Original Article

Design and application of weight gain graphs based on Bandura’s self-efficacy theory for patients on maintenance haemodialysis

Juan Qiao, Yan Shan, Qin Chen, Zhao-Ping Xu

Nursing College, Zhengzhou University, Zhengzhou, China
Hemodialysis Department, Zhengzhou People’s Hospital, Zhengzhou, China

Abstract

Purpose: To design interdialytic and daily weight gain graphs for patients on maintenance haemodialysis and to evaluate their effect on patient adherence to restricted fluid intake.

Methods: Forty-five patients on maintenance haemodialysis were recruited from August to October 2012. The graphs were applied for 12 weeks based on Bandura’s self-efficacy theory. Adherence to restricted fluid intake, dialysis adequacy, and satisfaction were compared before and after the graphs were applied.

Results: Adherence to restricted fluid intake increased from 53.3% to 91.1%; the mean rate of urea clearance (Kt/V) decreased from 1.197 to 1.311, and the qualified rate increased from 42.5% to 70%. The rate of adherence was 86.77%; acceptance and satisfaction rates were 100%.

Conclusion: It is acceptable to apply the graphs clinically for subsequent effective improvement of adherence to restricted fluid intake, promoting dialysis adequacy, and increasing patient satisfaction. Therefore, clinical application of the graphs is worthwhile.

Article history:
Received 10 October 2013
Accepted 23 January 2014
Available online 21 March 2014

Keywords:
Fluid intake
Graph
Interdialytic weight gain
Maintenance haemodialysis
Patient adherence

1. Introduction

Chronic kidney disease is continually increasing at home and abroad [1]; maintenance haemodialysis (MHD) is one of the most important and effective treatment modalities to aid the sustenance of life in end-stage renal disease (ESRD). Much evidence demonstrates that successful HD treatment is directly related to patient adherence, including dietary and...
fluid restrictions, prescriptions, and regular HD treatment [2]. However, numerous studies have proved that many MHD patients do not execute these self-care behaviours successfully, among which nonadherence to restricted fluid intake is the most common and one of the most problematic aspects for medical staff, patients, and their caregivers [2–5].

Interdialytic weight gain (IDWG) is the variable of choice for identifying fluid intake in MHD patients [6,7]. A high IDWG results from the accumulation of water and kidney failure, and can lead to hypertension and left ventricular hypertrophy, which is associated with poor outcome in the long-term [8–10] and dialysis-related complications such as hypotensive episodes, muscle cramps, nausea, and headache [11]. Therefore, it is apparent that improving the restricted fluid intake adherence of MHD patients can not only reduce the risk of symptoms and complications, but is also related to long-term survival and better quality of life.

To avoid fluid overload, it is recommended that patients adopt a strict diet and limit fluid intake, often generating great psychological stress for the patient [4]. The desire to drink normally, but being forbidden from doing so also creates a state of discomfort, thus many HD patients describe fluid management as a constant struggle, regardless of whether the outcome is successful [12,13]. Implementing interventions to improve concordance with fluid allowances can be essential [14], and the renal nurse may play an important role in it. However, China lacks pragmatic and effective methods of assisting patients in managing fluids.

In Bandura’s social learning theory, self-efficacy is the judgment of an individual regarding his own abilities or the confidence that he has the ability to perform special tasks in certain situations [15,16]. Bandura believed that our evaluation of the level of self-efficacy depends on four information sources: performance attainment, vicarious experience, verbal persuasion, and physiological feedback [17]. It has been suggested that implementing the promotion of self-efficacy in chronic diseases is essential [18].

MHD patients have to live with a long-term, complex treatment regimen involving lifestyle changes that influence their quality of life negatively. Having a sense of self-efficacy enables people to engage in health-promoting behaviours, avoid health-threatening behaviours, and influence all aspects of life. [19] A growing body of literature suggests that self-efficacy exerts a causal influence on patient behaviour [20]. Tsay and Healtstead proved that self-efficacy clarified 47.5% of the variance in the quality of life of 160 dialysis patients [21]. Beverly et al. proved that fluid adherence efficacy expectation was a significant predictor of mean weekend IDWG [22]. The study also found that patients with higher self-efficacy had lower mean weekend IDWG [22]. The study also found that fluid adherence efficacy expectation was a significant predictor of mean weekend IDWG [22]. The study also found that patients with higher self-efficacy had lower mean weekend IDWG [22]. The study also found that patients with higher self-efficacy had lower mean weekend IDWG [22]. The study also found that patients with higher self-efficacy had lower mean weekend IDWG [22]. The study also found that patients with higher self-efficacy had lower mean weekend IDWG [22]. The study also found that patients with higher self-efficacy had lower mean weekend IDWG [22]. The study also found that patients with higher self-efficacy had lower mean weekend IDWG [22].

Intervention research has suggested that increased self-efficacy is associated with adherence treatment [23], health-promoting behaviour [24,25], and improved quality of life [26–28]. In Taiwan, Tsay determined that an experimental group that received self-efficacy training had better restricted fluid intake compliance than the control group [14]. Moreover, the idea that implementing a self-efficacy promotion training programme would be effective in decreasing the IDWG of MHD patients was supported by the study of Aliasgharpour et al. [29]. However, no study has been carried out in China to evaluate the effects of self-efficacy training for improving adherence in MHD patients. In this study, we designed an IDWG graph and a daily weight gain graph (thereafter referred to as “graphs”) for MHD patients, and applied them for 12 weeks based on Bandura’s theory to evaluate the effect on patient adherence to restricted fluid intake. We hypothesised that adherence to restricted fluid intake in HD patients using the self-efficacy training method would be better than that before.

2. Methods

2.1. Graph design

The IDWG graph involved the usual assessment indicators of fluid intake in MHD patients at home and abroad. The graph design was as follows: time (days) as the abscissa; IDWG (kg) as the ordinate. IDWG was controlled at 3–5% of the patient’s dry weight [30]; IDWG < 3% indicated risk of malnutrition; IDWG > 5% predicted a series of short- or long-term complications, even increased risk of death. When graphed, the 5% patient dry weight was set as the “warning level”, namely the IDWG maximum permissible level, with a red line. When applied, the level could be adjusted according to the patient’s condition and doctor’s advice.

Interdialysis weight gain graph (Table 1), consists of three parts. The first part is Eyebrow bar, is the patients basic information; The second part is the draw data; The second part is the graph, and its instructions; The third part is a monthly summary completed by the patient. Daily weight gain graph (Table 2), also consists of three parts. The first part is the patient’s basic information, the second part is the graph, and the third part is the record of daily weight gain and its instructions.

2.2. Application of graphs

2.2.1. Participants

This study was designed using a quasi-one-group pre–post test design and was conducted from August to October 2012 in a blood purification centre in Henan, China. A convenience sample of 51 patients undergoing HD was selected. The inclusion criteria were diagnosis of ESRD and HD treatment for at least 3 months, age > 18 years old, oliguria/anuria (<400 ml/day); physical ability to perform self-care activities, volunteered for the study, and able to complete 3 months’ follow-up. Those with acute illnesses or who were hospitalised were excluded. Patients were lost to follow-up due to transfer to another hospital, kidney transplantation, illness progression, or death.

2.2.2. Ethical considerations

The Ethical Committees of Zhengzhou University and Zhengzhou People’s Hospital approved the study. Written consent was obtained from each patient. The purpose of the study, voluntary participation, freedom to drop out at any time without treatment being withheld was reviewed with patients prior to their participation.
## Table 1 – Interdialysis weight gain graph for maintenance haemodialysis patients.

<table>
<thead>
<tr>
<th>Name:</th>
<th>Gender:</th>
<th>Age:</th>
<th>Dry weight (kg):</th>
<th>3%-5%of Dry Weight (kg):</th>
<th>Date:</th>
</tr>
</thead>
</table>

### Instructions:
1. IDWG was calculated by subtracting the pre-dialysis body weight from the post-dialysis body weight, painted in dialysis day by a nurse, and then feedback to patients.
2. Weight gain between two dialysis should not exceed 5% of the dry weight, if interval only one day, the patient should not exceed 3%.
3. The red line in graph is the 5% of the dry weight, which is the "warning level" of IDWG.

### Personal summary:
Dear patients, this graph reflects your fluid intake adherence in this month, please evaluate and summarize it according to your graph.

How many times above your "warning level" in this month? ____________

The reason is: ____________

Your experience and lessons is: ____________
The controlled goal of next month is: ____________

## Table 2 – Daily weight gain graph for maintenance haemodialysis patients.

<table>
<thead>
<tr>
<th>Name:</th>
<th>Gender:</th>
<th>Age:</th>
<th>Dry weight (kg):</th>
<th>3%-5%of Dry Weight (kg):</th>
<th>Date:</th>
</tr>
</thead>
</table>

### Instructions:
1. Please test and record your weight before breakfast every day, subtracting the yesterday’s value from today’s is the D-value, and then draw it on the graph.
2. On dialysis day, you should record your weight pre-post dialysis, because the next day’s D-value resulted from the post dialysis weight subtract the morning weight.
2.2.3. Intervention
We established a committee consisting of the head nurse, a researcher (the first author), two physicians, four nurses, and two patient representatives. The head nurse was the leader and was mainly responsible for the coordination and part of the implementation work; the researcher was responsible for devising the study plan, training, and implementation. The physicians were responsible for determining the “warning line” for each patient according to the patient’s condition and doctor’s advice, and preparing the group activity by selecting three outstanding participants, termed “the stars of restricted fluid intake”, who performed well in terms of restricting fluid intake, and selecting 3–4 patients with poor control based on the monthly graph and the required progress graph where possible. The nurses were responsible for recording the IDWG and feeding this back to the patients; the patient representatives acted as team leaders for the group activities.

All committee members attended a training programme. The main content included: (1) A discussion on the health issues commonly encountered by HD patients, especially regarding fluid intake and some related basic knowledge; (2) Introducing the graphs and methods, including drawing them, and deriving and adjusting “warning line” problems; (3) Concepts of self-efficacy and how to organise and implement group activities based on the self-efficacy theory through the graphs; (4) How to provide individual bedside education according to the graphs and cultivate effective communication skills, and how to help patients set proper mutual goals for the next month. Training methods included lectures, case discussions, and scenario simulation. The committee members trained using a simulated patient.

Subsequently, we gave eligible patients a lecture lasting about 2 h; the main content included: (1) Some basic knowledge of the concept of dry weight, its measurement methods, and the importance of maintaining it; (2) Introducing the graphs and usage methods, including the drawing method, how to self-evaluate and summarise it monthly, and how to define the control target for the next month correctly; (3) How to use the graph to generate a group discussion, that patients were responsible for their own health, and the importance of participating in the activity and cultivating self-confidence in disease management; (4) Assessing patient motivations and needs in the daily disease management process, mainly through collective lectures and practical demonstrations.

All patients completed the 12-week self-efficacy training, which consisted of six group counselling sessions and individual (bedside) education where required. The group counselling sessions were aimed at improving patient disease management confidence and skills; mainly performance attainment, vicarious experience, verbal persuasion, and physiological feedback were used [17] based on the self-efficacy theory. We began the group intervention by having the three patients with good fluid intake control share their method(s) for fluid control, success, and experience individually. Then, we analysed the patients with poor control, addressing the causes of their weight gain according to their personal summaries from their respective graphs. At the second and third sessions, we encouraged patients whose fluid control progressed quickly to share their experience. All patients were selected by the physicians in the study committee, and every patient in the study was encouraged to participate in the discussions. All patients who spoke received a useful prize provided free by a pharmaceutical company. This activity was conducted twice a week, with each session lasting about 1.5 h and presided over in turn by the head nurse and researcher, who addressed any patient issues that were brought up then. The patient representatives organised and maintained order in the activities.

In our study, bedside education focused on identifying patient problems, setting mutual goals, and creating behavioural change plans based on the patient’s priorities. The first author, who is qualified to conduct these sessions and address HD patient problems, conducted all bedside education, which lasted about 10 min per session.

2.2.4. Outcome measures
Demographic data, i.e. age, sex, marital status, educational level, primary disease, residual urine, and duration and weekly frequency of HD treatment, were collected using a locally designed data form.

The IDWG was derived by subtracting the pre-dialysis body weight from the post-dialysis body weight [6,7], which was retrieved from patient medical records. The average IDWG for each patient was calculated from the IDWG in 1 month. The ratio of weight gain between dialysis (average of the latest three measurements) and dry weight < 5% indicated adherence to restricted fluid intake.

To investigate patient satisfaction, patients were invited to state their degree of satisfaction with the nursing service (only 1 item) during the past month.

We investigated other indicators, such as the rate of urea clearance (Kt/V) and patient attendance and acceptance in this study.

2.3. Data collection
As the patients were connected to the HD machine and therefore unable to move their hands freely, we completed the questionnaires using the interview method. Patients were informed that they would be asked to provide demographic and medical data and complete a patient satisfaction test; the data were collected within the first 3 h after the initiation of HD to ensure that patients did not experience dialysis-related discomfort. Three months after the educational intervention, the data were tested and re-collected.

2.4. Statistical analysis
All data analyses were performed using SPSS 17.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were used to summarise the data.

3. Results
In total, 51 patients agreed to participate; 45 patients completed the 3-month follow-up. Six patients dropped out of
the study: two emigrated to another city, one was transferred
to intensive care, two underwent kidney transplant surgery,
and the data of one patient were lost, thus the response rate
was 88.24%. The main sample characteristics were 28 men
and 17 women; the mean age was 50.3 ± 13.7 years and the
mean duration of HD was 28.86 ± 19.33 months. The primary
disease of 18 patients was chronic nephritis, 15 had high blood
pressure, and 12 had diabetes. The frequency of dialysis was 3
times/week for 20 cases, 5 times/2 weeks for 10 cases, and 2
times/week for 15 cases; mean residual urine volume was
74.51 ± 104.10 mL.

Descriptive statistics showed that after 12-week graph
intervention, adherence to restricted fluid intake increased
from 53.3% to 91.1%; the mean Kt/V decreased from 1.197 to
1.311 and the qualified rate increased from 42.5% to 70%. The
rate of adherence was 86.77%; the acceptance and satisfaction
rates were 100%.

4. Discussion

Our findings support the self-efficacy theory, which states
that patients who receive self-efficacy training have more
confidence in their ability to engage in health promotion be-
aviours and are more compliant with fluid intake re-
strictions, which supports our hypothesis.

In our study, adherence to restricted fluid intake increased
after 12-week graph intervention; the reasons may be the
features of our self-efficacy training, such as group sessions
for problem solving, counselling, and continuous support in
the problem-solving process [31], and the patient’s desire to be
involved and share successful experiences and lessons learnt
from failure. Additionally, our attempt to explore patients’
personal experience with fluid intake control for tailored
nursing in the form of interviews during individual (bedside)
education may be another reason for the observed changes.
Thus, we successfully cultivated patients’ feelings of self-
efficacy through performance attainment, vicarious experi-
ence, verbal persuasion, and physiological feedback to
improve their confidence in overcoming problems [17].

Improvement in restricted fluid intake adherence behaviour
of MHD patients after a self-efficacy promotion programme
was previously demonstrated in the studies of Tsay and Ali-
ashgarpour et al [14,29]. However, we need to consider other
aspects also associated with patient fluid intake behaviour
in China, such as duration of HD, primary disease, frequency of
dialysis, residual urine volume, demographic background,
other factors such as social support [32], and the patient’s
belief that the treatment will benefit their health, which has
been demonstrated previously. It also indicates that compli-
ance is not only a medical problem but also involves psycho-
logical and social elements, requiring more in-depth
consideration of the measures that would be appropriate for
MHD and chronic patients, and healthcare providers should
assist patients in making lifestyle changes for themselves and
their family [33].

A high IDWG indicates fluid overload and can precipitate
hypertension and left ventricular hypertrophy, which is
associated with poorer outcomes in the long term. Addition-
ally, the removal of excess fluid during traditional HD is
difficult and may result in dialysis-related complications such
as hypotensive episodes, muscle cramps, nausea, and head-
ache. Adherence to restricted fluid intake was increased, the
mean Kt/V decreased from 1.197 to 1.311, and the qualified
rate increased from 42.5% to 70%, the benefits of which not
only include reducing the risk of symptoms and complica-
tions, but are also related to long-term survival [8–10] and
better quality of life [12,13].

Satisfaction is an important aspect in the evaluation of the
quality of nursing. The descriptive statistics demonstrated
100% patient satisfaction after 12 weeks, which may be related
to the following factors: (1) The intervention, which used vi-
ual graphs, was useful and acceptable and led to patients
becoming actively involved in managing their own health [34];
(2) We had more opportunities than usual to communicate
with patients in the intervention process [35], (3) The group
and individual education improved the level of health
knowledge, filled the gaps in patient knowledge, and met
patient requirements for disease rehabilitation [36]; (4)
Patients felt that they benefited from the activities. Moreover,
self-perception of the therapeutic effect and physical
changes may play an important role in improving patient
satisfaction [37].

The main advantages of the graphs were: (1) Simple,
image-based, and directly reflected the dynamic changes of
monthly weight gain; (2) Helped patients review their dis-
ease management approach monthly and compare it with
that of the previous month; (3) Patients could participate
actively in self-management of fluid intake and enjoyed
being able to evaluate their individual monthly summary; (4)
Trained the ability of the nurses to assess, communicate,
and identify problems during the activities; (5) Facilitated
the researchers’ observation of the effects of intervention.
The daily weight gain graph helped patients realise that
controlling fluid intake is an indispensable part of their
lives, and helped them self-monitor by recording their fluid
intake, which played a role in enhancing the effect of
dialysis.

The following should be noted when applying the graphs:
(1) As the graphs are a means of enhancing patient confidence
in fluid intake control, we should consider the patient’s health
literacy and provide tailored education; (2) 3–5% of a patient’s
dry weight is only an ideal reference value; we should consider
every patient’s situation in practice together with the physi-
cian; (3) Health education nurses should possess certain
abilities, such as theoretical knowledge of self-efficacy
training and motivational interviewing techniques in the ed-
ucation process; (4) In the personal monthly summary, edu-
cators need to help patients confirm the self-management
goal for the next month after it has been defined by the pa-
tient, as we found that patients tended to overestimate their
own compliance and set relatively high goals casually, then
feel frustrated after failing to achieve the goals. It is only by
using this approach that patients feel more engaged in man-
aging their health.

In summary, the graphs are appropriate for clinical appli-
cation because they improved patient adherence to restricted
fluid intake effectively, promoted dialysis adequacy, and
increased patient satisfaction. Therefore, their clinical appli-
cation is worthwhile.
5. Conclusions

Applying the graphs in a clinical setting is acceptable; our findings support the effectiveness of self-efficacy training using the graphs for improving restricted fluid intake compliance in MHD patients.

6. Limitations

Using a quasi-one-group pre–post test design did not negate the effect of time on the results. Another possible limitation may be that due to the short study period (12 weeks), the sample size (45 patients) was relatively small. The results therefore should be interpreted with caution, as there has been no randomised controlled trial study of self-efficacy training on restricted fluid intake compliance of MHD patients in China. Therefore, further research programs in China are recommended.

7. Relevance to clinical practice

The findings of this study indicate that as HD nurses are in continual contact with patients undergoing HD, they are in the best position to implement self-efficacy promotion programmes. Self-efficacy intervention should be considered in HD centres to assist patients in managing their health-related problems, especially restricted fluid intake compliance, as it is a crucial factor for achieving good therapeutic results and contributes to better outcomes.

Acknowledgements

We would like to thank our HD staff and patients for their cooperation throughout the study. We would also like to thank the Zhengzhou University School of Nursing.

REFERENCES


