Self-Management Programs on eGFR, Depression, and Quality of Life among Patients with Chronic Kidney Disease: A Meta-Analysis

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A R T I C L E   I N F O

Article history:
Received 11 February 2015
Received in revised form 6 April 2016
Accepted 15 April 2016

Keywords:
depression
kidney diseases
meta-analysis
quality of life
self-management

S U M M A R Y

Purpose: Chronic kidney disease (CKD) is a condition characterized by the gradual loss of kidney function over time. Self-management programs have been widely applied to chronic disease education programs, which are designed to delay deteriorating kidney functions, preclude depression, and improve quality of life. This study aims to analyze effectiveness of self-management programs in bettering CKD patients’ eGFR, mitigating depression symptoms and improving quality of life in randomized control or clinical trials.

Methods: Using key terms, a search was conducted in English-language, peer-reviewed journals on CKD that were published between 2002 and 2014 on databases including CINAHL, Cochrane Library, MEDLINE. The measurable variables included CKD patients’ eGFR, depression, and quality of life. Random and fixed effects meta analysis were applied with standard error and correlation based measure of effect size.

Results: Eight studies met the inclusion criteria. A self-management program significantly impacted CKD patients’ depression and mental quality-of-life dimensions, with an effect size of .29 [95% confidence interval (CI) (0.07, 0.53)] and .42 [95% CI (−0.75, −0.10)]. However, the intervention of a self-management program had no significant effect on patients’ eGFR as well as physical quality-of-life dimensions, with effect sizes of .06 [95% CI (−0.69, 0.81)] and .16 [95% CI (−0.81, 0.50)].

Conclusions: Self-management programs of patients with chronic kidney disease can improve the depression and mental quality of life. Aside from providing more objective evidence-based results, this study provides a reference for clinical health care personnel who tend to patients with CKD.

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Introduction

Chronic kidney disease (CKD) is an important health issue worldwide. The high prevalence and incidence of CKD and end-stage renal disease (ESRD) are a serious global problem. According to the 2012 annual report of the United States Renal Data System, 361 out of every million people in Taiwan suffer from CKD, an incidence rate ranking second highest in the world. Approximately 3,000 incidental ESRD cases occurred in 2012 in a population of 10 million adults; the incidence rate would be 300 per million per year in the USA [1]. In addition to increasing the odds of death caused by cardiovascular disease, impacting an individual’s psychological and physical well-being, and affecting patient quality of life, CKD also poses a heavy burden on the nation’s healthcare system [2]. Moreover, patients who had received hemodialysis treatment were also responsible for self-care to minimize the physical, mental, social, and spiritual impact of renal failure [3,4].

The National Kidney Foundation redefined CKD as a five-stage disease, using the estimated glomerular filtration rate (eGFR) as an index to evaluate abnormal renal function. Stage 1 is defined as a mildly decreased eGFR (≥ 90.0 mL/min/1.73m²) with evidence of kidney damage such as proteinuria and hematuria. Stage 2 is defined as a mildly decreased eGFR (≥ 60.0–89.9 mL/min/1.73m²) with complications such as proteinuria and hematuria. Stage 3 is defined as a moderately decreased eGFR (≥ 30.0–59.9 mL/min/1.73m²). This stage can be subclassified into Stage 3a (≥ 45.0–59.9 mL/min/1.73m²), and Stage 3b (eGFR ≥ 30.0–44.9 mL/min/1.73m²). Stage 4 is defined as an advanced decrease in the
eGFR (≥ 15.0–29.9 mL/min/1.73m²). Stage 5 is defined as renal failure, with an eGFR less than 15.0 mL/min/1.73m². Stage 5 refers to patients suffering from irreversible loss of kidney function, accumulation of wastes and fluid, electrolyte imbalance, acid alkaline imbalance, with these conditions creating an imperative for dialysis treatment [2].

Self-management is a broad concept referring to patients’ responsibility and capability of living a healthy lifestyle. Self-management is also the prerequisite for humans to manage acute diseases and provide healthcare for patients with chronic disease. The concept of self-management is built upon an individual’s awareness of the importance of self-care in response to the progression of a chronic disease. Also, healthcare providers should share and provide information concerning treatment decisions to patients [5]. Self-management has been conceptualized as a subset of self-care behavior. Focused on managing the actual or potential impact of disease, the concept of self-management of a disease includes the self-care behaviors of self-monitoring, symptom management and other related concepts. Self-efficacy is the moderator or mediator of the concept of self-management [6]. These interventions are the property of a self-management intervention program. Self-management is an important concept in disease control, emphasizing health guidance to direct patients to focus on their own problems. Patients need to identify these problems of most concern and what they mean to them. This is one of the most effective health education programs around the world and the most widely accepted international health education program [7]. Self-management of patients with CKD is defined as patients’ positive efforts in monitoring their own health and symptoms, making the best use of available medical resources, living a preferred lifestyle, and minimizing the likelihood of deteriorating health conditions [8]. As such, patients with CKD need to be confident and capable of managing their long-term health condition [9]. Patients with CKD who have become self-management experts are capable of maximizing their ability to endure bad health and slow the pace of a deteriorating health condition. On the other hand, patients who effectively prevent the onset of medical complications are able to achieve better physical and mental well-being, a better quality of life, and live a preferred normal life [10]. A systematic review of previous research revealed that the content of self-management programs for patients with ESRD includes (a) a self-efficacy training program, (b) cognitive behavioral therapy, (c) an empowerment program, (d) education intervention, and (e) behavioral contracting and weekly telephone contact intervention [11].

A systematic review of the effectiveness of a self-management program on patients with CKD and an examination of research papers that adopted the randomized controlled trial (RCT) method revealed that most research results proved the effectiveness of the intervention with respect to experimental statistics, mental, behavior, and patient knowledge [12]. According to a study that examined systematic reviews (including 22 papers), 18 research papers is identified enhanced patients’ disease knowledge, improved patients’ body weights between two dialysis sessions, and kidney function. The other four papers identified mitigated patients’ depression and stress perception, and improved patients’ self-efficacy and quality of life [13].

Depression is a frequent symptom of mental distress for patients with CKD. Between 20 and 30 percent of patients with ESRD experience depression. Symptoms of ESRD that are not effectively alleviated are likely to increase the likelihood of patient readmission, to a medical facility or may even lead to death. For that reason, depression is a frequent variable in detecting patients’ adaptation to their health condition [14].

Patient self-management is a desired goal of healthcare management. Self-management reduces the risk of complications and minimizes the use of medical services (including the rate of hospitalization). Self-management reduces medical costs, enhances patients’ ability to adjust, and can increase patient satisfaction. These effects result in patients’ having better control of their medical symptoms and their recovery while also improving patients’ self-efficacy, sense of control, resilience, quality of life, and mental and physical wellbeing [15,16]. Previous studies have shown that the interventions of a self-management program did effectively improve patients’ eGFR [17]. However, two studies showed that the intervention of a self-management program did not effectively improve patients’ eGFR [18,19].

Today, evidence-based nursing is the trend. There is a risk of publication bias when analyzing a small number of studies. Intervention groups have a sample size of 20 [20, 25 [21] and 23 [19]. Such a relatively small number of unpublished studies with null results may not change the outcome of the analysis. Three common variables with CKD, eGFR, depression and quality of life were not included in the review. Only a few studies have focused on CKD or ESRD. Only one paper examined patients with stages 1–5 CKD [18]. Work remains to be done focusing on testing the population for ESRD or CKD stage 3 and stage 4–5. Furthermore, other limitations of previous reviews may have influenced the findings and conclusions reported in existing papers. To date, no meta-analyses have established the associations of eGFR, depression, and quality of life with the self-management program.

Conclusions about the association of eGFR, depression, and quality of life from these three earlier reviews are limited by the number of studies and the types of disease included. To address these important issues, we reviewed the recent literature relating to eGFR, depression, and quality of life across a range of CKD, performed a meta-analysis to evaluate the strength and direction of this association. As such, this study aims to systematically review and meta-analyse the effects of a self-management program on improving CKD patients’ kidney function, depression, and the quality of life from previous evidence-based studies. These comprehensive research results might inform clinical healthcare personnel of the empirical benefits of a self-management program on patients with CKD and provide an alternative to a traditional health education program.

Methods
Searching for and selecting relevant literature

This study adopted a systematic review and meta-analysis to evaluate previous research that addressed the effects of employing a self-management program intervention on CKD patients’ control of their kidney function. The search for reviewable English-language CKD studies from peer-reviewed journals published between January 2002 and June 2014 was carried out on databases including CINAHL, Cochrane Library, MEDLINE. Considering that the abnormal kidney function index had been changed from blood creatinine levels to the eGFR level by the American Society of Nephrology in 2002 to define CKD, the keywords we used for the literature search included “chronic kidney disease” and “self-management program” or “self-management promotion program” or “self-efficacy training program” or “empowerment program” or “cognitive behavioral group therapy” and “estimated glomerular filtration rate” and “depression” and “quality of life”. Research papers selected and analyzed in this study had to meet the following criteria: (a) adopted either the RCT or a quasiexperimental design, (b) chose CKD patients aged over 20 years old as research participants, (c) selected self-management program as the intervention, and (d) used measurable variables including eGFR level, depression, along with mental and physical components of quality of life.
Qualified research papers must have used the Beck Depression Inventory to measure patients’ depression condition and used the Medical Outcome Study, Short Form-36 (MOS SF-36) two distinct groupings, relating to physical health component scores and mental health component scores developed by Ware et al. [22] to examine the physical and mental aspects of patients’ quality of life. Also, research papers that met any of the following descriptions were excluded: (a) those that were reviews and systematic reviews of other research papers for the reason that such research papers would encompass results of a number of other studies; this indicated that complete relevant information of research samples was relatively difficult to find; (b) those that addressed multiple intervention measures, making it difficult to evaluate the effects of a single measure, and (c) those that did not include a control group in the experiments. After conducting a keyword search, we perused the title and abstract of the research papers resulting from the keyword search criteria we had set for qualified research papers. Furthermore, we thoroughly read the contents of these research papers while factoring in what features we preferred not to have in a research paper to select those papers that met the criteria of this study.

Quantitative quality

Two kidney disease experts were assigned a critical appraisal tool published by the Joanna Briggs Institute in 2011 to appraise the quality of selected research papers for this study. In addition, based on the quality of evidence, a method was developed to classify all of these research papers into seven levels, appraise the selected research papers, reach conclusions of the literature review with reference to the appraisal standards, and suggest different intensity levels based on the level of evidence in these papers [23]. The research paper selection involved two appraisers conducting independent appraisals first and cross-checking later, reaching a consensus through discussions or consultations with a third party when conflicting opinions arose.

Data analysis

The statistical software Comprehensive Meta-Analysis 2.0 (Biostat Corp. Englewood, NJ, USA) was used to analyze the effects of a self-management program as an intervention measure [24]. Measurable variables included the eGFR, depression, the SF-36 Health Survey for assessing patients’ quality of life, and subscales for assessing patients’ physical and mental wellbeing. Also, the arithmetic mean and standard deviation were analyzed. The standard error in the original research papers was converted into the standard deviation. Heterogeneity in the research papers was tested by using the chi-square statistic $Q$ and quantitative inconsistency ($I^2$) [25], and $p$ less than .05 indicated heterogeneity. Significantly different $Q$ values indicated the heterogeneity in selected research papers whereas the $I^2$ statistic could represent a low (25.0%), moderate (50.0%), or high (75.0%) level of heterogeneity. In order to include the between-group and within-group sampling error, a fixed effects model was used to perform meta-analysis on homogeneous research papers whereas a random effects model was used to perform meta-analysis on heterogeneous research papers [26]. The effect was set to a 95% confidence interval (95% CI). The effect size and the 95% CI were examined using a forest plot as an index of the strength of an intervention’s effects. Effect sizes of .2, .5, and .8 represented the weak, moderate, and strong effects of an intervention respectively [27]. Further, the existence of publication bias was examined using a funnel plot for asymmetry [28].

Results

Figure 1 is the flowchart of the process and results of our literature search. The initial search, conducted on three English database by factoring into components what we wanted in a research paper. There were 187 papers selected from the database, including 45 papers from CINAHL, 67 papers from Cochrane Library, 75 papers from MEDLINE. Also, there were 161 papers were conducted to eliminate duplication, and 26 articles remained from the process of selection. By reading the abstracts of each research paper, 17 papers were reviewed for the preliminary assessment and elimination of unqualified papers by two researchers who reached a consensus on the quality of selected research papers (represented with JBL level 9). One paper was remained after a scrupulous literature appraisal by eliminating substandard research papers or incomplete research data. Finally, there are 8 finalized research papers from Meta-Analysis. The searching steps were described in Figure 1. Table 1 shows a summary of the eight studies. Our elimination and selection process indicated that five of the eight studies could be used to discuss the effect of self-management programs on patients’ depression; the remaining three research papers could be used to discuss the effect of the self-management program on patients’ eGFR, each with three papers used to discuss the effects of self-management programs on patients’ physical and mental quality of life.

The analysis of the effect of self-management programs on patients’ eGFR indicated heterogeneity among the three chosen research papers ($Q = 11.37$, $p = .003$, $I^2 = 82.41$%). Using a funnel plot to check for the existence of publication bias revealed no such bias. As shown in the forest plot in Figure 2, a random effects model for meta-analysis generated an effect size of .06 [95%CI (−.69, 0.81)], indicating that the intervention of a self-management program did not significantly affect patients’ eGFR.

The analysis of the effects of self-management programs on patients’ depression indicated heterogeneity among the five chosen research papers ($Q = 16.30$, $p = .003$, $I^2 = 75.46$%). Using a funnel plot to check for the existence of publication bias revealed no such bias. As shown in the forest plot in Figure 3, a random effects model for meta-analysis generated an effect size of .29 [95% CI (0.07, 0.53)], indicating that the intervention of a self-management program significantly affected patients’ depression, although the effects were on the moderate side.

The analysis of the effect of the self-management program on patients’ performance on the physical quality-of-life dimension revealed heterogeneity among the three research papers on patients’ physical quality-of-life dimension ($Q = 8.07$, $p = .018$, $I^2 = 75.21$%). A funnel plot was used to check for the existence of publication bias. The result of the funnel plot supported no publication bias. As shown in the forest plot in Figure 4, a random effects model for meta-analysis generated an effect size of −.16 [95%CI (−.81, 0.50)], indicating that the intervention of a self-management program did not significantly affect patients’ performance on the physical quality-of-life dimension.

With regard to patients’ mental quality-of-life dimension, the three research papers were homogenous ($Q = 0.71$, $p = .703$, $I^2 < .001$). Further, a funnel plot was used to check for the existence of publication bias. The result of the funnel plot supported no publication bias. As shown in the forest plot in Figure 4, a fixed effects model for meta-analysis generated an effect size of −.42 [95%CI (−.75, −.10)], indicating that the intervention of a self-
management program did significantly affect the patients' performance on the mental quality-of-life dimension, with moderate effects.

**Discussion**

The present study was the first to use a systematic review and meta-analysis approach to investigate the effect of self-management programs on kidney function, depression, and quality of life in patients with chronic kidney disease (CKD).

We begin with the intervention of a self-management program on improving CKD patients' eGFR. As revealed by the results of a meta-analysis of three selected studies, the intervention of a self-management program did not effectively improve patients' eGFR. The outcomes for which we found none effect size (ES = .06) of patient's with chronic kidney disease self-management programs can improve patients eGFR. However, the intervention of a self-management program had no significant effect on patients' eGFR. The effect sizes of .06 imply no significant difference [17]. Two of three studies found no significant difference in patient's eGFR between groups [18,19]. More research evidence is required in order to confirm the ameliorating effects of intervention methods (group or individual) on CKD patients' kidney function.

The outcomes for which we found the moderate effect size (ES = .29) of patients with chronic kidney disease self-management programs can improve patient's depression. However, 4 of 5 studies found that patient's depression was better in the intervention (self-management programs) group than in the control (usual care) group [21,29–31]. One study found no significant difference in patient's depression between groups [20]. We found that the above research papers all conducted post intervention tests at least 6 weeks, 3 months, or even 9 months after the intervention of a self-management program [30]. All research papers found the effects of the interventions on alleviating patients' depression. Nevertheless, no specific effects were found in the research [20], nonsignificant effect was reported when depression was measured in a month. A piece of advice for papers that adopt the systematic review method to evaluate the effectiveness of a self-management program on patients inflicted with chronic diseases is that the intervention should last for at least 4 weeks, the first post intervention test should be conducted at least 4 weeks post intervention, and a follow-up effect should last for at least 3 months [4]. Therefore, we suggest that a period of at least 4 weeks between an intervention and the post intervention test as more likely to capture the effects of an intervention. The finding of this research may serve as reference for future research.

The outcomes for which we found the moderate effect size (ES = −.42) of patients with chronic kidney disease self-management programs did effectively improve patients' mental quality of life. However, all studies found that patient's mental quality of life was not better in the intervention (self-management programs) group than in the control (usual care) group [19,20,31]. This finding may be due to the differences in sample sizes that were used in these studies resulting in no significant intergroup differences in any single study.

The outcomes for which we found no effect size (ES = −.16) of patients with chronic kidney disease self-management programs cannot improve patient's physical quality of life. However, 2 of 3 studies found that patient's physical quality of life was better in the intervention (self-management programs) group than in the...
<table>
<thead>
<tr>
<th>Study/author</th>
<th>Study design/country</th>
<th>Subjects/age/sample size/ dropout n (%)</th>
<th>Intervention</th>
<th>Treatment (T) &amp; follow up (F)</th>
<th>Outcome (Mean ± SD)</th>
<th>Level of evidence based (Quality of the papers)</th>
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<tbody>
<tr>
<td>Chen et al [17]</td>
<td>RCT/Taiwan</td>
<td>CKD stage 3–5/ 68.2 ± 12.1; I: 27, C: 27/10 (16.0%)</td>
<td>Self-management support: providing health information, reinforcing patients’ motivation to learn, encouraging self-care and continuing existing treatments (once per month), telephone follow-ups (once per week) and a support group (twice a month, 5–10 people).</td>
<td>T: 12 mo F: 12 mo</td>
<td>eGFR (I: 29.11 ± 20.61; C: 15.72 ± 10.67), p = .04</td>
<td>II(7/10)</td>
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<tr>
<td>Choi &amp; Lee [18]</td>
<td>Quasiexperimental design/South Korea</td>
<td>CKD/ 56.13 ± 13.01; I: 31, C: 30/Not reported</td>
<td>Self-management educational program: teaching knowledge and skills in relation to kidney function and self-health care (8 groups in total, each of which consisted of 3–5 people; 20 minutes per session for a duration of 4 weeks).</td>
<td>T: 4 wk F: 4 wk, 8 wk</td>
<td>eGFR (I: 38.22 ± 14.96; C: 43.86 ± 11.73), p = .822</td>
<td>III(5/10)</td>
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<tr>
<td>Campbell et al [19]</td>
<td>RCT/Australia</td>
<td>CKD stage 4–5/ 69.75 ± 12.15; I: 23, C: 24/13 (22.0%)</td>
<td>Individualized nutritional counseling: providing individualized nutritional counseling (once every 2 weeks), telephone counseling, and self-management principles.</td>
<td>T: 1 mo F: 12 wk</td>
<td>eGFR (I: 21.90 ± 6.30; C: 23.40 ± 7.90), p = .53 SF-36: PCS (I: 35.90 ± 10.20; C: 29.90 ± 7.90), p = .107 SF-36: MCS (I: 47.70 ± 11.70; C: 40.00 ± 12.60), p = .069</td>
<td>II(7/10)</td>
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<td>Lii et al [20]</td>
<td>RCT/Taiwan</td>
<td>ESRD (HD)/ Not report; I: 20, C: 28/12 (20.0%)</td>
<td>Group psychosocial intervention: encompassing the cognitive-behavioral theory and the self-efficacy theory, which can enhance patients’ knowledge, familiarize patients with relevant skills, enable smoothly-performed treatments, and enable individuals the ability of self-management. A group class was used and there were 8 class sessions in total (1 session per week and 2 hours for each session).</td>
<td>T: 2 mo F: 1 mo</td>
<td>BDI (I: 12.85 ± 6.64; C: 21.39 ± 15.10), p = .001 SF-36: PCS (I: 42.87 ± 5.93; C: 40.46 ± 9.75), p = .008 SF-36: MCS (I: 43.49 ± 7.49; C: 40.10 ± 12.13), p = .19</td>
<td>II(9/10)</td>
</tr>
<tr>
<td>Tsay &amp; Hung [21]</td>
<td>RCT/Taiwan</td>
<td>ESRD (HD)/ 51.18 ± 9.75; I: 25, C: 25/Not reported</td>
<td>Empowerment program (3 times per week): assisting patients to develop skills and self-awareness, reinforcing patients’ self-efficacy, enabling patients to practice self-care, and self-management.</td>
<td>T: 1 mo F: 6 wk</td>
<td>BDI (I: 13.36 ± 10.55; C: 10.40 ± 10.34), p = .03</td>
<td>II(9/10)</td>
</tr>
<tr>
<td>Chen et al [29]</td>
<td>RCT/Taiwan</td>
<td>ESRD (HD)/ 58.00 ± 11.00; I: 37, C: 35/8 (10.0%)</td>
<td>CBT program including sleep hygiene education (once per week and 30 minutes each time for 6 weeks in total). Videos were used to supplement the CBT program in the period when patients received HD. Group discussions and education ensued after the HD.</td>
<td>T: 6 wk F: 6 wk</td>
<td>BDI (I: 13.80 ± 11.30; C: 16.10 ± 14.00), p = .022</td>
<td>II(6/10)</td>
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<tr>
<td>Duarte et al [30]</td>
<td>RCT/Brazil</td>
<td>ESRD (HD)/ 53.20 ± 14.30; I: 41, C: 44/16 (18.0%)</td>
<td>CBT program once per week, 0.5–1 hour, 12 week. Additionally, once per month, meetings for the purpose of reinforced effects were provided at the maintenance stage to help patients maintain abilities that they had acquired.</td>
<td>T: 12 wk F: 3 mo, 9 mo</td>
<td>BDI (I: 10.80 ± 8.80; C: 17.60 ± 11.20), p = .002</td>
<td>II(7/10)</td>
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control (usual care) group [20,31]. One study found no significant difference in patient's physical quality of life between groups [19]. We recommend continuing bigger sample of meta-analysis in the future.

Study limitations

The research papers analyzed in this study addressed the effects of self-management programs. RCTs and quasi-experimental designs were adopted, while a blind design was not feasible and a double blind design was especially difficult. Otherwise, a double blind design would have precluded selection bias, performance bias, and detection bias. Some of the studies did not clearly explain that the Joanna Briggs Institute quality assessment scores were lower. Studies that did not specify the rates of participant loss or the reasons for participant dismissal among different research groups were likely susceptible to attrition bias. In this study, systematic review has small number of studies (n = 8) included for the meta-analysis. As such, only three studies on the outcome of quality of life were analyzed. One study no answer was received from these papers' authors after our attempts to contact her/him.

As revealed in our study, the effects of a self-management program intervention on CKD patients' eGFR remain inconclusive. Such intervention may have some degree of effectiveness on emotional and psychosocial well-being but not on kidney function. In actuality, many factors can affect the control of renal function. Whether self-management is the cause of the real impact remains to be determined by future research. This study acquired three eligible papers for analyzing eGFR and quality of life. Future research is expected to substantiate this intellectual research regarding self-management programs for patients with CKD. Systematic literature analysis could be performed only on the documentation contained in the three studies to examine a self-management program. Given the greatly varied self-management program content, future research is expected to clarify what defines a self-management program and how to collect more empirical studies for meta-analysis.

Conclusion and recommendations

In conclusion, the present study adds to the evidence and show that a self-management program significantly impacts CKD patients' depression and mental components of quality of life. However, the intervention of a self-management program has no significant effects on patient's eGFR as well as physical dimensions of quality of life. As this study's results indicate, the intervention of a self-management program is moderate in effect size for depression and mental component of quality of life. A self-management program, which is an innovative health instruction method alternative to traditional health education, is designed for patients with chronic disease, such as CKD, to effectively alleviate patients' depressed mood and mental component of quality of life. The study's results not only provide more objective-based evidence for renal healthcare personnel, who in turn could educate patients on the importance of self-management for CKD, but also provide a reference for the delivery of relevant healthcare. As such, we advise that future research enthusiastically propose the use of a self-management program on patients with CKD. Lastly, given that a smaller research sample size may compromise the accuracy of an estimated population parameter [32], future researchers are advised to conduct research with a larger sample size to enhance the meticulousness of the research design and further verify the effects of a self-management program on patients with CKD.

Note: The level of evidence based on the Joanna Briggs Institute quality assessment scores were published by the Joanna Briggs Institute: there were 10 appraised items in total; the result of how many appraised items met the standards.

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Conflicts of Interest

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this paper.

Acknowledgements

This work received grant support from Taiwan Ministry of Science and Technology (MOST 104-2314-B-227-006-MY3).

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