

ORIGINAL RESEARCH

Analysis of the effect of health education model based on BCW theory in patients with acute retinal necrosis

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1. Introduction

Acute retinal necrosis (ARN), a form of viral uveitis, is one of the common severe ocular complications [1]. It is characterized by acute onset, rapid progression, and poor prognosis and the incidence of advanced retinal detachment is up to 75% [2]. ARN have a poor prognosis in sight and are susceptible to a variety of complications including retinal detachment, optic neuropathy, macular abnormalities, and retinal ischemia [3], and 64% of patients have final visual acuity of less than 20/200 [1]. Traditional health education based on text and pictures more focuses on improving patients' knowledge or changing their attitudes, and rarely conduct behavioral interventions on their mental health. The behavior change wheel (BCW) theoretical model is a comprehensive behavior change system centered on a model of competence, opportunity, and motivation that includes subjective factors (physical and mental competence, automatic and reflective motivation) and objective factors (physical and social opportunities), identifies the

conditions necessary for behavior and provides methods for developing appropriate health management plans, promoting health behavior change [4]. The BCW theory has been utilized to improve self-management, boost self-efficacy, and control the progression of chronic disease. However, BCW theory does not include ophthalmic health education [5]. In this study, BCW theory was applied to the health management program for ARN, and the details were reported in the present study.

2. Materials and methods

2.1 Research subjects

According to the convenience sampling method, a total of 78 patients who treated in our central fundus surgery day care unit between October 2020 and October 2022 were selected as research subjects. Then, according to the random number table method, patients were divided into the control (n = 39) and observation (n = 39) groups, respectively. In the control group, there were 28 males and 11 female cases. In the observation

Abstract

To explore the effect of the health education model based on the behavior change wheel (BCW) theory in patients with acute retinal necrosis (ARN). 78 patients diagnosed with ARN were randomly divided into the control group (n = 39) and observation group (n = 39). The control group received standard eye care, whereas the observation group was given the BCW theory-based health education model based on standard care. The two groups were compared on the uncertainty of the disease, anxiety and depression levels, treatment compliance, disease cognition, and nursing satisfaction. After the intervention, the scores of various dimensions of uncertainty in illness and the total score, the Self-Rating Anxiety Scale/Self-Rating Depression Scale (SAS/SDS) scores, treatment compliance, the degree of disease cognition, and nursing satisfaction in the observation group were higher than those in the control group, and the differences were statistically significant. The application of the health education model based on BCW theory in ARN can reduce the disease uncertainty and the level of anxiety and depression, thus improving the treatment compliance, disease cognition, and satisfaction of patients, which is worthy of widespread use in clinical practice.

Keywords

Behavior change wheel theory; Acute retinal necrosis; Health education

group, there were 26 male and 13 female cases. There was no statistically significant difference between the general data between the two groups ($p > 0.05$) (Table 1).

Inclusion criteria: (1) meet the American Uveitis Association's diagnostic criteria for the diagnosis of ARN; (2) Age ≥ 18 years; (3) Patients who received surgical therapy of retinal laser photocoagulation, vitrectomy with intraocular laser, or silicone oil-filled, and had a stable postoperative condition with well-controlled underlying disease and no serious complications; (4) Patients who were conscious and able to receive health education and follow-up; (5) Patients who were willing to cooperate with the scale evaluation.

Exclusion criteria: (1) Patients who do not undergo surgical therapy; (2) Combined with malignant tumors or severe heart, liver, lung, and other organ dysfunction; (3) Patients with impaired consciousness or mental illness with communication impairment; (4) Patients who are unwilling to cooperate with the study or unable to complete the follow-up; (5) Patients with incomplete clinical information.

2.2 Research methods

2.2.1 Control group

Upon admission, each patient received routine nursing measures and health education, including routine dietary care, monitoring of vital signs during treatment, and medication instructions. In addition, the medical staff was set up to explain information, therapeutic schedule, prognosis, adverse effects, and precautions related to ARN to each patient and their family timely. Postoperatively, patients' signs were monitored in real time to enhance risk assessment, prevent complications and manage underlying diseases; patients were

instructed on medication use and informed of the importance of medication compliance; personalized diet plans were formulated according to patients' conditions, with a diet rich in protein and vitamin; patients were urged to develop a good lifestyle habits, ensure adequate rest for the eyes, exercise reasonably, and avoid strenuous activities and heavy physical activities; patients were instructed on home self-care methods before discharge, and advised to come to the hospital for regular follow-up.

2.2.2 Observation group: a health education model based on BCW theory was given to the control group

Establishment of BCW Theory Intervention Team: An intervention team was established, consisting of an ophthalmic director, two ophthalmologists, two ophthalmology nurses, a nurse specialist, and a head nurse. The head nurse and nurse specialist were responsible for coordinating communication and developing a standardized training program, which included BCW theory, ophthalmology-related knowledge, how to implement the intervention program, and how to conduct quality control.

Development and implementation of a health education model based on the BCW theory for ophthalmic patients: BCW is centered on a model of competence, opportunity, and motivation to achieve healthy behaviors. Team members comb through and analyze patient data to develop a comprehensive care intervention based on the progress of ARN patients. The team established mutual assistance clusters, analyzed patient compliance rates and related influencing variables, and identified influencing elements of poor compliance, and then selected these aspects as the starting point for

TABLE 1. Comparison of general information between the two groups of patients (n (%)).

Items	Control group	Observation group	χ^2	p
Gender				
Male	28 (71.79%)	26 (66.67%)	2.531	0.691
Female	11 (28.21%)	13 (33.33%)		
Age				
<45	10 (25.64%)	9 (23.08%)	1.953	0.804
45–60	14 (35.9%)	16 (41.03%)		
>60	15 (38.46%)	14 (35.90%)		
Marital status				
Married	28 (71.79%)	30 (76.92%)	2.069	0.747
Unmarried or Single	11 (28.21%)	9 (23.08%)		
Education				
Junior high school and below	8 (20.51%)	7 (17.95%)	1.995	0.785
Technical secondary school and high school	21 (53.85%)	20 (51.28%)		
College and above	10 (25.64%)	12 (30.77%)		
Monthly income				
<2000	9 (23.08%)	7 (17.95%)	0.978	0.894
2000–4000	19 (48.72%)	20 (51.28%)		
>4000	11 (28.21%)	12 (30.77%)		

nursing services, and implementation of appropriate nursing interventions. These aspects interact to produce influential behaviors, such as competence, opportunity, and motivation, which in turn change bad habits.

(1) Motivation: Help patients generate motivation through motivation, education, persuasion, modeling, and compulsory.

Motivation function: Upon admission, the nurse specialist comprehensively assesses the patient's condition, basic information, disease knowledge, mental status, and establish a health record. Warmly receive patients, leave a good first impression, establish good communication with patients, and enhance patients' confidence in treating diseases.

Educational and persuasive function: In the case management room, one-on-one education is provided to patients. The nurse specialist explains ARN-related information such as eye structure, disease characteristics, prognosis, treatment options, surgical options, drug effects and side effects, eye self-care methods, and how to monitor and protect the contralateral eye to improve patients' understanding of ARN and its prognosis, and reinforce the necessity for cognitive intervention.

Modeling function: Group support activities are carried out to guide recovering patients to share their experience in fighting with ARN, set goals with patients, and encourage others to build confidence in treatment.

Compulsory function: An integrated nurse-patient holistic care model is used. The nurse specialist establishes a healthy communication relationship with patients and their families, providing a relax atmosphere to enhance their cooperation and improve patients' compliance behavior. Forced restriction of patient disengagement from the treatment plan during the visit, emergence of disengagement from follow-up, and provide immediate corrective guidance. During the nursing care progress, nurses should pay attention to protecting patients' privacy, avoid talking about their conditions freely, and choose a private and quiet environment to explain their conditions and treatment to patients.

(2) Developing Competence: Helping patients develop competency through education, training, and realization.

Education function: Diverse forms of health education are used, such as face-to-face health education with graphics, voice and video health education to improve patients' knowledge related to surgery and perioperative health. The nurse specialist provides health education through informational videos and video presentation of perioperative surgical knowledge, divided into preoperative, intraoperative, postoperative, postural care, and discharge education. Furthermore, patients can scan the WeChat code to watch the video repeatedly.

Training function: including intensive training and personalized training. Intensive training: intensive health education is placed before the patient's scheduled surgical period. When surgery is necessary, appointment information letters were issued with printed text instructions and perioperative health education QR codes, which patients are instructed to scan to learn about perioperative surgical knowledge. Patients who need surgery are given focused health education and their questions are answered in a timely manner. Personalized training: Health education is provided throughout the perioperative surgical period, especially personalized postural care

education for postoperative patients, and appropriate postural guidance is given according to vitreoretinal surgery method. A combination of on-site teaching and informal education is used to teach patients and their families the essentials of postoperative posture while guiding them to scan QR codes for learning.

Realization function: One-on-one private chat guidance *via* WeChat software to answer patients' questions, introduce surgical procedures and precautions, and enhance self-care capabilities. The nurse specialist should concentrate on assessing the patient's visual acuity, psychological status, illness awareness, and level of disease education. Improve the level of overall admission evaluation by patients and families and give individualized education. Education should focus on psychological guidance for ARN patients, vitreoretinal perioperative health education, and fall prevention safety instructions for patients with low vision.

(3) Provide opportunities: Patients are provided with access to gain relevant knowledge and support through the reconstructing, limitation, and realization of functions in the environment. At the same time, these create opportunities for sharing and arrange for patients with better post-operative outcomes to enhance communication, improve their understanding of the disease and increase their confidence in treatment.

Environment reconstruction function: Reconstructing a good atmosphere by participating in patient clubs, peer support groups, and WeChat communication. To help patients comprehend the significance of positive emotions in improving treatment outcomes and the adverse effects of negative emotions on their treatment. ARN is characterized by rapid onset, progression, and devastation, and patients with ARN are prone to fear, anxiety, depression, stress, and other negative emotions, which can affect their compliance and clinical outcomes. Therefore, according to their characteristics, nurses are required to create a quiet environment, listen carefully, and guide patients to vent negative emotions to relieve psychological pressure. In addition, patients are encouraged to participate in social activities and develop more friends to maintain a cheerful mood.

Restriction function: Nurses instruct patients on the proper use of eyedrops, application precautions, and the management of drug adverse effects. Furthermore, nurses trained the patients to master the correct use method of eye drops through explanation and demonstration. Avoid the spout of eyedrops or ointment contact with eyes, tears, and mucous membranes. Instruments that come into direct contact with the patient's eyes should be disinfected and sterilized before reuse. Before and after interaction with patients, nurses are required to wash their hands and put on gloves. During lacrimal flushing, gloves, medical masks, and protective glasses should be worn to maintain eye hygiene and avoid eye infections, given that the patient's body fluids or flushing solution may contact the operator's face.

Realization function: Out-of-hospital telephone follow-ups and outpatient follow-ups are available. When patients are discharged from the hospital, nursing staff should clearly inform the time and place of review, postoperative precautions, and help patients establish postoperative contact. After 2 hours of discharge, nurses should make a return visit to check if the

patient has returned to his or her residence, if it is safe, and if there are any discomfort symptoms. Additionally, nurses should pay attention to postoperative visual acuity, intraocular pressure, postoperative medication, and body position compliance. During follow up, regular observation of symptoms in the affected eye, inflammation condition, and extent of lesions will aid in the early detection of disease complications. Moreover, patients need to strengthen the observation and protection of the lateral eye. Patients with low vision should be promptly matched with low vision centers for vision training. Patients should be advised to pay attention to safety hazards in daily life and place objects in a fixed location to prevent accidents such as falls, crushing, and burns and need to be accompanied by family members when going out.

2.2.3 Observation indicators

Sense of disease uncertainty: The Mishel Uncertainty in Illness Scale (MUIS) was used, and the scale includes four dimensions of uncertainty, complexity, lack of information, and unpredictability, with lower scores indicating that patients have less uncertainty about the disease [6].

SAS/SDS scores: Psychological conditions were assessed by the Self-Rating Anxiety Scale (SAS) and the Self-Rating Depression Scale (SDS) [7, 8], which consisted of 20 items on a 4-point scale from 1 to 4, with a total score of 20–80 points. The cut-off value in SAS and SDS are 50 and 53 points, respectively. In SAS, a score of ≥ 50 points indicates the presence of anxiety symptoms, and in SDS, a score of ≥ 53 points reveals the presence of depressive symptoms, with higher scores meaning more severe symptoms.

Compliance behavior and Disease awareness [9]: Treatment compliance was rated on a 4-point scale of 1 to 4, with 1 point indicating non-compliance, 2 points indicating partial compliance, 3 points indicating basic compliance, and 4 points indicating full compliance. Disease awareness was measured by a questionnaire, which was self-administered by our hospital. The disease awareness questionnaire assesses disease knowledge, treatment methods, postoperative precautions, and self-management measures, with scores ranging from 0 to 100 points, and higher scores indicating higher awareness of diseases.

Care satisfaction: Based on the literature review, a nursing satisfaction questionnaire was designed ranging from 0 to 100 points, with < 69 being dissatisfied, 70–79 being less satisfied, 80–89 being satisfied, and ≥ 90 being very satisfied. Satisfaction = (less satisfied + satisfied + very satisfied)/total number of cases $\times 100\%$.

2.2.4 Statistical analysis

All data were statistically analyzed using SPSS 26.0 (IBM Corporation, Armonk, NY, USA). Measurement data were described by $\bar{x} \pm s$, and the data such as disease uncertainty scores and SAS/SDS scores were determined by Student's *t*-test. The count data were reported as frequency and *n* (%) and the comparison between groups was carried out by χ^2 test. $p < 0.05$ (2-tailed) was regarded as statistically significant.

3. Results

3.1 Comparison of disease uncertainty between patients in two groups

The four dimensions of disease uncertainty scores (uncertainty, complexity, lack of information, and unpredictability) before and after the intervention between the patients in the observation and the control groups were compared. The results showed that the differences before the intervention were not statistically significant, while after the intervention, the observation group performed considerably better than the control group, and the differences were statistically significant ($p < 0.05$) (Table 2).

3.2 Comparison of SAS/SDS scores between patients in two groups

Comparing the SAS/SDS scores before the intervention, the differences were not statistically significant. However, after the intervention, the SAS/SDS scores in observation group was significantly higher than the control group, and the difference was statistical ($p < 0.05$) (Table 3).

3.3 Comparison of treatment compliance, compliance behavior, and disease awareness between patients in two groups

The comparison of treatment compliance and compliance behavior between the observation group and control group after the intervention showed that the observation group was statistically better than the control group ($p < 0.05$) (Table 4). Before the intervention, compared the scores of disease awareness between observation and control, the differences have no significant different, while after the intervention, the scores of disease awareness in observation group were significantly higher than control group ($p < 0.05$) (Table 4).

3.4 Comparison of care satisfaction between patients in two groups

After the intervention, the comparison of care satisfaction between the observation and control group showed that, the care satisfaction of the observation group was 92.3%, which was significantly better than that of the control group (71.8%), and the difference was statistically significant ($p < 0.05$) (Table 5).

4. Discussion

4.1 The health education model based on BCW theory can reduce the uncertainty of disease

ARN, a potentially blinding ocular disease with progresses rapidly, requires a high degree of attention [10]. Despite substantial breakthroughs in the diagnosis and treatment of ARN, the prognosis for patients with ARN remains poor, as indicated by the long duration of the disease, the complexity of treatment, and the loss of somatic function, resulting in a sense of disease uncertainty [11]. In this study, the scores of all dimensions of MUIS were decreased in the observation group after the intervention compared with that in the control group, and the difference was statistically significant, which

TABLE 2. Comparison of disease uncertainty between two groups of patients ($\bar{x} \pm s$).

Group	Uncertainty		Complexity		Lack of information		unpredictability	
	Before intervention	After intervention	Before intervention	After intervention	Before intervention	After intervention	Before intervention	After intervention
Observation group	40.64 ± 6.089	23.79 ± 2.419	20.44 ± 1.651	14.62 ± 1.995	15.51 ± 1.972	10.62 ± 0.877	15.59 ± 1.634	12.10 ± 0.995
Control group	38.59 ± 5.123	25.62 ± 5.112	20.85 ± 1.268	15.90 ± 1.789	15.54 ± 1.804	11.15 ± 0.587	15.90 ± 1.535	13.90 ± 1.071
<i>t</i>	-1.610	2.010	1.231	2.988	0.060	3.187	0.857	7.669
<i>p</i>	0.112	0.048	0.222	0.004	0.952	0.002	0.394	0.000

TABLE 3. Comparison of SAS/SDS scores between two groups of patients ($\bar{x} \pm s$).

Group	SAS		SDS	
	Before intervention	After intervention	Before intervention	After intervention
Observation group	59.41 ± 3.851	37.97 ± 2.879	63.33 ± 3.916	37.72 ± 2.752
Control group	58.49 ± 3.219	44.90 ± 5.467	62.49 ± 3.219	41.49 ± 4.160
<i>t</i>	-1.149	6.998	-1.042	4.719
<i>p</i>	0.254	0.000	0.301	0.000

SAS: Self-Rating Anxiety Scale; SDS: Self-Rating Depression Scale.

TABLE 4. Comparison of treatment compliance, compliance behavior, and disease awareness between two groups of patients ($\bar{x} \pm s$).

Group	Treatment compliance	Compliance behavior	Disease awareness	
	Before intervention	After intervention	Before intervention	After intervention
Observation group	3.28 ± 0.456	3.41 ± 0.595	61.26 ± 7.708	78.13 ± 8.464
Control group	2.79 ± 0.732	2.72 ± 0.647	59.28 ± 5.920	70.23 ± 7.150
<i>t</i>	-3.528	-4.921	-1.169	-4.451
<i>p</i>	0.001	0.000	0.208	0.000

TABLE 5. Comparison of care satisfaction between the two groups (n (%)).

Group	Unsatisfied	Less satisfied	Satisfied	Very satisfied	Satisfaction
Observation group	0	3 (7.69%)	18 (46.2%)	18 (46.2%)	36 (92.3%)
Control group	1 (2.56%)	10 (25.60%)	14 (35.9%)	14 (35.9%)	28 (71.8%)
χ^2					6.258
<i>p</i>					0.008

indicated that the implementation of a planned, organized, and systematic health education based on BCW for patients can improve lifestyle, strengthen disease recognition, and enhance patients' disease management, thus effectively reducing the sense of disease uncertainty [12], which is consistent with the findings of Paolo M [13].

4.2 The health education model based on BCW theory can reduce anxiety and depression in patients

Life and work are significantly impacted by eye illness, and it is more likely to trigger unpleasant feelings such as depression and anxiety [14]. After the nursing intervention, the score of depression and anxiety in the observation group was considerably lower than those in the control group, demonstrating

that the patients in the observation group had a significantly improved psychological state and less negative emotions and ameliorated their quality of life. This further implies that the environmental reconstruction, restriction, and realization of the health model might provide patients with access to pertinent information and assistance. In addition, patients are provided with a quiet and comfortable admission environment, nurses are instructed to thoroughly explain the precautions for disease treatment, and to give timely preventive and therapeutic measures, therefore strengthening their self-care ability [15]. Patients undergo multiple consultations and multidisciplinary prior to surgery in order to determine the surgical plan, and the medical staff must communicate carefully to present the treatment plan to patients [16]. In addition to ensuring the safety of patients during the perioperative surgical

period, medical personnel should adhere to the standards of prevention, sterilization, and isolation, providing emotional and material support to patients to enhance their confidence in recovering health, which were consistent with the results of Chen M [17], thereby relieving depression and anxiety [18, 19].

4.3 The health education model based on BCW theory increases treatment compliance and disease awareness of patients

Positive family cooperation and social support can raise patients' confidence in overcoming the disease. Nurses should provide perioperative care, extended care, psychological support, standard protection, and surgical care, and promote them in conjunction with the network, to increase treatment compliance and consolidate efficacy [18]. After the nursing intervention, treatment compliance, compliance behavior, and disease awareness were significantly higher in the observation group than in the control group, which may be attributed to the education, training, and realization functions of the health education model. Patients' families participate in learning about ARN information and urge patients to receive regular examinations for early detection, diagnosis, early treatment and increase treatment compliance. Related studies have found that some patients suffer from malpractices such as self-medication discontinuation, indiscriminate medication, improper eye care, and unscheduled return visits after treatment, which undermine the continuous treatment of ARN and effective control of intraocular pressure and visual acuity, leading to even blindness [20]. Therefore, effective nursing interventions for patients with ARN are imperative to improve patient treatment compliance, compliance behavior, and disease awareness [10].

4.4 The health education model based on BCW theory improves patient satisfaction

ARN is an acute viral retinitis and ophthalmic emergency that requires immediate diagnosis and treatment [1]. Without adequate disease-related knowledge, self-management skills, and competence, patients with ARN would have difficulties positively addressing the adverse effects of visual impairment on their lives, so ophthalmic care should focus on conveying health information to patients to aid in making lifestyle adjustments and developing better self-care capacities [21, 22]. According to the findings, after the nursing intervention, the observation group's patients reported significantly higher levels of satisfaction than the control group, which may be due to the comprehensive intervention of the health education model to ensure that patients receive comprehensive, systematic and personalized health education, so that they have a comprehensive and in-depth understanding of disease-related knowledge and establish a correct health concept, and thus better follow the doctors' recommendations [23]. Additionally, nursing interventions can assist patients to change unhealthy behaviors and habits while improving the compliance of patients and their families, which benefits disease control [24]. Under the health education model based on BCW theory, mutual help groups are established to provide nursing care and related assistance to patients during hospitalization and after discharge, so that

patients can still enjoy efficient, sound, and continuous nursing care after discharge and feel cared for, which has positive significance for disease control, reduce patients' psychological stress, and ease their families' economic burden [25].

5. Conclusions

In conclusion, the application of BCW-based health education model in patients with ARN can reduce the uncertainty, anxiety, and depression of the disease, improve patients' compliance with treatment and disease awareness and increase patient satisfaction, which is worthy of wide promotion in clinical application. However, the short study duration and small sample caused some limitations of the study. In addition, the study requires a multicenter randomized controlled trial with a large sample size in the future to better observe the effect of the BCW-based health education model on patients with ARN.

AVAILABILITY OF DATA AND MATERIALS

The authors declare that all data supporting the findings of this study are available within the paper and any raw data can be obtained from the corresponding author upon request.

AUTHOR CONTRIBUTIONS

RRL and YQW—designed the study and carried them out, prepare the manuscript for publication and reviewed the draft of the manuscript; RRL, YEY, WDX, YHS, HRC, XQH and YYC—supervised the data collection, analyzed the data, interpreted the data; All authors have read and approved the manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval was obtained from the Ethics Committee of Optometry Hospital Affiliated to Wenzhou Medical University (Approval no. 2019-088-K-84). Written informed consent was obtained from a legally authorized representative(s) for anonymized patient information to be published in this article.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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