CHAPTER 2 LITERATURE REVIEW

2.0 Introduction

The focus of this research was to determine fluid compliance status and to evaluate the effectiveness of patient education on improving fluid compliance among haemodialysis patients. An overview of the literature relevant to the research topic, and a critical review of the existing literature, all mainly related to fluid compliance and educational interventions are presented in this chapter. The researcher starts with a brief description on the literature search strategy used to identify the relevant articles and to retrieve the existing literature. The subsequent section presents a description on treatment with haemodialysis, hypertension in haemodialysis, hypervolemia and interdialytic weight gain, compliance, patient education followed by a critical review on previous interventional studies on compliance. This literature review also examines Social Cognitive Theory as a foundation for the development of the conceptual framework of this study.

2.1 Literature Search

A criteria was set during the search process for relevant articles that were to be reviewed and analysed. Various databases were assessed using identified keywords to search for articles.

2.1.1. Criteria

The main criteria for articles included were that they were in English, and be on an educational program or behavioral modification program that aimed to improve fluid compliance among patients. The articles included for review were then further limited to those published in the last 10 years unless there was no more recent publication available. The researcher included studies involving compliance in dietary sodium and fluid intake, poor blood pressure control due to fluid overload, large interdialytic weight gain that contributed to cardiovascular complications, and education intervention methods applied to render compliance.

2.1.2 Sources

A literature search was done using various electronic databases with 'fluid compliance', 'patient teaching' and 'haemodialysis' as the key words. From this there were 506 journal articles published on this topic from 1997 to 2012. Relevant articles were strategically searched and retrieved for appraisal and discussion. A comprehensive search was carried out to identify systematic reviews; evidence based clinical practice guidelines or health technology assessments, randomized controlled trials, cohort, analytical, and case control studies.

The researcher utilized the following electronic databases, which are subscribed by the University of Malaya databases' digital library services:

- Medical Database (EBSCOhost):

  MEDLINE with Full Text database

  CINAHL with Full Text database

- Evidence Based Medicine (EBM) Review®OVID:

  OVID MEDLINE (R) 2005 to 2012

  EBM Reviews – Cochrane database of Systematic Review 3rd Quarter 2010

- OvidSP database – Journal @ Ovid Full Text
- Science Direct database

2.1.3 Keywords

The keywords used in the database search included:

'haemodialysis', 'fluid overload', 'excessive fluid retention', 'fluid compliance/ adherence', 'noncompliance/ nonadherence', 'interdialytic weight gain', 'patient education/ teaching', 'behavioral modification', and 'self-efficacy'.

Titles of items searched and retrieved from the database, either in the full text or abstract was viewed on screen. Relevant full text articles found were downloaded, saved and stored to facilitate the retrieving process. The reference lists of articles found were also reviewed to search for further relevant articles.

2.1.4 Results of key studies

There were 73 articles retrieved from combinations of the key words used. Most of the articles were studies on the determinants of fluid compliance or noncompliant behavior, review articles on fluid compliance, and analyses of the concept of patient education. After a critical review of the contents, there were a total of 10 original articles with interventional studies addressing fluid compliance or fluid adherence from the year 2003 onwards.

2.2 Haemodialysis treatment

Chronic renal disease is usually accompanied by a progressive and irreversible decline in kidney function. When much of the normal function of the kidney is lost, patients are characterized as having end stage renal disease. This disease presents special challenges to patients and their families because of the complexity of the treatment plan, lifestyle changes required and the pervasiveness of the symptoms and the treatment regimen in the individual's life. Renal replacement therapy includes haemodialysis, continuous ambulatory peritoneal dialysis and kidney transplantation which are the treatment options for these patients. The aim of renal replacement therapy is not only to prolong life, but also to restore quality of life by allowing patients to be independent and able to take care of themselves with minimal support.

Patients with end-stage renal disease undergo a complex treatment regimen involving dialysis and a wide range of dietary restrictions and lifestyles changes which affect their social and psychological functioning (Tsay & Healstead, 2002). Although such patients routinely receive haemodialysis treatment, which can remove large quantities of fluid in short periods of time, compliance in dietary and fluid intake remains essential for optimal health in their daily lives.

Maintenance dialysis is necessary to keep a person with irreversible kidney failure alive and healthy. However, it is not without complications such as cardiovascular disease which is one of the leading causes of morbidity and mortality among dialysis patients. It contributed to approximately 50% of deaths in the dialysis population and patients with chronic renal insufficiency (Locatelli, Marcelli & Conte, 2000). Many risk factors for cardiovascular disease such as age, smoking, hypertension, diabetes mellitus, hyperlipidaemia, which are found in the healthy population, are also found in end stage

renal disease patients. Besides these general risk factors, uremia related risk factors such as volume overload, hypertension, anemia, chronic inflammatory processes and other accumulation of uremic by-products can also be responsible for the progression of cardiovascular disease. Locatelli *et al*. (2000) pointed out that the classical cardiovascular risk factor in dialysis patients was hypertension. Several studies show that blood pressure control is generally poor in dialysis patients compared to the targeted guidelines (Chalmers, MacMahon & Manica, 1999). The poor control of blood pressure among dialysis patients is mainly attributed to the difficulty in achieving dry weight, associated with large interdialytic weight gain and unrestricted, often excessive dietary sodium and fluid intake (Peixoto & Santos, 2010).

2.3 Hypertension in haemodialysis

Hypertension is the most common complication among chronic haemodialysis population, with more than two thirds of these patients with uncontrolled hypertension. Uncontrolled blood pressure is one of the most important risk factors for cardiovascular disease and a leading cause of morbidity and mortality in dialysis patients (Zerbi & Luciano, 2010).

A study by Lucas, Quereda & Teruel (2002) demonstrated that uncontrolled hypertension leads to cardiovascular comorbidity and left ventricular hypertrophy, a highly lethal condition among dialysis patients. The study was done on 184 haemodialysis patients, conducted retrospectively from 1987 to 1997 in Spain. The results showed that the relative risk of cardiovascular morbidity for uncontrolled hypertension was 2.92 (95% CI 1.68 to 5.12, $p<0.001$) using a Cox proportional hazards model. From the number of patients with uncontrolled hypertension before

dialysis, 30% remained uncontrolled after dialysis. This data suggested that uncontrolled hypertension is a predictor for cardiovascular mortality in hemodialysis patients. Although it was not concluded that cardiovascular morbidity and mortality could be reduced with better hypertension control, the study pointed to an improved survival rate associated with lower blood pressure in dialysis patients. There is no evidence to support an ideal targeted blood pressure based on actual values among haemodialysis patients. The Kidney Disease Outcomes Quality Initiative (K-DOQI) guidelines however recommend a target blood pressure of less than 140/90 mmHg for predialysis treatment and less than 130/80mm Hg for post dialysis treatment (NKF, 2005).

The pathogenesis of hypertension is rather complex in the haemodialysis population. There are various pathophysiologic responses contributing to high blood pressure in these patients. Retention of fluid and sodium retention plays a pivotal role in regulation of blood pressure in haemodiaysis patients (Zerbi & Luciano, 2010). The kidney declines in its function as an excretory organ in balancing water and electrolytes, and this leads to hypertension. Cardiac output is also increased with volume expansion in patients with end stage renal disease (Morse *et al.* 2003). The renin-angiotensin system is activated because of the volume expansion and this increases the activity of the vasoconstrictive system which further increases blood pressure. Sympathetic activity may also contribute to hypertension among end stage renal disease patients. Volume overloads of greater than 6% of total body weight will activate the sympathetic nervous system and increase blood pressure. Patients with normotensive readings have significantly less total body water than hypertensive patients.

Hypertension is common in chronic haemodialysis patients and contributes to the morbidity and mortality of these patients (Mazzuchi, Carbonell & Fernandez, 2000). The causes of hypertension are multifactorial and the effect of volume expansion on blood pressure among haemodialysis patients recognized. Interdialytic weight gain (IDWG) provides an estimation of the degree of predialysis fluid overload (Leypoldt *et al*. 2002), and its impact on high predialysis and post dialysis blood pressure.

The cause of hypertension in haemodialysis patients is contributed by various factors and the blood pressure control difficult (Horl & Horl, 2002) but the importance of volume status is well known in haemodialysis. Inrig *et al.* (2007) conducted a study to examine the relationship between interdialytic weight gain and blood pressure among prevalent hemodialysis patients. Four hundred and forty two subjects were selected from the records of a dialysis center. Patients were followed up for six months using the Crit-Line Interdialytic Monitoring Benefit (CLIMB) Study. The author controlled nutritional and demographic characteristics which were shown to influence blood pressure in other studies. With the control measures, the author could define a clear relationship between interdialytic weight gain and blood pressure. The independent variable was IDWG (%) while the dependent variable was SBP predialysis. The results showed that every 1% increase on the IDWG was associated with an increased predialysis SBP and decreased post dialysis SBP ($P < 0.0001$). The study concluded in that increases in IDWG percentage was associated with increases in predialysis BP. Based on the findings from this previous study, by maintaining interdialytic weight gain between dialysis intervals as recommended, blood pressure can be controlled to a certain extent, although this is dependent on the patient's clinical parameters.

2.4 Interdialytic weight gain

Interdialytic weight gain (IDWG) is routinely assessed at the beginning of the dialysis session along with clinical signs and symptoms and predialysis blood pressure readings on which the amount of fluid removed during a dialysis session is based. The IDWG is also used as a basis for fluid and salt intake recommendations (Sarkar, Kotanko, Levin, 2006).

Patients with end stage kidney disease on haemodialysis have to restrict fluid intake to prevent fluid overload. Fluid overload or fluid surplus is a major clinical problem among end stage kidney disease patients (Newmann & Litchfield 2005; Charra 2007). The interdialytic weight gain depends on the amount of fluid consumption per day. Haemodialysis patients have dialysis treatment three times a week and most patients do not pass urine as they have lost their renal function. Water removal only occurs when they are on dialysis treatment. Patients may still consume water on days without dialysis but if the water consumption is more than the recommended 500ml per day, water retention or fluid overload results. Consequently, patient body weight might increase by a few kilograms between dialysis intervals. If the interval is longer, such as during the weekend, weight increment and fluid overload is also usually greater (Welch Perkins, Johnson, & Kraus, 2006). Haemodialysis patients need to control fluid intake in order to control interdialytic weight gain. The recommended interdialytic weight gain should not exceed 1 kg during the week and 1.5 to 2 kg during the weekend, and patients should restrict their consumption of dietary sodium and fluid (NKF, 2006).

The most important factor for arterial hypertension in haemodialysis patients is excessive interdialytic weight gain which is often related to sodium and water retention. Intake of water and salt can cause volume overload, and may be the main predisposing factor in developing high blood pressure and left ventricle hypertrophy, which can lead to increased cardiovascular risk (Lopez-Gomez, Villaverde, Jofre, Rodriguez-benitez & Perez-Garcia, 2005). A 5-year prospective observational study was conducted to assess the effects of interdialytic weight gain and its relationship with blood pressure in haemodialysis patients. All patients received conventional haemodialysis three times a week, over a duration of four hours. The average interdialytic weight gain and blood pressure from patients from 12 haemodialysis sessions was collected during the study period. The mean blood pressure (MBP) was calculated as systolic blood pressure plus 2 times diastolic blood pressure, divided by three {MBP = [SBP + (2 X DBP)] / 3}. Interdialytic weight gain was expressed as the difference between predialysis weight and the weight at the end of the previous dialysis session. Study results showed a direct correlation between interdialytic weight gain and predialysis mean blood pressure. Interdialytic weight gain was considered a measurement of fluid compliance, but a measurement which varied between patients (Lopez–Gomez *et al.* 2005).

2.5 Noncompliance in haemodialysis

Compliance in patients receiving haemodialysis is an important issue as noncompliance with the primary treatment regime leads to complications and even death in patients already suffering from a chronic illness. Compliance with a prescribed therapeutic regime has become a prime health care issue over the years. Noncompliance with prescribed therapy obviously influences dialysis care and outcomes. At least 50% of haemodialysis patients are believed to be noncompliant

with some of their regimes (Kutner, 2001) which may lead to many consequences. The evidence shows that patients who skip or shorten treatment have an increased risk of mortality because of increased fluid volume status and this excess of fluid volume has frequently been used to measure noncompliance. Increased interdialytic weight gain, is usually related to water and sodium overload, is the most important factor for hypertension in dialysis patients. A body weight of 10 mL/h/kg carries a risk of higher morbidity and mortality. Interdialytic weight gain is used as a quality indicator to enhance compliance to fluid control. (Lindberg, Prutz, Linberg, & Wikstrom, 2009). Interdialytic weight gain has been reported as a reliable measure of noncompliance to fluid restriction, with an interdialytic weight gain that exceeds 3.5% of dry body weight considered noncompliance on fluid intake (Denhaerynck *et al*. 2007; Kimmel, 2000).

Adherence to the dietary, fluid and medication recommendations bears a significant impact on the survival and health maintenance of patients with end stage renal failure being treated with long term haemodialysis. Failure to follow the prescribed treatment regime can result in adverse physical symptoms and even fatal consequences. Vlamick, Maes, Jacobs, Reyntjens & Evers (2001) developed the dialysis diet and fluid non-adherence questionnaire (DDFQ) for clinical practice to assess non-adherence in patients with end stage renal disease receiving hospital-based haemodialysis treatment. The study showed that 50% of patients reported that they were noncompliant in their behavior with regards to fluid intake for 5 days, and therefore, there was an average of 2 kilograms of weight gain between the two consecutive dialysis treatments. In addition, a strong positive correlation was established between the degree and frequency of fluid non-adherence.

Compliance in haemodialysis is multifactorial and depends mostly on its defining parameters although there is currently no standard parameter to measure compliance. Compliance in haemodialysis patients depends on the extent of the individual's behavior in conforming to the advice of the health care team on the treatment regimen prescribed, including fluid control, dialysis schedules and dietary restrictions. Due to the complexity of the parameters, Kimmel *et al*. (2000) identified several factors as haemodiaysis compliance markers, such as interdialytic weight gain (IDWG), serum phosphate and potassium concentrations, protein catabolic rate and adequacy of dialysis treatment to measure patients' compliance. In this study, interdialytic weight gain was used to determine its relationship with survival rates in haemodialysis patients. Interdialytic weight gain was calculated using patient weight at the beginning of each haemodialysis session (preweight) minus the weight after the haemodialysis session (postweight), divided by the nephrologists' determined dry weight, divided by the interdialytic period days, and expressed as the percentage of change per day (%/d). Calculated every three months, the results obtained showed interdialytic weight gain to be correlated with several nutritional and dialysis variables and with parameters that predict survival rates in haemodialysis patients.

Different approaches have been used to assess nonadherence in haemodialysis patients. For example, fluid excess has frequently been used as a means to measure noncompliance with haemodialysis treatment. Fluid excess is measured using weight gain, peripheral edema, and abnormal pulmonary functions taken before each haemodialysis treatment.

Sehgal (2002) used interdialytic weight gain alone as an index of adherence to fluid intake recommendations. Interdialytic weight gain is a way to measure nonadherence to fluid guidelines, and it refers to the amount of weight between consecutive haemodialysis sessions and is a biological measurement of an individual's fluid intake. This is supported by a study conducted by Rambod *et al.* (2010) to determine diet and fluid adherence in a group of Iranian haemodialysis patients. The indicators used to measure diet adherence were serum nitrogen and serum potassium levels. Once again, interdialytic weight gain was used as an outcome to measure fluid adherence which can reflect both fluid and sodium intake. Two hundred dialysis patients were recruited from 5 hospital-based dialysis centers. Patient inclusion criteria included those who received haemodialysis treatments 3 times per week for at least 3 months, were above 18 years of age, living in home settings and were literate. The authors reviewed medical records, blood results and pre- and post-dialysis weight gain. Blood urea nitrogen and potassium levels were used to measure dietary compliance, and interdialytic weight gain used as an indicator for fluid compliance. Interdialytic weight gain (IDWG) was calculated by subtracting post-dialysis weight gain from pre-dialysis weight (Lindberg *et al*, 2009).

The findings showed that 56% of patients did not adhere to fluid control while the mean weight gain was 2.5kg or more than 5.7% of the body weight. In this study, Rambod, Peyravi, Shokrpour & Taghi *(*2010) identified educational levels as associated with noncompliance while other factors such as gender, age and the duration of dialysis were not correlated with noncompliance. Rambod *et al.* (2010) found discrepancies in the prevalence of compliance behavior when compared to Western countries, probably due to differing cultures and beliefs. A limitation of this study was that the authors assumed predictors of dietary and fluid adherence and did not perform multivariate analysis. Results may therefore not generalize to other parts of the country. In future,

cluster sampling of the major hospitals in Iran should be carried out in order to be able to generalize the findings.

Chan, Zalilah & Hii (2012) conducted a cross-sectional study to identify factors influencing compliance behavior among haemodialysis patients locally. One hundred and eighty eight subjects participated in this study. Purposive sampling technique was used based on the inclusion criteria, which included that the patients had to attend three dialysis sessions per week, and be on haemodialysis treatment for at least 3 months, was 18years old, with no major acute disease or psychological disorders. A 25-items questionnaire was used to evaluate the patient knowledge on their dietary and fluid regime including nutrient sources from food , and consequences of noncompliance to dietary recommendations. The main measure of fluid compliance was using interdialytic weight gain, and the Dialysis and Diet Nonadherence (DDFQ) was used to determine fluid compliance behavior. The findings showed that 24.5% of patients were compliant on recommended fluid restrictions. Factors associated with fluid compliance were age, sex, employment status, and duration of dialysis. The study concluded that patients were compliant on their dialysis prescription, but their compliance on fluid restriction remained low. Younger males, those who were working and those who were on a longer duration of dialysis treatment needed more attention and support because they were not compliant on fluid restrictions. The small sample size and cross-sectional study design limited generalizability of the findings and cause and effect interpretations. It was suggested that a future study is needed to address this limitation by using a larger sample size and by implementation of an interventional study.

Haemodialysis treatment has gained acceptance and is seen as an option for renal replacement therapy for end stage renal disease patients, but many modifications and adjustments in daily life is required to adhere to treatment restrictions such as diet and fluid control. It is noted that more than 50% of the dialysis patients have been found noncompliant with the fluid restriction (Kugler, Vlaminck, Haverich & Maes, 2005). Pang, Ip & Chang (2001) used daily interdialytic weight gain as an indicator to measure patient compliance behavior on fluid intake restrictions. The formula given to calculate daily interdialytic weight gain was by subtracting postdialysis weight from the next session's predialysis weight, and divided by the number of days between the interdialytic sessions. A patient with an interdialytic weight gain of more than 0.9 kg per day was classified as having poor fluid compliance with those who had an interdialytic weight gain of less than or equal to 0.9 kg were categorized as having good fluid compliance. The findings showed that 30% of the patients had poor fluid compliance. Furthermore, higher interdialytic weight gain was more likely to occur for patients who had lower satisfaction with their perceived support, higher monthly family income and who managed one or more comorbid disease(s).

Many studies use interdialytic weight gain (IDWG) as a measure of fluid compliance because IDWG is a valid and objective outcome measure for fluid restriction compliance among haemodialysis patients (Kugler *et al*. 2005; Rambod *et al.* 2010; Chan *et al.* 2012; Tsay, 2003; Pang *et al.* 2001). However, there are two methods of assessing the IDWG (Richard, 2006). The first method is by expressing the mean IDWG in kilogram (Rambod *et al*. 2010; Chan *et al.* 2012; Tsay, 2003; Pang *et al.* 2001). It is simple to calculate and is based on the recommended weight gain between the days of dialysis treatment, which should not be more than 1 kg during the week and 1.5 to 2 kg during the weekend for dialysis sessions done thrice weekly (NKF

Guidelines, 2006). The researcher uses this calculation to measure fluid compliance in this study as dry weight is not included in the calculation.

Another method of calculation is by expressing the mean IDWG as a percentage above dry weight (Fisher, 2006; Ifudu *et al.* 2002; Kimmel *et al.* 2000; Saran *et al.* 2003). The calculation is based on weight gain for three dialysis sessions in a week which is subtracted from dry weight and divided by 7 days (week) to derive a mean IDWG % daily.

The problems with noncompliance and fluid overload are multifactorial and efforts to address these issues have long been recognized. Many studies have identified factors related to noncompliance and have developed interventions to improve compliance to increase positive patient positive outcome to promote a better quality of life.

2.6 Improving compliance in haemodialysis patients

Patient education plays an important role in patients compliance as an increased rate of compliance is directly linked to an effective patient education (Abbott, 1998). Researchers have found many benefits of successful patient education which includes patient participation in healthcare decision making, improved commitment to treatment, increased ability to cope with chronic diseases, improved quality of life in patients and their family members as well as decreased anxiety levels (Yoon, Conway & McMillan, 2006).

As prevention is better than cure, so is the step of developing strategies to assist patients in achieving fluid control and compliance to fluid restrictions better than increasing fluid removal by ultrafiltration during dialysis treatment. Several interventional studies have been done to address the issue of fluid compliance, also aimed at helping patients develop better fluid management.

2.5.1 Educational interventions

Many educational interventional studies have been conducted and aimed at achieving fluid compliance behavior among haemodialysis patients, but past findings show that numerous interventions have not been effective in changing compliance behavior through educational efforts alone. Two studies which utilized only educational interventions were found to be ineffective in the reduction of interdialytic weight gain.

A pilot study was done by Casey, Johnson and McClelland (2002) using the educational approach at an outpatient haemodialysis unit to assess a program using verbal and written advice on fluid balance. Twenty-one haemodialysis patients were followed over three separate 6-week periods. The first block group recorded their interdialytic weight gain following routine practice, while the second block group had a dietician and ward staff to reinforce health promotion and fluid intake; and the third block group referred to a leaflet on interdialytic fluid allowance which included tips for controlling fluid intake. The control measures used for all cohorts were a preset of sodium142 mmol/L dialysate and a no added salt diet of 80-100 mmol sodium per day. Interdialytic weight gain was used as an outcome measure of patient compliance. The interdialytic weight gain was calculated by taking the weight of the patient before dialysis treatment and subtracting post dialysis weight following the treatment.

The findings showed that more than 60% of the samples in block one (no intervention) had an average weight gain of 2.6 kg between dialysis sessions. However, there were improvements in block group two (dietician and staff verbal reinforcement during dialysis), in which 62% of the sample showed an improvement in their mean weight gain, which was 2.3 kg between dialysis sessions, but only 48% of the patients showed an improvement in weight gain in block three (education leaflet), however the improvement was not statistically significant (p=0.50). The limitations of this study included a small sample size and not having a control group to compare the effectiveness of the intervention. The patients were advised to limit their salt intake, but the assessment on the amount of salt taken was not clear or documented, and their thirst and drinking behavior probably influenced the results. Nevertheless, the study concluded that there was an improvement in the reduction of interdialytic weight gain following the intervention.

An educational intervention study was done by Molaison & Yadrick (2003) to evaluate the effects of a twelve-week educational intervention on fluid control in a group of 216 participants. Knowledge on the recommended weight gain, and mean weight gain was obtained from five experimental and control haemodialysis units respectively. There were two stages in the education intervention, with a six-week period for each stage. The first six weeks concentrated on increasing awareness and knowledge on fluid in daily diets and the importance of fluid control and minimizing weight gain during dialysis intervals. The information was delivered in three different methods, including a display of the importance of fluid restriction in the dialysis waiting room, twenty minutes of group education sessions, handouts, and direct feedback provided by a dietician to patients who exceeded 2.5kg.

During the second six week, participants were taught skills and strategies on preventing excessive fluid intake and ways to measure fluid intake amounts as well as methods to reduce their thirst desire. The findings showed that the knowledge scores increased significantly in the experimental group (P <0.001), but as weight gain increased from baseline up to 12 weeks, no significant difference was found between the experimental group and the control group. Thus, it was concluded that education alone was not an effective method of intervention to change behavior in relation to fluid restrictions. The possible explanation for the ineffective education intervention was probably due to the time factor. There might have been a gap between receiving the knowledge and applying of skills. The application of knowledge into skills may have been difficult because this was divided into two stages, and might have affected the outcome. Knowledge and skills should go hand-in-hand to ensure an effective intervention.

Barnett, Tang, Pinikahana & Tan (2008) conducted a study to evaluate the effectiveness of an education program on fluid compliance. The study was conducted using a quasi-experimental design, with one group of twenty-six noncompliant participants (IDWG >2.5kg). The outcome measures for fluid compliance were interdialytic weight gain, mean predialysis blood and rate of fluid adherence. The education intervention included individual teaching sessions that lasted about 20-30 minutes, with the teaching content consisting of the purpose of haemodialysis treatment, the importance of fluid control, fluid and salt intake and tips to control intake as well as weight control. The initial teaching session was followed by 10-minute reinforcement sessions weekly on the same teaching content over a two-month period where encouragement and positive reinforcement were given to patients to increase compliance on fluid restrictions.

The findings revealed that the mean IDWG decreased significantly from 2.62 kg to 2.21kg ($p<0.05$) for fluid restrictions, and the rate of fluid adherence significantly increased from 47% to 71% ($p<0.05$). There was no difference in the mean predialysis blood pressure before and after the intervention. However, the predialysis systolic blood pressure reduced from 221mmHg to 161 mmHg after the education intervention. The possible reason for these significant findings was the addition of weekly reinforcement sessions, which may have been a boost, compared to just individual teaching alone. Suggestions for future studies include a larger sample size and possibly a two-group design to overcome the current study's limitations, which included having only a small sample size from a single center, and not having a control group for comparison. Therefore, the results of the study were not generalizable.

Baraz, Parvardeh, Mohammadi & Broumand (2009) also conducted an interventional study to determine the effect of an educational intervention on dietary and fluid compliance in haemodialysis patients. This randomized clinical trial was conducted on 63 patients in three general hospitals in Iran. The authors used two methods of interventions -oral and video education. The first group had oral education; patients were invited to attend a 30-minute class after haemodialysis and the second group was on a 30-minute video education two times per week for two months. Both educational interventions had similar content which included general knowledge on end stage renal disease, dietary management, fluid restriction and complications of fluid overload. The results showed that the mean IDWG decreased significantly following the oral and video interventions. Compliance as indicated by the IDWG was observed to be 76.2% for all patients after the intervention. However, there were no outcome differences between the two educational interventions. There was no comparison made between the two education interventions, therefore a conclusion on the more effective method could

not be done. However, the findings showed that both oral and video education improved fluid compliance. As this was a cross-sectional study, retrieval of long term effects and measurements was not possible. It is suggested that a longitudinal study be done in the future to address this limitation.

2.5.2 Multidimensional intervention

The following studies applied a combination of the various interventions which made it difficult to identify which independent intervention contributed the most to fluid compliance. However, significant reductions on the IDWG were found in all the studies which applied a combination of self-regulation and education strategies (Tsay, 2003; Nozaki *et al*. 2005).

Tsay (2003) conducted a randomized clinical trial on sixty- two chronic haemodialysis patients to evaluate the effectiveness of self-efficacy training on fluid intake compliance. A structured, individualized training program was implemented for the treatment group. The intervention was based on Bandura's theory and included an educational component as well as performance mastery, experience sharing, and stress management. The outcome measurement was mean body weight gain between dialysis sessions. Data was collected and calculated for the baseline, and at one, three and six months following the intervention. Fluid intake compliance was measured by mean weight gain between dialysis sessions, which was indicated by postdialysis weight subtracted from the weight preceding the weight of the next dialysis session. There were no significant differences between gender, age, education level, current use of medication, duration of dialysis and other factors. However, the data did show that the mean weight gain decreased gradually in the experimental group following self-efficacy training. The mean weight gain in the experimental group decreased by 0.27 kg in first

month, further reduced by 0.33 kg in the third month, and dropped to 0.12 kg during the sixth month after the intervention. However, the mean weight gain for the control group only showed a slight decrease for the first and third month, but it increased slightly in the sixth month. The finding supported the hypothesis that patients who received educational interventions had better fluid compliance than those who did not receive any intervention. Hence, patient education or self-efficacy training plays an important role in managing the patients' compliance and promoting adherence. The limitation of the study included the inability to generalize the results because it was conducted in only one research site in the northern part of Taiwan. It is suggested that replicated and expanded studies are done to provide stronger evidence to support that self-efficacy training is solely responsible for improving fluid compliance. However, the findings demonstrated that self-efficacy training is important as a behavior modification intervention.

Another study was conducted in Japan using a quasi-experimental design on 22 subjects (Nozaki, Oka & Chabooyer, 2005). The aim of the study was to make a comparison between the effects of a standard patient education program (SPE) and a cognitive behavioral therapy (CBT) study on weight gain and sodium intake. The SPE group was given an education pamphlet with the content of kidney functions, fluid and salt management as well as water and salt content of the food. The CBT group focused on self-monitoring, a shaping method, assertion training and response prevention. The self-monitoring included the recording of salt and fluid intake, and participants were required to identify behaviors needed to achieve the target behavior. In the shaping method, assertion training was used to encourage patients to role play as a noncompliant patient and appropriate responses were discussed to prevent negative behaviors. On the other hand, response prevention encouraged participants to control their impulsive

behavior with regards to the consumption of fluid and salt. The duration of the intervention was six weeks, and the mean IDWG was calculated for the six weeks. A twelve week follow up phase was conducted to determine if the changed behavior was sustained even after completion of the intervention.

The results in the CBT group showed significant differences on the IDWG between the baseline and the intervention phase (p=0.04) and the 12 week follow- up phase (p=0.40). In the SPE group, significant differences were found between the baseline and intervention phase (p=0.04). The IDWG was found to be decreased in both groups. However the effect was sustained longer (12 weeks) in the CBT group while the effect of the SPE group only lasted for 8 weeks. The findings indicated that both interventions were effective, but the longer lasting effect was found in the CBT group. Even though the study was carried out with a small sample size, the significant findings validated the various interventions engaged in the study.

In another study, Fincham & Moosa (2008) applied the Theory of Planned Behavior (TPB) to predict dietary and fluid adherence among 62 in-center haemodialysis patients. The participants were asked to complete a psychometric instrument measuring attitudes, subjective norms, perceived behavioural control regarding dietary and fluid adherence, health literacy, perceived social support, and self-reported dietary as well as fluid adherence. Interdialytic weight gain (IDWG), predialytic serum potassium levels, and predialytic serum phosphate levels served as the biochemical indicators of dietary and fluid adherence. The results showed that TPB did not explaining interdialytic weight gain optimally. Nonetheless, attitudes and perceived behavioral control were found to be associated with dietary and fluid compliance. The results might not reflect the actual findings because the distribution of the health literacy scores was

significantly skewed, which might have affected the results of the correlation analysis. The participants reported that they were not sure about the difference between 'strongly agree' and 'agree' in the Likert Scale found in the questionnaire, and this may have contributed to the negatively skewed distribution and non-normally distributed health literacy data. Future research should consider using interview techniques to resolve this problem. There was no correlation analysis done for the dietary and fluid nonadherence with psychological and demographic factors. Future studies should also look into the association of these factors, because they play an important role as predictors for dietary and fluid adherence among haemodialysis patients.

The focus of this research was to evaluate the effectiveness of an educational intervention to improve patients' fluid compliance. Several educational interventions were reviewed and gave some directions to the intervention evaluated in this study.

Intervention that incorporated education and self-regulation components (self-monitoring and reinforcement) appeared to have the most impact on fluid adherence.

Thus, in this study adapted the structured, individualized training program based on Bandura's theory (Tsay, 2003),which included 1) personal teaching and weekly follow-up (Barnett et al.2008), 2) handouts (Patient Information Booklet), 3) direct feedback (Molaison & Yadrick 2003) and 4) recording of fluid intake based on the CBT (Nozaki, Oka & Chabooyer, 2005). The outcomes of this study were 1)IDWG 2)MPBP and 3) RFA which was used as a major outcome in all reviewed studies (Barnett et al.2008).

2.7 Patient education in end stage renal disease

Many educational strategies including personalized teaching, encouragement and supervision have been identified to improve patient compliance among haemodialysis

patients (Kutner, 2001). Nevertheless, knowledge is a prerequisite for adherence in behavior (Karamanidou *et al*. 2007; Bland *et al*. 2008; Mason *et al*. 2008; and Sun *et al*. 2008). To achieve optimal heath, patients with end stage renal disease need to understand all the aspects of their care which includes information on the disease, dialysis, education, dietary and fluid restriction and methods of coping with a chronic disease. Patient education is a process to facilitate such understanding. It is a teaching and learning process that involves an interaction or communication with the individual in the right environment to achieve goals. End stage kidney failure patients have specific yet different characteristics that occur as a result of the disease, therefore, the process of learning varies from individual to individual. End stage kidney patients usually become depressed; have short attention spans, altered sensory systems and decreased level of concentrations. Due to these characteristics, the teaching intervention for end stage renal disease should be carried out individually, with the teaching session not longer than 20 minutes each time, with the teaching content repeated and reinforced. Effective teaching enhances compliance and help to reduce the morbidity and mortality that is associated with noncompliance among the haemodialysis population.

2.8 Cognitive Theory

The social cognitive theory proposed by Bandura (1977) has become a most influential theory in the learning and development area. There are three core concepts found in social cognitive theory. The first concept is that people can learn through observation, the second idea is that the internal mental states are an essential part of this process and the final part of the theory recognizes that even though something has just been learned, it does not ensure change of behavior.

2.8.1 Observational learning

Bandura identified three basic models of observational learning:

i) A live model, which involves an actual person demonstrating or acting out a behavior.

ii) A verbal instruction model, which involves descriptions and explanations of a behavior.

iii) A symbolic model, which involves real or fictional characters displaying behaviors in books, films, television or in online media.

2.8.2 Mental states are important to learn

Intrinsic reinforcement is a very important factor in influencing learning and behavior besides external and environmental factors. Intrinsic reinforcement is a form of an internal reward, such as a sense of satisfaction, pride and accomplishment.

2.8.3 The modeling process

Behaviorists believe that learning leads to a permanent change in behavior, but observational learning demonstrates that people can learn new things without showing new behaviors. In order to have successful and effective learning, certain steps are involved in the observational learning and modeling process:

i) Attention – in order to learn, focus or paying full attention is essential.

ii) Retention – the ability to store information.

iii) Reproduction – once an individual is fully attentive and has retained the information, the learned behavior may be reproduced with more practice leading to improvement in skills and advancement in those behaviors.

iv) Motivation – reinforcement and punishment plays an important role in motivation

2.9 Conceptual framework

As mentioned previously, the conceptual frame for the educational intervention was developed based on the Social Cognitive Theory using the three core concepts of the theory.

The education intervention is the verbal instruction model*;* whereby the teaching was done face -to -face (*Attention)* for each patient using a prepared file with slides (*observational learning*). The educational session which lasted about 20-30 minutes focused on the purpose of haemodialysis treatment, importance of fluid control, fluid intake and tips on fluid control, salt intake and control as well as weight gain control. The patient was given time to ask questions during the teaching session and patient feedback on their understanding (*reproduction*) was continuously assessed via questions and answers throughout the session.

The individual teaching session was carried out only once during the study, and was followed up with weekly reinforcement (*reinforcement*) sessions. The follow-up sessions took about 10-15 minutes weekly over the duration of three months and carried out once the haemodialysis treatment had begun in the clinical setting. Encouragement and motivation (*motivation)* was given to participants who adhered to the fluid intake recommendation and maintained the recommended weight gain. A patient information booklet was given to patients after the teaching session *(retention)* for their reference.

The conceptual framework proposes a relationship between the independent variable, educational intervention and the dependent variables. Assumptions for the framework include a) noncompliance to fluid restriction creates a need for learning, b) patients often seek knowledge from their health care providers, c) demographic and medical variables affect the patient's response in compliance, d) knowledge and fluid compliance are the outcome variables, e) patient's knowledge and fluid compliance improve after the educational intervention.

Haemodialysis patients were lacking in knowledge and were noncompliant on the recommended amount of fluid intake. The educational intervention was given to the experimental group while the control group received routine patient education from health care providers occasionally when problems occurred.

The framework schematically (Figure 2.1) depicts how patients who receive the educational intervention demonstrate increased knowledge and change in behavior related to fluid compliance.

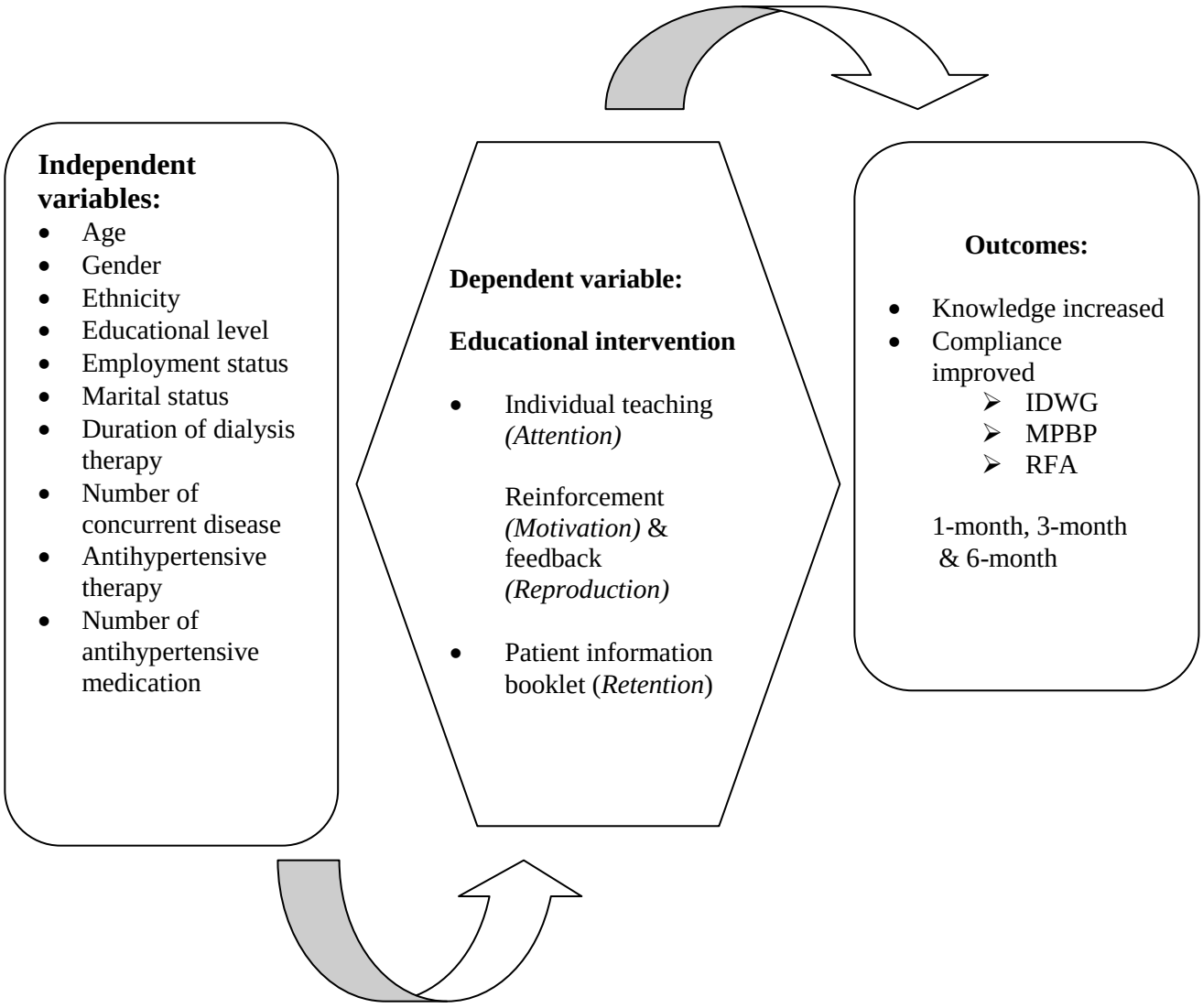

Figure 2.1 Education – Compliance Model for haemodialysis patients

2.10 Summary

This chapter presented a description of the literature search, with articles on common problems faced by haemodialysis patients including hypertension, interdialytic weight gain and noncompliance. Related studies pertaining to various interventional strategies on educational approaches were also described and the methodology discussed. Relevant studies were also critiqued and suggestions for the current study were highlighted. The chapter concluded with an explanation of the conceptual framework using Bandura's Social Cognitive Theory applied to facilitate the implementation of this study.