.3 \pm 0.9	<0.001***
	Heart failure	44	6.7 \pm 1.2	8.8 \pm 1.2	<0.001***
	Stroke	43	7.8 \pm 1.2	9.2 \pm 0.8	<0.001***
	Self-management skill education	43	6.7 \pm 1.5	8.8 \pm 1.4	<0.001***
Care coordination		45	7.1 \pm 1.0	9.0 \pm 0.9	<0.001***
Communication		37	7.3 \pm 1.0	9.1 \pm 0.8	<0.001***
Mean score for all tests		32	7.1 \pm 0.8	9.1 \pm 0.6	<0.001***
t-test					

*** $p < 0.001$.

4.3. Evaluation on Program Operability by Subjects

Evaluations on the program operability by subjects are shown in **Table 4**. As a learning method, 47 subjects (97.9%) rated e-learning as “good” or “relatively good”. Regarding the easiness of taking a course, 40 subjects (85.5%) rated e-learning as “easy” or “relatively easy”. There were 7 subjects (14.6%) who rated as “difficult to take” mainly because “it was difficult to write down contents and I wanted a text” or “I want to know my course record and past test results”.

Regarding the duration of e-learning, 25 subjects (52.1%) rated as “appropriate” and other 22 (45.8%) rated as “too long”. For the numbers of themes included in the e-learning, 14 subjects (29.2%) rated as “appropriate” and 34 (70.8%) rated as “too many”. Those who replied that the duration of e-learning was “too long” or that the number of themes included in e-learning was “too many”, also described “since the course was divided into short sessions, it was easy to focus on, but it is too hard to complete the all sessions within the term.”

As voluntary comments, we had some distinctive answers, e.g. the learners said that they could repeatedly learn about disease management based on evidence, and they thought that they understood the processes of patient education and could utilize it in the practice.

5. Discussion

5.1. Operability of Program

Among the subjects, 97.9% replied that e-learning was a good learning method, and 85.5% replied that it was easy to take, which indicates a high evaluation for the program quality. In addition, the completion rate of the program was 87.3% and all subjects who stopped the program did so because they were too busy. In this study, taking into account the operability, we set the time frame at 2 months. However, since some subjects commented in program evaluation that they felt it as a burden to complete the whole program within the limited time, the operability may be improved if we set a longer time frame.

5.2. Efficacy of Program

Telenursing is a concept that was defined by the International Council of Nurses in 1998, and there have been various reports abroad and in Japan on improvement of disease management and containment of healthcare expenses by telenursing in patients with a chronic disease [29]–[33]. ICN states that the skill of telenursing is a tool to perform nursing process including assessment, diagnosis, planning, exercise and evaluation for patients, and that the ability to perform nursing process as well as development of partnership influence the quality of telenursing. In addition, in order to perform disease management, not only evidence-based patient education but also the abilities to support practice and collaborate with other professionals are required [34]. We developed our learning program to train and evaluate nurses so that they could acquire knowledge and skills related to them.

The subjects of our program increased scores of e-learning for the emotional domain (interests in disease management and patient education) and the cognitive domain (subjective evaluation on acquiring knowledge about disease management and patient education). Also, for the psychomotor domain (patient education skills),

Table 4. Evaluation of the program by the subjects.

	N = 48 n (%)			
Overall view of e-learning	Good 25 (52.1)	Relatively good 22 (45.8)	Not so good 1 (2.1)	Bad 0 (0.0)
Easiness of e-learning	Easy 33 (68.8)	Relatively easy 8 (16.7)	Difficult 7 (14.5)	
Duration of e-learning	Too long 22 (45.8)	Appropriate 25 (52.1)	Too short 1 (2.1)	
Themes included in e-learning	Too many 34 (70.8)	Appropriate 14 (29.2)	Too few 0 (0.0)	

we set items that could evaluate skills required for face-to-face and telenursing patient education. However, the evaluation for the psychomotor domain was made only after the program. Although there is the limitation of the study, we consider that since we achieved our intended results, the program was structured appropriately.

Knowls stated that in adult learning, it is important to utilize their own experience as abundant learning resources and to show how to apply them in the practice [35]. Also, there were voluntary comments by subjects such as “I could learn by comparing with my actual experience” and “I would like to make good use in everyday practice”, and these comments indicate that they could learn deeply using their own experience and that they could obtain some suggestion for the actual practice. Therefore, we consider that repeated learning using experience and contents along with thinking process of experts based on the practice were effective.

Furthermore, it has been reported that in chronic disease management, education to improve patient’s ability of self-management is most effective in improving patient’s outcome [19] [36], and it is essential for disease management. To understand how the intervention by nurses who enhanced their skills in patient education after our e-learning program could improve outcomes in patients with a chronic disease, it would be necessary to conduct further investigation.

6. Limitations of the Study and Future Challenges

As the design of our study, we performed tests before and after only in an intervened group and did not set a control group, because the nurse administrators of the facilities desired that all nursing staff needed to learn the skills. Also, the evaluation term was short with 2 months, but it is considered that in order to evaluate skill acquisition, a longer term for before-after evaluation and comparison was necessary. However, the positive result from this study suggests that further investigation with a controlled comparison and a longer-term evaluation may demonstrate more valuable results.

7. Conclusion

We carried out a nurse training program using e-learning on disease management and patient education, and it improved subject’s knowledge and interests. We consider that knowledge enhancement through e-learning and learning along with the process of patient education can contribute to improvement of patient education skills.

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