Heart Failure

Weight Management Belief is the Leading Influential Factor of Weight Monitoring Compliance in Congestive Heart Failure Patients

Min-Xia Lu,¹ Yan-Yun Zhang,¹ Jun-Fang Jiang,² Yang Ju,¹ Qing Wu,¹ Xin Zhao¹ and Xiao-Hua Wang¹

Background: Daily weight monitoring is frequently recommended as a part of heart failure self-management to prevent exacerbations. This study is to identify factors that influence weight monitoring compliance of congestive heart failure patients at baseline and after a 1-year weight management (WM) program.

Methods: This was a secondary analysis of an investigative study and a randomized controlled study. A general information questionnaire assessed patient demographics and clinical variables such as medicine use and diagnoses, and the weight management scale evaluated their WM abilities. Good and poor compliance based on abnormal weight gain from the European Society of Cardiology (> 2 kg in 3 days) were compared, and hierarchical multiple logistic regression analysis was used to identify factors influencing weight monitoring compliance.

Results: A total of 316 patients were enrolled at baseline, and 66 patients were enrolled after the 1-year WM program. Of them, 12.66% and 60.61% had good weight monitoring compliance at baseline and after 1 year of WM, respectively. A high WM-related belief score indicated good weight monitoring compliance at both time points [odds ratio (OR), 1.043, 95% confidence interval (CI), 1.023-1.063, p < 0.001; and OR, 2.054, 95% CI, 1.209-3.487, p < 0.001, respectively]. Patients with a high WM-related practice score had good weight monitoring compliance at baseline (OR, 1.046, 95% CI, 1.027-1.065, p < 0.001), and patients who had not monitored abnormal weight had poor weight monitoring compliance after the 1-year WM program (OR, 0.244, 95% CI, 0.006-0.991, p = 0.049).

Conclusions: Data from this study suggested that belief related to WM plays an important role in weight monitoring compliance.

Key Words: Belief • Compliance • Congestive heart failure • Weight management • Weight monitoring

INTRODUCTION

Congestive heart failure (CHF) is a common chronic illness with increasing incidence, frequent hospital readmission, high mortality, and causes a palpable and substantial economic burden.¹⁻⁴ Self-management programs have been shown to improve quality of life (QoL), all-cause hospital readmission, HF-hospitalization rates, and HF-related mortality rates.⁵⁻⁷ Although there is growing evidence of the effectiveness of such programs, only 10.3% of CHF patients are able to provide effective self-management due to impaired cognition, depression, lower education level, and poor family functioning.⁸ Considering the complexity of self-management programs, an easier weight management (WM) program for CHF patients emerged in 2013.⁹

This WM program included weight monitoring compliance, the abnormal weight standard, and treatment...
Influencing Factor of Weight Monitoring Compliance

measures for abnormal weight. WM education could improve patient’s adherence to weight monitoring, WM ability, New York Heart Association Classification (NYHA), and CHF-related rehospitalization. However, weight monitoring compliance was lower in the 1-year WM intervention (60.61%) than in the 6-month WM intervention (71.21%). Many other studies indicated that only about 50% of patients could regularly monitor their body weight, and that 95% of patients in a Hong Kong cohort could not weigh themselves regularly. Meanwhile, Kamrani et al. found that weight monitoring was one of the most prevalent behaviors, and it was not performed properly in 80.5% of cases.

There were various reasons that patients did not adequately monitor body weight, such as age, living status, education level, and HF knowledge. However, there are seldom reports of factors influencing weight monitoring. Therefore, it is important to identify those factors that influence weight monitoring compliance to help health-care providers provide targeted patient interventions. Our study aimed to analyze the factors influencing weight monitoring both at baseline and after a 1-year WM program to compare the differences in time points, and to detect the key points of nursing intervention.

MATERIALS AND METHODS

Study population

This was a secondary analysis of an investigative study that included 186 CHF patients for which we established the WM scale, and a randomized controlled study (RCT) including total 130 CHF patients using WM intervention for 1 year. We initially enrolled 142 patients at baseline (71 in the control group and 71 in the WM group). In long-term follow-up, two patients received hemodialysis, one was lost, and four died in the control group, while three received hemodialysis, one was lost, and one died in the WM group. Ultimately, there were 64 patients in the control group and 66 in the WM group. The patients’ baseline data in this study included 186 patients in the surveyed study and the data from 130 patients before the WM intervention mentioned above. The 66 patients’ data after the 1-year WM came from the WM education intervention group.

From June 2011 to February 2013, patients were recruited from five Class 3 Grade A hospitals in Shanghai, Zhejiang, and Jiangsu (50 cases from two hospitals in Shanghai, 21 from one hospital in Zhejiang, and 245 from four hospitals in Jiangsu). The inclusion criteria were as follows: (1) confirmed diagnosis of CHF for > 1 month using the Framingham criteria; (2) cardiac function status classified into grades II-IV according to the NYHA and grade III in RCT; (3) > 18 years old; (4) ability to communicate with others; and (5) willingness to participate in the study. The exclusion criteria included patients with: (1) cognitive impairment or mental disorder; (2) acute HF, transient HF or other heart diseases like myocardial infarction within the past 3 months; and (3) other organ diseases like lung disease, renal disease, or tumors such as in the liver or lungs.

Procedures

All of the patients were investigated using the CHF Patients General Situation Questionnaire and CHF Patients Weight Management Scale (WMS). The data collection was obtained and completed face-to-face by five researchers who received a 1-hour training session for data collection at the beginning of the study. The questionnaires of the 66 patients who received 1-year WM intervention were completed when they returned to the hospital for echocardiography. Furthermore, we asked every patient how many times he (she) weighed his (her) body weight within a week.

General situation questionnaire

The CHF Patients’ General Situation Questionnaire was designed by our team after a review of the literature and consultation with cardiovascular experts. It included demographics (age, sex, marital status, education level, occupation status, medical insurance, diagnosis, and family support), diagnoses, NYHA classification, current medications, and readmission times within 6 months. We continued to collect data about readmission times within the 1-year WM education program, and whether intervention group patients were of abnormal weight. Additionally, patients who had caregivers or family members’ care were identified as having family support.

Weight management scale

The WMS is a quantitative self-reported question-
naire that includes four subscales: weight monitoring (two items), WM knowledge (four items), WM belief (four items), and WM practice (five items). It uses 3- or 4-point Likert scale response options in each item; the total score is 0-42, with higher scores indicating better WM ability. The scale’s content validity index is 0.88, and the coefficient α for internal consistency was 0.843 for WMS and 0.608-0.790 for the four subscales.9

Because the dimension of weight monitoring of WMS includes weight monitoring frequency, we did not use it as a variable.15 We used the standard score instead of an actual score to better present the changes between baseline and 1-year WM education. The formula of the standard score was as follows: standard score = actual score/total score of the dimension x 100.

Definition of good compliance with weight monitoring

The Heart Failure Association of the European Society of Cardiology proposed that a sudden unexpected weight gain of > 2 kg in 3 days or > 0.5 kg per day might be a sign of exacerbation. According to this guide, we defined good weight monitoring compliance as self-weighing ≥ 3 times per week.9,16

Statistical analysis

All analyses were performed with a statistical significance level of 0.05 using SPSS 18.0 (SPSS, Inc., Chicago, Illinois, USA). Categorical variables were reported as numbers (%), while normally distributed continuous variables are shown as means (SD), and non-normally distributed continuous variables are shown as medians (min, max). The chi-square test was used for categorical data, the two-sample t-test was used for normally distributed continuous data, and the Wilcoxon rank-sum test was used for non-normally distributed continuous data. A hierarchical logistic regression was performed to determine which factors individually influenced weight monitoring compliance. Missing values were imputed based on the overall mean.

RESULTS

Demographics and clinical variables

There were no obvious distribution changes in age, sex, marital status, occupational status, medical insurance, diagnosis, or NYHA classification between baseline and after 1 year of WM. However, patient education level, family support and medicine use differed between the two time-points. Although the mean age was similar at both time points (69.35 ± 10.923 vs. 67.35 ± 10.456 years), compared with patients with poor compliance, those with good weight monitoring compliance were younger (70.42 vs. 65.35 years). Furthermore, 71.20% of patients had a low education level (secondary school or less) at baseline versus 63.64% after 1 year of WM. The rate of family support after 1 year of WM (68.18%) was much lower than that at baseline (80.06%), especially in patients with poor weight monitoring compliance (53.85% vs. 78.62%). A full 84.81% of patients were using diuretics at baseline versus 78.79% after 1 year of WM, whereas 61.08% of patients were using angiotensin converting enzyme inhibitors/angiotensin receptor blockers [angiotensin-converting enzyme inhibitor (ACEI)/angiotensin II type 1 receptor antagonist (ARB)] at baseline, and 72.73% after the 1-year WM program; 69.62% of patients were using a β-blocker at baseline versus 92.42% after 1 year of WM. Patients with poor weight monitoring compliance had a lower usage rate of diuretics and a higher usage rate of ACEI/ARB and β-blocker after 1 year of WM than that at baseline (Table 1).

Correlation between WM-related dimensions and weight monitoring compliance

All of the patients’ scores of the three dimensions improved after 1 year of WM compared to baseline, but the change of each dimension of the two groups differed. The WM-knowledge dimension knowledge scores in the two groups generally improved, whereas the WM-belief dimension score of patients with good compliance improved more than that of patients with poor compliance. The WM-practice dimension score of patients with poor compliance improved more than that of patients with good compliance. Our study indicated that at baseline and after the 1-year WM intervention, the three dimensions related to WM (knowledge, belief, and practice) were factors that influenced weight monitoring compliance (Table 2).

Independent factors influencing baseline weight monitoring compliance

Hierarchical logistic regression was performed to determine independent factors that influenced baseline weight monitoring compliance. Demographic variables
Influencing Factors of Weight Monitoring Compliance

Table 2. Comparison between dimensions related to WM and weight monitoring compliance both at baseline and after 1-year WM

<table>
<thead>
<tr>
<th>Variables</th>
<th>Baseline, compliance of weight monitoring</th>
<th>After 1-year WM, compliance of weight monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Good (n = 40)</td>
<td>Poor (n = 276)</td>
</tr>
<tr>
<td>WMS Score</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WM-knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WM-belief</td>
<td></td>
<td></td>
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<tr>
<td>WM-practice</td>
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<tr>
<td>Data are presented as median (min, max) at baseline and as mean ± SD after 1-year WM. WM, weight management; WMS, Weight Management Scale.</td>
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</tbody>
</table>
were entered in block 1, followed by WM-related variables in block 2. We performed a Hosmer-Lemeshow test to judge the model’s goodness-of-fit because of continuous variables. The result ($\chi^2 = 11.255$, $p = 0.188 > 0.05$) suggested that the model had good goodness-of-fit. These five variables were used to account for 36.1% of the variance in weight monitoring compliance (Cox & Snell $R^2 = 0.192$, Nagelkerke $R^2 = 0.361$). We found that belief [odds ratio (OR), 1.043; 95% confidence interval (CI), 1.023-1.063; $p < 0.001$] and practice (OR, 1.046; 95% CI, 1.027-1.065; $p < 0.001$) related to WM were independent factors that influenced baseline weight monitoring compliance (Table 3), which indicated that patients with high WM-belief and WM-practice scores had better weight monitoring compliance.

**DISCUSSION**

This study provides a quantitative attribution analysis of factors that influenced weight monitoring compliance at two time points: baseline, and after 1-year WM. The baseline cross-sectional study data suggested that, on univariate analysis, age, education level, WM-knowledge, WM-belief, and WM-practice are associated with weight monitoring compliance. However, only WM-belief and WM-practice are associated with weight monitoring compliance after 1-year WM intervention (Table 4). Our findings suggested that patients who monitored their abnormal weight and had higher WM-belief score were more likely to weigh themselves regularly.

**Table 3.** Hierarchical logistic regression analysis on variables and weight monitoring compliance at baseline

<table>
<thead>
<tr>
<th>Variables</th>
<th>OR (95%CI)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>1.001 (0.963-1.041)</td>
<td>0.95</td>
</tr>
<tr>
<td>Educational level</td>
<td>1.037 (0.770-1.396)</td>
<td>0.81</td>
</tr>
<tr>
<td>WM-related variables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WM-knowledge</td>
<td>0.996 (0.978-1.015)</td>
<td>0.69</td>
</tr>
<tr>
<td>WM-belief</td>
<td>1.043 (1.023-1.063)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>WM-practice</td>
<td>1.046 (1.027-1.065)</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

WM, weight management.

**Table 4.** Hierarchical logistic regression analysis on variables and weight monitoring compliance after 1-year WM

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Variables</th>
<th>OR (95%CI)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical variables</td>
<td>Family support</td>
<td>2.231 (0.273-18.222)</td>
<td>0.45</td>
</tr>
<tr>
<td></td>
<td>Monitored abnormal weight</td>
<td>0.244 (0.006-0.991)</td>
<td>0.049</td>
</tr>
<tr>
<td></td>
<td>Diuretics</td>
<td>0.183 (0.022-1.543)</td>
<td>0.12</td>
</tr>
<tr>
<td></td>
<td>ACEI/ARB</td>
<td>5.171 (0.555-48.217)</td>
<td>0.15</td>
</tr>
<tr>
<td>WM-related variables</td>
<td>Readmission times within 1-year</td>
<td>1.755 (0.644-4.779)</td>
<td>0.27</td>
</tr>
<tr>
<td></td>
<td>WM-knowledge</td>
<td>0.843 (0.490-1.449)</td>
<td>0.54</td>
</tr>
<tr>
<td></td>
<td>WM-belief</td>
<td>2.054 (1.209-3.487)</td>
<td>0.008</td>
</tr>
<tr>
<td></td>
<td>WM-practice</td>
<td>0.846 (0.622-1.149)</td>
<td>0.28</td>
</tr>
</tbody>
</table>

ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin II type 1 receptor antagonist; WM, weight management.
monitoring compliance on multivariate analysis. The data from the longitudinal study after 1-year WM indicated that WM-belief and monitored abnormal weight play important roles in weight monitoring compliance. Although family support, diuretics and ACEI/ARB use, readmission within 1 year and WM-knowledge are associated with weight monitoring compliance in univariate comparisons, this association did not persist after inclusion in the hierarchical multiple logistic regression model.

**WM-related belief**

Patient needs and/or concerns about a treatment arm are associated with the formation of belief, and belief in a treatment arm can influence the motivation to start and continue treatment. Baker et al. pointed out that patients’ beliefs of controlling their diseases are strongly related to their self-care behaviors and compliance. To our knowledge, this is the first study to demonstrate an association between WM-belief and weight monitoring compliance. Before or after WM, belief related to WM is always an independent factor that influences weight monitoring compliance. In our study, WM-related belief consisted of four items, including “I can control my weight,” “I can weigh myself every day,” “I can monitor my condition through WM,” and “I can reduce the number of hospitalizations through WM.” The study found that higher scores indicate better weight monitoring compliance. In the other words, patients who believe they can control their conditions through WM will weigh themselves regularly. After 1 year of WM, there was no obvious improvement in WM-belief score (58.33 to 72.71), especially in patients with poor compliance (33.33 to 37.82). WM-belief is always the leading factor that influences WM compliance. Patients had insufficient belief before WM intervention and no obvious improvement after WM intervention. The possible reason for this is that the process of belief formation is complex and the WM program lacked psychological guidance for patients.

Although few studies have assessed the association between belief and weight monitoring compliance, a previous study found that poor weight monitoring is associated with not recognizing the importance of examining fluid retention. Increased doubts about the personal need for a treatment approach and increased concerns about the approach regimen were associated with non-adherence by Horne et al., who confirmed the impact of belief on compliance, which supported our research to some extent. However, important issues require further research, including how to better promote the formation of WM-related patient beliefs, how to make them believe WM can control their disease condition and believe that they can control their body weight.

**WM-related practice**

WM-practice is the most important factor affecting baseline WM compliance. WM-practice includes but is not limited to factors such as controlling salt and water intake, monitoring of leg edema and urine, and timely addition of diuretics. These factors are closely related to weight monitoring and are easily performed. When patients come to the Department of Cardiology or hospital for medical treatment, they could also benefit from education by medical personnel, even without WM intervention. However, although WM-practice is associated with weight monitoring compliance, it was not an independent factor after 1-year WM. This is because patients are aware of the importance of weighing themselves to evaluate liquid retention though WM, but routinely neglect other WM measures such as controlling water intake and monitoring leg edema and urine. However, this phenomenon did not affect patient condition monitoring or improve clinical outcome. Therefore, in clinical practice, health care workers should avoid repetitive education of all measures for patients; rather, they should make patients master WM by strengthening the core content like weight monitoring tasks to increase their disease management competency.

**Abnormal weight monitoring**

In the WM process, we determined whether abnormal weight monitoring becomes an independent factor to predict weight monitoring compliance. Good weight monitoring compliance can help patients more easily identify abnormal weight to improve their attention to their condition, and help them better adhere to weight monitoring. This is consistent with the results of Ni and colleagues, which found that no weight abnormality over an extended period of time is one of the reasons why patients do not persist with weight monitoring. How-
ever, failure to monitor abnormal weight in long-term WM decreases disease stability, and patient condition improvements, making it one of the important targets of weight management. It is worth noting that a proportion of the patients did not monitor their weight in this study, so we do not know whether abnormal weight gain occurred. This comprises a limitation of this study.

Other factors
An individual’s activity is a dynamic system of cognition, behavior, and environment, and patients’ cognition of the disease affects the formation of self-management beliefs and behavior.20 Patients’ knowledge is associated with their weight monitoring compliance but is not an independent factor at baseline or after 1-year WM. This finding is consistent with Maurice’s result.14,22 Patient baseline knowledge level was generally low. Although knowledge level is improved after 1-year WM, it is still not ideal. This suggests that the WM intervention failed to increase patient knowledge to the level that could independently affect weight monitoring behavior; therefore, it cannot be an independent factor to predict weight monitoring compliance.

At baseline, age and education level were correlated with the patients’ weight monitoring compliance. The higher the age, the worse the weight monitoring compliance, a finding that is consistent with Soraya’s result.23 A high education level can help patients realize the importance of weight monitoring, so the higher the education level, the better the weight monitoring compliance.

Good family support can change patients’ attitudes about their disease and improve their ability to reintegrate into family and society,24 indirectly improving weight monitoring compliance. However, at baseline, families little about the disease and have low WM knowledge, so they lack attention to weight monitoring. This is why family support is associated with weight monitoring compliance after 1 year of WM. Diuretics can help patients achieve a normal weight by rapid urination; therefore, this study showed that the uses of diuretics is correlated with weight monitoring compliance. Repeated hospital readmissions can increase a patient’s attention to the disease, making them more willing to weigh themselves. This is why number of readmissions within 1 year is associated with weight monitoring compliance. Although studies have shown that being unmarried was associated with poor compliance, our study showed that other demographic clinical variables were not associated with weight monitoring compliance.4,22

Limitations
This study has some limitations. The data of the 186 CHF patients used to establish the WM scale lacked occupation status, medical insurance, and primary diagnosis information, so we can only analyze these variables of the 130 CHF patients in the RCT. Because only 66 patients underwent WM, the small sample size was analyzed after 1 year. In the future, researchers should expand the sample size and perform a more accurate longitudinal study to demonstrate the factors influencing patients’ weight monitoring compliance in the WM intervention. Because weight monitoring was the key behavior in WM practice, we chose weight monitoring compliance as the study endpoint. However, other factors in WM practice are important and will be used as endpoints in future studies.

CONCLUSIONS
Our study supports the important role of a high WM-belief score in better adherence to weight monitoring compliance both at baseline and after 1 year of WM. We demonstrated that WM-practice score is associated with weight monitoring compliance at baseline, and that the monitoring of abnormal weight is associated with weight monitoring compliance after 1 year of WM. It is important that health care providers strengthen the cultivation of WM beliefs in CHF patients using professional psychological guidance and strengthen weight monitoring as an important measure of checking liquid retention rather than focusing on other non-key measures such as monitoring leg edema and urine volume. Further studies should expand the sample size and perform a more accurate longitudinal study to demonstrate the factors influencing patients’ weight monitoring compliance in WM intervention.

What’s new and important
Our study provides an analysis of the different factors associated with weight monitoring compliance at two time points (baseline and after 1 year of WM).
We support the important role of a high WM-belief score in better adherence to weight monitoring compliance both at baseline and after 1 year of WM. We also demonstrated that WM-practice score is associated with weight monitoring compliance at baseline and that the monitoring of abnormal weight is associated with weight monitoring compliance after 1 year of WM.

It is important that health care providers professionally cultivate WM beliefs in CHF patients and strengthen weight monitoring as an important way to check for fluid retention.

**CONFLICT OF INTEREST**

All authors have no conflict of interest regarding this paper.

**REFERENCES**