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Effectiveness of multimedia interactive patient education on knowledge, uncertainty and decision-making in patients with end-stage renal disease

Chou-Ping Chiou and Yun-Chen Chung

Aim. This study tested the efficacy of a multimedia interactive DVD as an education tool for patients with end-stage renal disease in terms of enhancing patient knowledge and decision-making skills and decreasing uncertainty.

Background. End-stage renal case numbers in Taiwan are growing by approximately 6000 new patients per year. Helping patients choose an optimal treatment method to maximise quality of life is an important healthcare issue for this patient population.

Design. This study adopted a quasi-experimental design and focused on subjects being treated at one medical centre in southern Taiwan. The study divided subjects into experimental and control groups.

Methods. The experimental group received three multimedia interactive DVD nursing–guided interventions. The control group received only normal hospital health education. The study gathered data using several scales addressing knowledge, uncertainty perception and decision regret. Scales were implemented immediately before and after the multimedia interactive DVD nursing guidance intervention and at four and eight weeks postintervention. This study used an independent *t*-test, chi-square test and repeated measures analysis of variance.

Results. This study found significant improvements in the experimental group in terms of knowledge, pre-dialysis uncertainty and decision regret. Experimental group subjects scored particularly less in terms of decision regret than those in the control group.

Relevance to clinical practice. This study demonstrated the efficacy of the developed multimedia interactive DVD in significantly improving end-stage renal patient knowledge and reducing patient uncertainties and postdecision regret. Study findings can be used as a reference guide for clinical nursing education efforts in hospital and other healthcare settings.

Key words: decision regret, decision-making, end-stage renal disease, interactive multimedia DVD, knowledge, patient education, uncertainty

Introduction

End-stage renal disease (ESRD) is a chronic disease for which there is currently no cure. Official statistic noted that there were 50,074 patients in Taiwan receiving renal replacement therapy in 2007. Owing to the long-term nature of dialysis therapy, medical staff have a responsibility to help patients choose an appropriate therapy regimen to sustain life quality. Uncertainty can affect patient medical choice making and increase the possibility of regret afterwards, which can have a negative impact on subsequent quality of life (Fox & Kohn 2008). Wenger (1995) indicated providing proper

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professional knowledge and information as the optimal approach to helping reduce patient uncertainty regarding their medical options. Patient education is a critical component of nursing quality. The paucity of research to date on the efficacy of using interactive multimedia DVDs in patient education provided the main motivation for this current research. This study was thus designed to study the results of using an interactive multimedia DVD to deliver relevant medical information to patients quickly and effectively. This study used advanced interactive patient education tools in a convenient DVD format to provide patients relevant dialysis information, hoping the two-way communicative teaching approach would help patients with ESRD choose an optimal remedy and avoid uncertainty and nervousness.

Background

The three principal renal replacement therapies today include haemodialysis (HD), peritoneum dialysis (PD) and kidney transplantation (Landreneau & Ward-Smith 2006). Despite the strong benefits of kidney transplantation, healthy kidneys are difficult to obtain. Thus, most patients with ESRD rely on dialysis to sustain their lives. HD and PD are the main dialysis approaches currently used by patients with ESRD. A priority, therefore, must be to help patients choose an optimal dialysis regimen based on individual needs and expectations. O'Connor (1999) argued that the lack of relevant knowledge of dialysis can lead to conflictive feelings in patients with ESRD leading to uncertainty and frustration. Decision-making and cognitive judgment correlate with level of education, and a lack of relevant disease information can impair a patient's judgment (Hall 2002). Therefore, having abundant knowledge and techniques facilitate patients to engage in self-observation, recognise and distinguish disease symptoms, enhance abilities to self-care, evaluate and choose optimal treatments (Lowrie *et al.* 2003, Tweed & Ceaser 2005). McCormick (2002) indicated that the uncertainty faced during therapy/treatment decision-making came mostly from a lack of relevant disease knowledge and that such uncertainty will directly influence individual decision-making, increase the possibility of regret and impact life quality later on. Therefore, in the face of patient uncertainty owing to insufficient knowledge regarding their condition, medical staff should provide timely and relevant treatment information to relieve treatment decision-making uncertainty and anxiety (Mishel *et al.* 1991).

Decision-making is a complex process of explanation, sequential thinking and sorting out resources undergone when confronting problems. It is also a kind of activity that can be accomplished only after a multiple-step process of research and discussion. Relevant information and resources must be obtained before a patient can determine next steps and identify possible sources of help to reduce decision-making uncertainty and avoid postdecision conflict and regret (Murray *et al.* 2001). Whittaker and Albee (1995) indicated that, during the therapy decision-making process, patients evaluate their own priorities such as whether the patient wants to maintain his/her former lifestyle, maintain autonomy, acquire self-care abilities and basic resources before starting dialysis and assess the potential negative impacts of the therapy selected. Gorden (2001) explored the factors that influence ESRD patient dialysis choices and found one reason to be dialysis knowledge. Allowing patients to see the two dialysis processes, Gorden (2001) also noted, can help patients choose their optimal dialysis therapy. Interaction between patients and professional caretakers, i.e. education, is critical to decision-making, helping patients to clarify their understanding of issues, increase knowledge and minimise the potential of making therapy decisions based on 'gut' feelings (Benbassat *et al.* 1998). Orsino *et al.* (2003) explored the relationship between the knowledge and dialysis decision-making and found a significant relationship. Most research on correlations have found providing patient education to be helpful for patients in terms of value clarification, knowledge promotion, decision-making, stress and uncertainty reduction and postdecision satisfaction (Pierece 1996, O'Connor 1999, O'Connor *et al.* 1999, Murray *et al.* 2001). Lim *et al.* (2005) applied interactive multimedia to the teaching of health knowledge to help patients select their preferred therapy. They found that multimedia teaching both enhanced patients' disease knowledge and effectively helped patients chose their optimal therapy option. Kohlmerier *et al.* (1997) and Rosser *et al.* (2000) indicated that diversified teaching using interactive multimedia can avoid the need for repetitive instruction while enhancing patient education efficacy. Multimedia computer teaching systems permit learners to select learning content based on need and level and allow repetitive viewing without time limitations (Krouse 2001). Some studies have pointed out that dynamic interactive multimedia DVDs can enhance learning efficacy (Stanford *et al.* 1996, Stern *et al.* 2001). Block *et al.* (2000) illustrated that using interactive multimedia health education DVDs can help promote patients' knowledge and stimulate thinking. Therefore, independent interactive patient education multimedia DVDs can address patients' unique learning requests, help them choose their optimal dialysis option, relieve uncertainties and increase satisfaction with nursing care and patient education.

Prior to this study, Taiwan had no interactive patient education multimedia DVD designed to deliver predialysis

education to patients. The authors thus developed a set of guidelines for interactive patient education multimedia DVDs focused on enhancing patient knowledge and informed decision-making, reducing stress and uncertainty. This study explored the effects of using an interactive patient education multimedia DVD on ESRD patients' knowledge, uncertainty and therapy decision-making.

Methods

Pilot study

Preresearch used a quasi-experimental design with purposive sampling on subjects recruited mainly from amongst kidney disease outpatients being treated at one medical centre in southern Taiwan. Twenty subjects were enrolled in the experimental and control groups, respectively.

The preresearch was designed to estimate the testing duration of the formal research, identify potential problems in the formal research, pretest the questionnaire, evaluate potential problems in researching the patient education DVD and test instrument scale reliability. Reliability was assessed by testing scale coherence and the test–retest reliability. Five experts assessed scale validity. Finally, the sampling quantity necessary for the formal research project was deduced and estimated using pretest results.

Design

Research used a quasi-experimental design and purposive sample recruited mainly from amongst kidney outpatients and inpatients being treated at one medical centre in southern Taiwan.

Subjects and procedure

The sample size was inferred from preresearch results. The authors invited 30 patients for experimental group and 30 for control group (total sample: 60 patients). Qualifications included the following: (1) patient's absolute indication is within the standard set by the Bureau of National Health Insurance using the glomerular filtration rate (eGFR) < 5 ml/min per $1 \cdot 73$ m^2 and *serum creatinine* (Cr.) > 8 mg/dl or a relative indication of eGFR ≤ 15 ml/min per $1 \cdot 73$m^2 and Cr. > 6 mg/dl, (2) physician diagnosis of ESRD with prescribed dialysis, (3) no prior dialysis record, (4) over 18 years of age with healthy basic visual and auditory functions, (5) no serious cognitive injury and (6) agreement to join the research using signed informed consent.

Following researcher explanation to the patient of the research study and patient verbal confirmation of interest to participate, the researchers then had the patient sign an informed consent form and demographic data questionnaire during that patient's next return visit to the medical centre. Those assigned to the experimental group were guided to a private cubicle to view the prepared DVD. Those assigned to the control group were provided the normal patient education handout. Before commencing patient education, all subjects filled out questionnaires designed to test knowledge of relevant diseases and assess the subject's level of uncertainty. Experimental group subjects took the post-test for knowledge of relevant diseases and level of uncertainty immediately after using the DVD. In addition, experimental group subjects received telephone follow-up calls three times during each two-week period. The authors also took the post-test to test their knowledge of relevant diseases and level of uncertainty immediately after nursing guidance. Testing outcome coordinates included baseline, immediate post-test, four weeks post-test and eight weeks post-test. The authors also administered a therapy decision regret scale at four months post-test.

Measures

1 Personal demographic data: including the subject's gender, age, occupation, education, marriage status, religion, main caregiver, having a computer (PC) at home or not, frequency of contact with PCs and familiarity with PC operation and the last blood test including blood urine nitrogen (BUN) and creatinine.

2 Scale of knowledge: This scale was used to evaluate the patient's relevant disease knowledge, dialysis modalities and items that should be tracked over time. The scale mainly applied a dichotomy response (e.g. right/wrong), but to prevent patient guessing, the researchers added the choice of 'I don't know' as well. There were 20 questions in total with a total possible score ranging from 0–20. The higher the subject's score, the more knowledge he/she was presumed to possess. The scale content validity index (CVI) was measured at $0 \cdot 93$. The Kuder-Richardson 20 (KR-20) for the preresearch was $0 \cdot 76$, and the intraclass correlation (ICC) was also $0 \cdot 76$ at a one-month retest.

3 Scale of uncertainty: The scale used to evaluate feelings of uncertainty in patients with ESRD included 13 questions with answers given on a five-point Likert scale. Scores ranged from 35–65, and the higher the score, the more the uncertainty exhibited. The content validity index (CVI) for this scale was $0 \cdot 95$. The Cronbach's α was $0 \cdot 89$, and the ICC was $0 \cdot 86$ at one-month retest.

4 Decision-making regret scale: Permission from the scale developers Brehaut *et al.* (2003) was received to translate the scale into traditional Chinese. The questionnaire was translated and back-translated. The questionnaire included five questions scored on a five-point Likert scale. The range of total possible scores was 0–100, with a higher score indicating a higher level of patient regret. The Cronbach's α was 0·92, and CVI was 0·95 for the Chinese version scale.

5 Interactive patient education multimedia DVD: Researchers developed DVD content based on a literature review and applied clinical experience and a content review conducted by two kidney specialists, a head nurse and a dietician. DVD content was produced in cooperation with a professional software developer.

Ethical considerations

The ethics committees of participating hospitals approved this study, and prior to data collection, researchers discussed research purpose and procedures with invited patients. Those who agreed to participate signed a consent form before being formally enrolled as a study subject. The study guaranteed the confidentiality and anonymity of all subjects. If any subject wished to withdraw from the study, they could do so at any time. All subjects received a gift after research completion.

Data analysis

Data were coded and input into a computer, checked for accuracy and then analysed using SPSS 13.0 software running on a Windows operating system. Descriptive statistics and an analytic method were used to certify the average of both groups in the pretest; chi-square and *t*-test were used to test basic attributes of both groups, and repeated measures analysis of variance (ANOVA) was used to test for significant pre/post-therapy differences between the two groups. Specifically, researchers performed a series of one between-subjects variable (treatment vs. control) and one within-subjects variable (pretest, post-test, follow-up) repeated measures ANOVAs with level of significance set to 0·05.

Results

Demographic characteristics of the participants

Demographic data on the 60 subjects addressed subject age, highest level of education, gender, occupation, marital status, prior receipt of patient education and creatinine value (Table 1). Results were certified using *t*-test and chi-square,

Table 1 Comparison of subject demographics (*n* = 60)

Variable	Experimental group (*n* = 30)	Control group (*n* = 30)	*t**	χ^2	*p*
Age					
Mean (SD)	57·6 (13·12)	59·83 (6·79)	−0·83		0·41
Education level (year)					
Mean (SD)	7·2 (4·35)	6·5 (3·45)	0·69		0·50
Gender					
Male	16 (53·3%)	15 (50%)		0·07	0·80
Female	14 (46·7%)	15 (50%)			
Employment status					
Not employed	21 (70%)	16 (53·3%)		1·76	0·18
Employed	9 (30%)	14 (46·7%)			
Marital status					
Married	29 (96·7%)	28 (93·3%)			1·00†
Unmarried	1 (3·3%)	2 (6·7%)			
Previous education consultation					
No	14 (46·7%)	17 (56·7%)		0·60	0·44
Yes	16 (53·3%)	13 (43·3%)			
Cr.					
Mean (SD)	11·18 (2·61)	10·43 (1·96)	1·28		0·21
Knowledge Mean (SD)	8·36 (2·66)	9·17 (3·81)	−0·94		0·35
Uncertainty Mean (SD)	51·5 (7·0)	48·87 (5·99)	1·57		0·12

**p* < 0·05.
†Fisher's exact probability test *p* value.

which showed no significant difference for any demographic data item (*p* > 0·05) and therefore high homogeneity between experimental and control groups.

Knowledge and uncertainty in patients with ESRD: Pretest

To assess ESRD patient knowledge and uncertainty in both groups, the author used an independent-sample t-test and found similar scores for knowledge (*p* = 0·35) and uncertainty (*p* = 0·12). This indicated strong homogeneity between the two groups, with averages not reaching statistically significant differences.

Patient education DVD effects on ESRD patients' knowledge

Researchers used an independent-sample t-test and repeated measures ANOVA to analyse differences before and after the introduction of the patient education DVD. Table 2 shows significantly higher scores for knowledge in the experimental group after exposure to the DVD programme.

Repeated measures ANOVA demonstrated that differences in pretest and post-test scores between both groups attained statistical significance and that interaction was also signifi-

Table 2 Postintervention knowledge scale analysis of variance ($n = 60$)

Variance origin	Sum of squares	Degree of freedom	Average sum of squares	F	p	LSD test
Experimental with control group	963·351	2·4	401·06	81·27**	0·000	3 > 2* > 1**
Group error	1056·21	58	18·21			4 > 2* > 1**
Time × category	785·7	2·4	327·1	66·28**	0·000	
(Group × time) error	687·45	139·35	4·934			

*$p < 0.01$; **$p < 0.001$.

cant ($F = 66.28$, $p < 0.001$). Using LSD (least significant difference) to compare binately the averages of those four lots demonstrated the knowledge increase in the experimental group as higher than in the control group. Multiple comparisons of scores for the four experimental group lots showed that differences between all scores achieved significance ($p < 0.001$, Fig. 1), with the exception of the 3rd and 4th lot ($p = 0.664$), which showed no difference. This denoted that the DVD intervention had realised a lasting increase in experimental group knowledge.

Patient education DVD effects on ESRD patients' uncertainty

Table 3 shows significantly lower post-test uncertainty scores for experimental group participants, as confirmed using an independent-sample *t*-test and repeated measures ANOVA. Averages for the differences between the four lots all reached levels of significance, as checked using repeated measures ANOVA and multiple comparison of scores using LSD. Inspection of the variety of uncertainty scores of patients in both groups at different time periods found significant interaction ($F = 58.07$, $p < 0.001$; see Fig. 2). This indicated significant improvement in uncertainty following the DVD intervention.
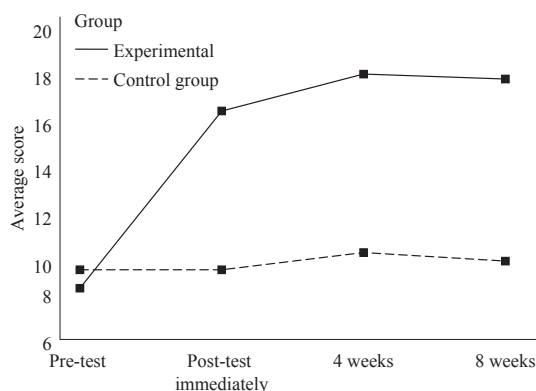

Figure 1 Comparison of knowledge scales: immediate post-test, four-weeks and eight-weeks.

Comparing ESRD patient decision-making regret: Postintervention

The 40 subjects (66·7%) taking dialysis four months after the pretest included 23 (38·3%) in the experimental group and 17 (28·3%) in the control group. The majority (30 subjects, 50%) of the dialysis subjects chose HD and 10 (16·7%) chose PD. The authors used an independent-sample *t*-test on the decision regret scale to investigate differences in decision result between those accepting dialysis in both groups. Results illustrated in Table 4 show a statistical difference ($p < 0.001$) between experimental group subjects who accepted dialysis after DVD intervention and control group subjects who accepted dialysis in terms of decision regret. Results demonstrate that decision regret was significantly lower in experimental group than in control group subjects electing to receive dialysis.

Discussion

Effects of DVD intervention on ESRD patient knowledge

Results found that experimental group knowledge scores significantly increased and uncertainty scores significantly decreased following the DVD intervention. Results also found significantly lower scores for decision regret in this group as compared with their control group peers. The main reasons underlying the positive effect of the DVD intervention on patient knowledge included the following: (1) DVD content delivery is tailored to the specific need of each patient user, (2) DVD content is easy to interpret and understand, (3) DVD content effectively enhances patient motivation and interest in learning by using audio, video, 3D animation and full-course video files that demonstrate the complete treatment process for both dialysis modalities, (4) patients can preselect DVD education segments for repeated replay and learning to facilitate information familiarisation and absorption, (5) researchers conducted phone interviews with experimental group subjects after using DVD content to clarify learning progress and address issues of remaining concern to subjects. Scholars have advocated previously that

Table 3 Postintervention uncertainty scale analysis of variance ($n = 60$)

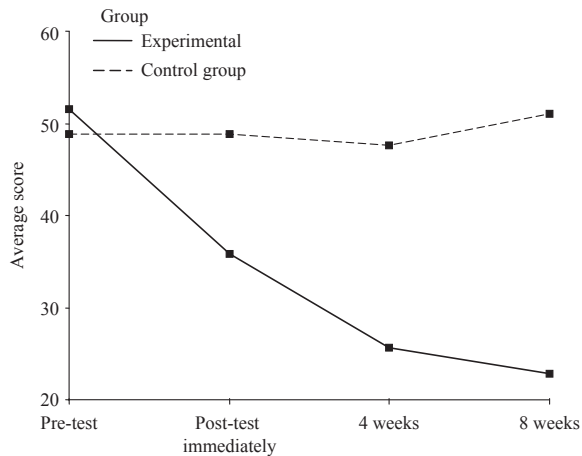| Variance origin	Sum of squares	Degree of freedom	Average sum of squares	F	p	LSD test
Experimental with control group	7240·18	2·51	2882·56	51·99**	0·000	1 > 2** > 3** > 4*
Group error	3404	58	58·69			
Time × category	8088·18	2·51	3220·18	58·07**	0·000	
(Group × time) error	8076·13	145·67	55·43			

*$p < 0.05$; **$p < 0.001$.

Figure 2 Variance in uncertainty scores at pretest, immediate post-test, four weeks and eight weeks.

Table 4 Comparison of decision-making regret ($n = 40$)

Group	Mean (SD)	t-value	p-value
Experimental	17·83 (12·32)	−5·36	< 0·000
Control group	47·35 (20·09)		

patient ability to select and review learning content on their own time would reduce the time currently spent by staff on patient education (Kohlmerier *et al.* 1997, Rosser *et al.* 2000). Experimental group scores through the three post-tests showed an initial rise followed by the maintenance of higher score levels. This demonstrates the greater effectiveness of the patient education DVD intervention over traditional patient education methods. The findings of this study were similar to those of Klang *et al.* (1998, 1999), which indicated that patient education prior to dialysis enhances patients' knowledge and dialysis decision-making. Findings also coincided with those of Ruthman and Ferrans (2004) who explored the effects of using an interactive multimedia DVD in prostate cancer patient education to enhance treatment cognition.

Effects of DVD intervention on ESRD patient uncertainty

This study found significant differences ($p < 0.05$, Table 3) between average experimental group patient pretest scores and four-week and eight-week follow-up post-test scores. This study used a researcher-developed interactive multimedia patient education DVD to explore the effects of reducing predialysis uncertainty in patients with ESRD and found a significantly positive effect owing to the generally insufficient predialysis knowledge delivered to patients by traditional means. This study achieved results similar to those of Murray *et al.* (2001), who used an interactive multimedia DVD intervention to lower uncertainty in climacteric women accepting hormone remedies.

Effects of DVD intervention on ESRD patient decision-making regret

Twenty-three experimental group (HD: 17 persons, PD: six persons) and seventeen control group (HD: 13 persons, PD: four persons) subjects chose dialysis as their treatment option. Average decision regret was 17·83 (SD 13·32) for the experimental and 47·35 (SD 20·09) for the control group. Independent-sample t-test confirmed significantly less ($p < 0.000$) decision regret amongst experimental group subjects. The average 17·83 (SD 12·32) value for decision regret in the experimental group coincides with the findings of Davision and Goldenberg (2003) and Potosky *et al.* (2000). The former explored decision regret amongst patients with prostate cancer following a patient education interactive multimedia DVD intervention and earned an average decision regret value of 15·6 (SD 16). The latter provided patients health education prior to treatment and found that 92% of subjects receiving an operation or irradiation therapy did not regret their treatment decision two years afterwards. Results of this and numerous other studies show that enhanced patient education using an interactive multimedia DVD–based intervention helps patients make significantly more satisfactory treatment decisions compared with traditional

patient education methods. Also, providing the DVD intervention before dialysis successfully increased patients' knowledge, helped choose appropriate dialysis modalities, enhanced postdecision satisfaction and reduced decision regret (Murray *et al.* 2001, Ruthman & Ferrans 2004, Lim *et al.* 2005).

Relevance to clinical practice

Research results found that patients had unresolved concerns about PD and presumed dialysis to be a distressing experience. Medical staff should reinforce dialysis education and clarify incorrect concepts for patients. The authors propose that medical units use computer programs to design appropriate DVD patient education tools that reflect different prognosis phases and promote patient learning.

Study limitations

1 This study was designed only to explore the impact of interactive education multimedia DVDs on ESRD patient dialysis knowledge, uncertainty and decision-making. With patient autonomy increasingly emphasised in health care, the authors suggest that future relevant researches should integrate concepts such as patient autonomy, self-efficiency and health belief models to explore the impact and application of such DVD interventions on medical autonomy in patients with ESRD.

2 Because of limited time, manpower and budget, this study only traced research results for a four-month post-test period. As patients with ESRD accepting dialysis may yield different health problem levels, the authors suggest that future research further extend the post-test observation period to understand time effects and evaluate patient decision-making satisfaction over the long term.

3 In the light of the limited follow-up period (four months) and the limitation of the sample to outpatients and inpatients at certain medical centre in southern Taiwan, the authors suggest future researchers expanding the research in terms of both time and space to enhance result rigour.

Conclusions

Traditional clinic patient education provides only two-dimensional written information. When patients must make decisions regarding complicated therapy options, simple education leaflets are inadequate to guide patients or provide the full scope of critical information. The patient education interactive DVD developed for this study enlivened information using video, audio and animation and incorporated comprehensive video presentations on the two major dialysis options. The interactive format used allowed patients to choose any section for review and repeat viewing. Research results demonstrated the ability of the DVD to help patients with ESRD make proper decisions and reduce decision regret. Subjects who received the DVD intervention had significantly better knowledge scores and less uncertainty than their control group peers.

Relevance to clinical practice

The authors recommend initiation of education for patients with end-stage renal disease during the predialysis stage and continuance of such education after the commencement of maintenance dialysis.

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Contributions

Study design: C-PC, Y-CC; data collection and analysis: C-PC, Y-CC and manuscript preparation: C-PC, Y-CC.

Conflict of interest

None.

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