


Enhancement of Adherence to Therapeutic and Lifestyle Recommendations Among Hemodialysis Patients: An Umbrella Review of Interventional Strategies

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Objective: To systematically retrieve and condense the best possible evidence on the successful interventions that targeted enhancement of therapeutic and lifestyle recommendations adherence in hemodialysis patients (HDPs).

Design: An umbrella review of interventional studies.

Data Sources: A comprehensive search of the Cochrane Database of Systematic Reviews, Ovid, PubMed, Scopus, EMBASE and Web of science databases to identify relevant publications in 2000–2018 (June) timeframe.

Study Selection: Two reviewers independently applied inclusion criteria to select potential systematic reviews assessing the successful interventions that targeted enhancement of therapeutic and lifestyle recommendations adherence in HDPs. Data were summarized for information about the first author(s)' names, year of publication, type(s) of the intervention and output variables, main findings and also the applied quality appraisal tools in the retrieved research evidence.

Data Extraction: Eligible studies were selected and data were extracted independently by two reviewers. The Joanna Briggs Institute (JBI)'s critical appraisal tool for systematic reviews was used to assess the quality of the identified publications, and discrepancies were resolved by consensus with a third reviewer.

Data Synthesis: Thirteen systematic reviews (12 solely systematic reviews and 1 systematic review with meta-analyses) were eligible to be enrolled in the study. The range of interventions that had been reported to boost therapeutic and lifestyle recommendations adherence in HDPs' included psycho-educational programs, physical activity enhancement initiatives, information technology (IT)-based interventions and aromatherapy. Depression, diet biomarkers and interdialytic weight gain (IDWG) were among the myriad of output variables that had been measured as proxies to assess impacts of the implemented interventions. Psycho-educational interventions were among the prevalent initiatives to boost therapeutic and lifestyle recommendations adherence among the HDPs.

Conclusion: This umbrella review revealed that various intervention approaches and strategies can be used for HDPs' better therapeutic and lifestyle recommendations adherence with considerable methodological heterogeneity. The pinpointed research evidence is also supporting application of multifaceted interventional modalities to reach an improved acquiescence from the patients' side and their families. Further studies are recommended to address the interactions across various interventions in discordant socio-cultural contexts.

Keywords: hemodialysis, intervention, adherence, psychosocial, cognitive, exercise

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Introduction

More than 2 million patients are undergoing hemodialysis worldwide as a result of mostly life-style related chronic conditions that cause kidney failure including type 2 diabetes, hypertension and Atherosclerotic Reno Vascular Disease (ARVD).¹ Hemodialysis is one of the life-supporting renal replacement therapies (RRT) for patients suffering from an absence of effective kidney function or kidney failure to remove wastes and extra fluid and also balance important minerals such as potassium, sodium, and calcium in the patients' blood. HDPs require blood dialysis for 4 h, 3 times a week as a standard protocol to remove toxic waste metabolites in their blood. The procedure could pose restrictions in patients' everyday life, e.g., limitations in fluid and food intake which in turn could exacerbate their vulnerability to other health conditions such as hampered intestinal transit and its consequent complications.

The patients inevitably should have numerous alterations and adjustments in the daily life routines to fit into the rhythm of the dialysis sessions. Considering the required dietary change (restriction in salt, phosphorus, potassium, and fluid contents of diet) and plenty of medications HDPs should take, non-adherence to the prescribed dietary change and medications are common among the patients.^{2–4} Successful management of chronic conditions require immense impetus from the patients' side, their families and also care givers.⁵ Dietary and medication non-adherence in HDPs could cause serious negative consequences including poor health outcomes and increased morbidity and mortality.⁶ Several precipitating factors were suggested to affect medical advice adherence including HDPs' educational level and health literacy, their socio-economic status, presence of multiple comorbidities,⁷ complexities of the medication regimen and inadequate education of the HDPs about the prescribed life-style change or medicines.^{8–10}

To empower patients with chronic disorders several educational interventions were designed and implemented throughout the world to enhance the patients' knowledge or psychological preparedness for maintaining the recommended changes or adherence to prescribed medications.^{11–13} The experiences were similarly successful in changing the HDPs' beliefs, their health-related behaviors and improving adherence to the recommended diet and medications.^{12,13}

Due to heterogeneity of the studies and presentation of their results, this umbrella review was conducted according to the recommended protocol of Joanna Briggs Institute (JBI)¹⁴ to retrieve and condense the best possible

evidence on the successful interventions that targeted the HDPs' therapeutic regimens of adherence improvement.

Materials and Methods

Literature Search

A comprehensive search of the Cochrane Database of Systematic Reviews, Ovid, PubMed, Scopus, EMBASE and Web of science databases was carried out to identify relevant publications in the 2000–2018 (June) timeframe. A conclusive combination of keywords related to three main headings of hemodialysis, intervention and adherence (as listed in [Appendix 1](#)) was utilized to retrieve the congruous publications.

The title and abstract screenings were performed independently by the two members of the research team (LZH, ASH) to reduce probability of identification/selection bias and all discrepancies were discussed and adjudicated by the senior author (ASH). Full texts of the supposedly admissible research reports were obtained and assessed for relevance against the pre-determined inclusion/exclusion criteria and any disagreements were mitigated by a third reviewer (HN).

Eligibility Criteria and Data Extraction

All systematic reviews with or without meta-analyses that examined effectiveness of the conducted interventions to enhance therapeutic and lifestyle recommendations adherence with definite health outcomes in diet, dialysis, fluid restriction and medications dimensions as proxy measures to clinical outcomes and QOL in HDPs were eligible to be included in this study. A broad range of psycho-educational interventions or their combinations individual or group-based interventions, interdisciplinary versus multidisciplinary Interventions and also information technology (IT) assisted interventions were considered for inclusion.

Those reviews that have been conducted on pediatric patients (<18y); the reviews that assessed impacts of pharmacological interventions; non-English publications; narrative literature reviews; studies on only Peritoneal Dialysis (PD); reviews of qualitative studies and reviews of economic evaluation studies were all excluded in this study. A complete list of retrieved publications is provided in [Table 1](#).

Information about the first author(s)' name and family name in the identified publications, year of publication, type(s) of the intervention, number of the included studies, the number of participants, main findings and also quality of the research evidence (using the JBI checklist for systematic reviews)¹⁵ were extracted independently by the two

Table 1 The Utilized Quality Appraisal Tools in the Retrieved Systematic Reviews of Interventions to Enhance Therapeutic and Lifestyle Recommendations Adherence Among Hemodialysis Patients.

Author, Year	The Applied Quality Appraisal Tool
Barcellos et al 2015 ²⁷	Cochrane Collaboration's assessment tool ⁴²
Gomes et al 2018 ²⁸	PEDro* scale ⁴³
Bouya et al 2018 ³¹	Jadad scale for experimental and JBI** appraisal tool for quasi-experimental studies ^{44,45}
Campell et al 2015 ²⁹	Academy of Nutrition and Dietetics (AND) quality criteria checklist for primary research ⁴⁶
Jeddi et al 2017 ³⁰	Cochrane Collaboration's assessment tool ⁴⁷
Idier et al 2011 ²⁰	Not stated
Karavetian et al 2014 ²¹	Not stated
Mason et al 2008 ²²	Jadad scale for experimental studies ⁴⁴
Matteson et al 2010 ²³	Not stated
Milazi et al 2017 ⁶	JBI Meta-Analysis of Statistics Assessment and Review Instrument (JBI-MAStARI) ⁴⁸
Pascoe et al 2017 ²⁴	Cochrane Collaboration's assessment tool ⁴²
Reid et al 2011 ²⁵	JBI Meta-Analysis of Statistics Assessment and Review Instrument (JBI-MAStARI) ⁴⁸
Sharp et al 2005 ²⁶	Authors' developed quality criteria based on the recommended guidelines to conduct SRs*** in HCR**** ⁴⁹

Notes: *Physiotherapy Evidence Database (PEDro). **Joanna Briggs Institute. ***Systematic reviews. ****Health care research.

members of the research team (LZH and ASH) and any disagreement was resolved by consensus.

Quality of the Systematic Reviews

The methodological quality appraisal of the identified relevant publications was performed by the two authors (LZH, ASH) based on the JBI¹⁵ critical appraisal tool for systematic reviews and discrepancies were resolved by consensus with a third reviewer (HN). The reviews that had all 11 criteria of the JBI checklist¹⁵ were categorized as publications with high quality, those that had criteria of the 1–3 and concurrently criteria of the 5–8 in addition to at least one of the criteria of 9–11 from the JBI checklist were classified as having admissible quality group. Those publications that lacked the specified quality criteria of this study were excluded. But considering the JBI's broader view of what constitutes research evidence for practice, and its developed unique levels of evidence and grades of recommendation,¹⁶ all included publications with high and admissible quality will be categorized in the “strong” level of evidence. The selected reports based on the ranking, however, must be looked upon as the likely best available evidence, and should not be used as a definitive measure of the best available evidence.¹⁶

Statistical Analysis of the Systematic Reviews or Meta-Analyses

Data synthesis of the retrieved systematic reviews of therapeutic and lifestyle intervention strategies will involve comparison of the outcomes, aggregation and categorization of the qualitative evidence on the basis of similarity in the implemented interventions and their contrastive outcomes. The intended statistical data pooling procedure for the quantitative outcome measures will include calculation of the Higgins I2 statistic¹⁷ for testing the retrieved studies' findings for heterogeneity. Based on the test results a fixed or random effect model will be employed to estimate the interventions' effect size using the professional version of the Comprehensive Meta-Analysis (CMA) software.¹⁸

Results

Literature Review

The primary search of the literature retrieved 727 publications. After removing duplicates in overlapped databases, non-relevant and incompatible reports (based on the inclusion/exclusion criteria) 45 publications remained for further scrutiny and after their full-text screening only 13 study reports were identified as having the intended eligibility criteria, including 12 solely systematic reviews and 1 systematic review with meta-analyses. The utilized quality appraisal tools in the retrieved systematic reviews were tabulated in Table 1. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram¹⁹ was used to summarize process of the studies selection (Figure 1).

Findings from Systematic Review with/ Without Meta-Analysis

The range of interventions that had been reported in this group of systematic reviews to boost therapeutic and lifestyle recommendations adherence in the hemodialysis patients included psycho-educational (in 8 publications),^{6,20-26} physical activity enhancement (in 2 systematic reviews^{27,28} with recommended home and HD center-based aerobic, resistance and low-intensity strength training before or during HD sessions, home-based cycling and walking, stretching, Hatha yoga exercise in the included studies of the systematic review conducted by Barcellos et al²⁷ and intradialytic exercise training in the systematic review of the Gomes Neto et al),²⁸ IT platform-based intervention (in 2 studies)^{29,30} and aromatherapy in another systematic review study.³¹ None of the included publications had all the 11 quality criteria of the JBI

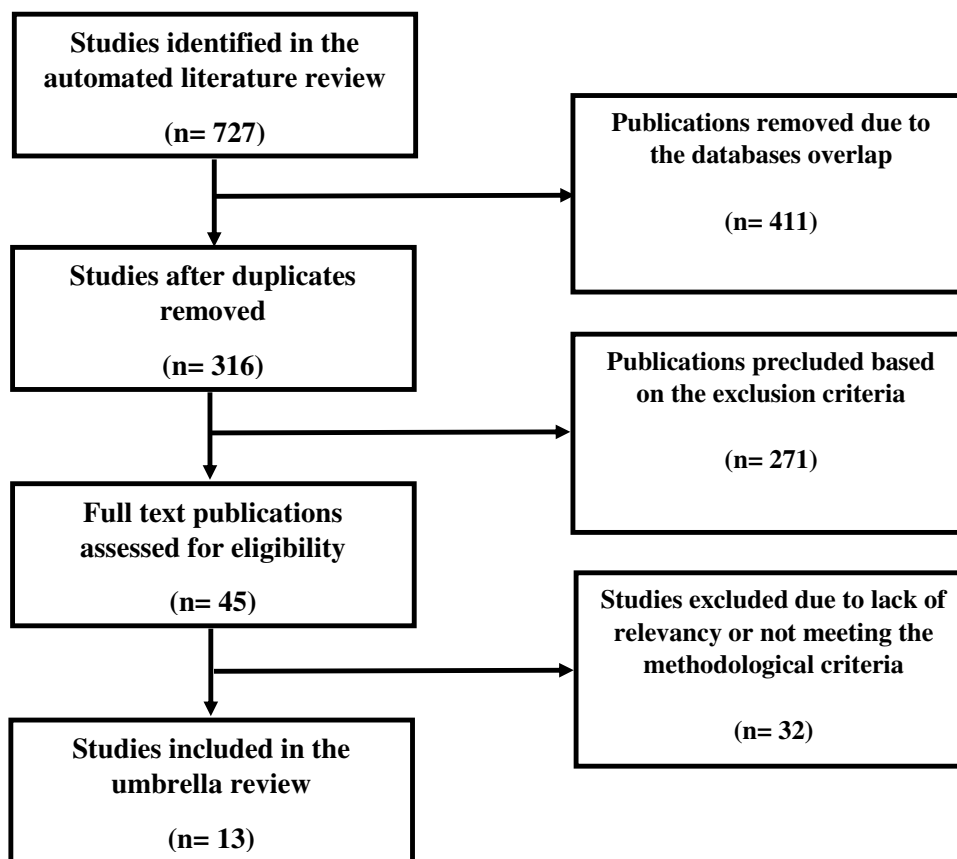


Figure 1 The PRISMA flow diagram of the publications screening process in the umbrella review of interventional studies* to enhance therapeutic and lifestyle recommendations adherence among hemodialysis patients.

Notes: * The identified publications in the literature review included: Cochrane Database of Systematic Reviews (n= 66), OVID (n= 135), PubMed (n= 120), Scopus (n= 96), EMBASE (n= 161) and Web of Science (n= 149).

checklist.¹⁵ Four study reports^{20,23,27,29} had only 8 quality criteria, 4 other studies^{21,24-26} had 9 quality criteria and 5 publications^{6,22,28,30,31} had 10 quality criteria of the checklist that were categorized in the “likely best available evidence” group of studies.¹⁶ The retrieved research evidence about the effectiveness of the different interventions to reinforce therapeutic and lifestyle recommendations adherence among HDPs was tabulated in [Table 2](#). Objectives of the included studies, types of the applied interventions and the outcome measures that have been utilized to assess the mediatory impacts of the implemented interventional initiatives on diet, spectrum of the dialysis behavior, fluid restriction and prescribed medications adherence as proxy dimensions of an improved clinical outcome and QOL in HDPs were summarized in [Table 3](#).

The Reported Achievement(s) in the Psycho-Educational Interventions

The various intervention approaches identified in the studies are as follows: educational interventions^{6,20,24} to enhance patients’

knowledge, self-care and self-management skills based on the constructs of the behavioral cognitive theory,^{18,21-26} trans-theoretical model of change,²⁶ self-regulation model^{19,21} and social cognitive theory²⁰ as well as the psychosocial interventions including counseling,^{20,22} application of motivational techniques^{20,21} and social support^{23,25} as explained in the self-efficacy theory.^{22,25} The findings revealed that dietary/fluid intake adherence and important biomarkers level (i.e., phosphorus or potassium levels etc.) in line with other clinical feature (i.e., IDWG) and most importantly the perceived quality of life could be improved by the successful implementation of the psycho-educational interventions. For instance in the study by Matteson et al²³ the baseline adherence to the therapeutic regimens of adherence was reported to be improved from 33% to 54.1%. A significant reduction in the serum phosphorus level was reported in the study by Karavetian et al (variation of reduction was from 0.3 mg/dl to 1.6 mg/dl).²¹ Meta-analysis of the eight RCTs for serum phosphate control was also pinpointed the mean reduction of -0.23 mmol/l in the study of Milazi et al.⁶

Table 2 List of the Retrieved Publications that Reported Interventions to Enhance Therapeutic and Lifestyle Recommendations Adherence Among Hemodialysis Patients.

Author, Year, Study Location	Intervention (Study Population)	Included Studies Number, Design, Search Time Limit	Number of Participants/ Study Setting	Main Results/Findings
Barcellos et al ²⁷ 2015 – Brazil	Aerobic and resistance exercises training (KTPs, PDPs, HDPs)	59 RCTs, up to June 2015	2858 Tertiary settings	Health-related quality of life, physical fitness, heart rate variability, pulse wave velocity and arterial stiffness, lipid profile, inflammatory markers, body composition, CKD progression, depression
Gomes et al ²⁸ 2018 – Brazil	Aerobic and resistance exercise (HDPs)	56 RCTs, up to December 2017	2586 Tertiary settings	Reduced depression symptoms: (effect size: -9.3, -5.3)
Bouya et al ³¹ 2018 – Iran	Aromatherapy by inhalation and massage (HDPs)	22 RCTs, NRCT, quasi-experiments, up to 30 Dec 2017	1087 Primary settings	Reduced hemodialysis related anxiety, depression and stress
Campbell et al ²⁹ 2015 – Australia	Dietary education/monitoring through mobile apps (CKDPs, HDPs)	5 (RCTs & case studies), up to 2014	122 Primary settings	No changes in nutrient intake, biochemical marker or IDWG
Jeddi et al ³⁰ 2017 – Iran	Dietary education/and monitoring through mobile apps and wearable devices (CKDPs)	8 RCTs, up to May 2016	1637 Primary settings	Improved medication adherence, patients' knowledge and dietary sodium intake
Idier et al ²⁰ 2011 – France	Motivational/psycho-educational interventions/ counseling (HDPs)	35 RCTs, NRCTs, CBAs, 1972 – 2011	2318 Primary settings	Improved dietary and fluid adherence/phosphorus, potassium levels, quality of life and reduced depression
Karavetian et al ²¹ 2014 – The Netherlands	Self-regulation education/ motivational counseling (HDPs)	18 RCTs, quasi-experiments, up to June 2013	1982 Primary settings	Reduced serum phosphate levels (effect size: -0.13 to -8.0 mg/dl)
Mason et al ²² 2008 – UK	Educational and psychological interventions (KTPs, PDPs, HDPs)	22 RCTs, 1980-2007	1967 Primary/ Tertiary settings	Improved fluid intake and diet concordance/ potassium and phosphorus levels/quality of life and reduced depression
Matteson et al ²³ 2010 – USA	Self-regulation/self-efficacy education/hypnotherapy/ coaching (HDPs)	8 RCTs, up to 2008	594 Primary settings	Improved diet adherence and phosphorus level (effect size: 0.04 to 0.74)
Milazi et al ⁶ 2017 – Australia	Behavioral/psychological interventions (HDPs)	18 (RCTs, NRCTs, CBAs, cohort studies), 2005-2015	2760 Primary/ Tertiary settings	Reduced serum phosphate levels (weighted mean difference = - 0.23 mmol/l, 95% CI - 0.37, - 0.08)
Pascoe et al ²⁴ 2017 – Australia, UK	CBT, social support, counseling, roleplaying skills demonstration (CKDPs)	8 RCTs, up to May 2016	515 Primary/ Tertiary settings	Greater relief of depressive symptoms

(Continued)

Table 2 (Continued).

Author, Year, Study Location	Intervention (Study Population)	Included Studies Number, Design, Search Time Limit	Number of Participants/ Study Setting	Main Results/Findings
Reid et al ²⁵ 2011 – Australia	CBT, self-efficacy training/ contract with a FM/F to care patient/(HDPs)	5 RCTs, NRCTs, CBAs 1966-2009	417 Primary/ Tertiary settings	Reduced IDWG, depression and improved quality of life/self-care, self-efficacy and psychosocial skills
Sharp et al ²⁶ 2005 – UK	CBT, educational interventions, (HDPs)	12 RCTs, observational studies, up to January 2004	863 Primary/ Tertiary settings	Improved fluid intake regimen/decreased IDWG.

The Reported Achievement(s) in the Physical Activity Improvement Interventions

Combined aerobic and resistance exercise (both during dialysis and in separate sessions) were suggested in the identified publications to alleviate the depression symptoms in the HDPs and in consequence meliorate the health-related quality of life.^{27,28} Depression scores of the HDPs were assessed in four RCTs (using the Beck Depression Inventory [BDI]), in three of them aerobic exercises and in one study aerobic plus resistance exercises were endorsed. The cumulative findings of the studies revealed that aerobic exercises could reduce depression scores of the HD patients by 30–40% and application of combined aerobic and resistance exercises may reduce significantly the depression symptoms (-7.3 ; 95% CI -9.3 , -5.3 ; $N = 88$).

The Reported Achievement(s) in the Information Technology-Based Interventions

The IT-based interventions refer to use of Internet, local area networks (LANs) and mobile devices (personal digital assistants [PDAs], smartphones etc.) in delivery of disease-related services or information due to their noticeable feasibility of application and efficiency in embracing positive outcomes. The study by Campbell et al²⁹ found that installation of dietary mobile applications on PDAs for dietary improvement and sending information about sound dietary habits for HD patients indicated no significant improvement in the nutrients intake. However, in the other IT-based intervention³⁰ that used smartphones/PDAs, wearable devices, computerized systems and

multiple digital components for providing information and counseling about positive and protective behaviors for HDPs, remarkable improvements in 75% of the clinical outcomes (e.g., IDWG, ultrafiltration rate, BP) and 86% of the process of care or outcomes (e.g., medication adherence, dietary sodium intake, etc., as the proxies to clinical outcomes) were observed.

The Reported Achievement(s) in the Aromatherapy Interventions

The systematic review conducted by Bouya et al³¹ suggested that aromatherapy could reduce some of the prevalent complaints of the HDPs, including anxiety, stress, depression, etc. According to the reported findings of the included studies inhalation of the essences of lavender and damask rose oils could reduce the severity of depression in HDPs.

Discussion

No gold standard intervention was identified in this umbrella review for boosting adherence to therapeutic regimens in the HDPs. Four main categories of interventions were reported (psycho-educational, physical activity, IT-based and aromatherapy interventions) to have direct effects on therapeutic and hygiene–dietary regimens adherence of HDPs and reduction of their complaints and also indirect effect on their conformity with the prescribed medication or lifestyle recommendations.

Psycho-educational interventions were among the most prevalent suggested interventions to reinforce adherence to the therapeutic and other lifestyle recommendations in HDPs.^{6,20,26} Based on the retrieved scientific literature proper application of cognitive/behavioral strategies in planning interventional programs for HDPs could target the patients' abilities

Table 3 The Objectives, Types of Interventions and Outcome Measures in the Retrieved Systematic Reviews of Interventions to Enhance Therapeutic and Lifestyle Recommendations Adherence Among Hemodialysis Patients.

Author, Year	Study Objective in Effectiveness Assessment of	Types of Interventions	Outcome Measures
Barcellos et al 2015 ²⁷	Exercise interventions	Aerobic and resistance exercises training	Health-related quality of life, physical fitness, heart rate variability, pulse wave velocity and arterial stiffness, lipid profile, inflammatory markers, body composition, CKD progression, depression
Gomes et al 2018 ²⁸	Intradialytic exercise training	Combined intradialytic aerobic and resistance exercise	VO2 max, depression, physical function, vitality, health-related QOL, walk test distance, knee extensor strength
Bouya et al 2018 ³¹	Aromatherapy interventions	Massage and inhalation aromatherapy	Fatigue, stress, pain, depression, anxiety, sleep quality, pruritus, headache, pruritus, pain of arteriovenous fistula puncture and QOL
Campell et al 2015 ²⁹	Mobile apps application	Personal digital assistant (PDA) use to self-monitor dietary and fluid intake	Nutrient intake (sodium, potassium, phosphorus, fluid, protein and energy), biochemical markers (serum albumin, potassium and phosphorus), IDWG
Jeddi et al 2017 ³⁰	Automated IT-based interventions	Wearable devices use to measure BP and PDA use to provide nutrition guideline	Medication adherence, patients' knowledge, dietary sodium intake, BP, IDWG, parathyroid hormone level, ultrafiltration rate
Idier et al 2011 ²⁰	TPE programs	Motivational/psycho-educational interventions/counseling	Knowledge, QOL, dietary, fluid and medication adherence, phosphorus, potassium levels, depression
Karavetian et al 2014 ²¹	Optimal nutrition education methods for management of hyperphosphatemia	Education of self-evaluation and self-regulation techniques, individualized counseling,	Serum phosphate levels
Mason et al 2008 ²²	Short-, medium-, and long-term impacts of educational interventions	Collaborative role learning, psycho-social support, self-monitoring, goal setting, self-regulation & stress management skills education, CBT	Intention to initiate dialysis, knowledge/ attitude toward self-care dialysis, survival rates, time to dialysis, depression, anxiety, perceived social support, physical fitness, social functioning, IDWG, emotional functioning, self-care efficacy, adaptation to CKD & dialysis, diet/fluid restriction, medication concordance, satisfaction, locus of control, death acceptance & suicidal thinking, QOL, serum calcium, phosphorus & albumin, potassium & parathyroid hormone levels
Matteson et al 2010 ²³	Different RCTs' impacts	Cognitive, behavioral and hypnotherapy coaching, self-monitoring skills education, stress reduction exercises, self-efficacy training	Dietary sources of phosphorus management, treatment time adherence, diet/medication or fluid adherence
Milazi et al 2017 ⁶	Education or behavioral interventions	Educational and/or behavioral interventions	Serum phosphate levels, knowledge/ adherence/perceived self-efficacy/self-management behavior to phosphate control

(Continued)

Table 3 (Continued).

Author, Year	Study Objective in Effectiveness Assessment of	Types of Interventions	Outcome Measures
Pascoe et al 2017 ²⁴	Psychosocial interventions on patients and/or their carers	Psychosocial intervention with supportive therapy	Depression, anxiety symptoms or QoL in CKD patients and/or their carers
Reid et al 2011 ²⁵	Nursing interventions	Individualized self-efficacy training, group CBT, teaching and supporting	Adherence with hemodialysis treatment, depression and/or anxiety, QOL, care provider burnout, social support, satisfaction
Sharp et al 2005 ²⁶	Psychological interventions	Self-regulation/self-monitoring education, social reinforcement, stress management, CBT	IWG, blood pressure, blood urea nitrogen level, potassium level, health beliefs, self-efficacy

Abbreviations: CKD, chronic kidney disease; HRV, heart rate variability index; PWV, pulse wave velocity; BMI, body mass index; TC, total cholesterol; HDL, high density lipoprotein; LDL, low density lipoprotein; TG, triglyceride; HDs, hemodialysis; QOL, quality of life; VO2 max, maximum rate of O2 consumption during incremental exercise; IDWG, interdialytic weight gain; TPE, therapeutic patient education; BP, blood pressure; PDA, personal digital assistant; CBT, Cognitive Behavioral Therapy; ESRD, end-stage renal disease.

for better management of their health conditions with extrusive bio-psychological outcomes. The psycho-educational approach that was employed in the conducted studies is compatible with the World Health Organization (WHO)'s recommended Therapeutic Patient Education (TPE) program.³² The TPE was aimed to help patients in acquiring and maintaining the skills they need in management of their life with a chronic disease in the best possible way. The recommended constituents of the TPE include: 1) Presence of a psychologist in a multi-disciplinary team that consists different professions, i.e., nurse, dietician, pharmacist or physician for the patients' skills development to achieve better adherence; 2) Merging collective and individual oriented practices to obtain more beneficial effects compared to application of single approach; 3) Combination of biological/clinical outcomes (objective measure) and psychosocial criteria (subjective measure) in evaluation of interventions that target therapeutic and lifestyle recommendations adherence's improvement; and 4) Continuous follow up of not only the short-term effects but also the medium- and long-term effects of the interventions, since some of the achievements might be at risk with time.³²

Self-management capacity of the HDPs could enable these patients to take better care of themselves and enable knowledgeable decision-making about their well-being.³³

The psychological status of patients (e.g., mild or severe depression) with chronic conditions was also suggested to exert negative impact on their therapeutic regimens adherence and illness behavior.³⁴⁻³⁶ Empirical research evidence

exists to suggest the importance of physical exercise as a non-pharmacological means of reducing depressive symptoms among healthy and non-healthy individuals.^{37,38}

Supervised exercising has been suggested to improve exercise capacity, muscular strength, and QOL in HDPs and reduce their depression symptoms.³⁷⁻⁴⁰ The main un-answered question that requires further scrutiny however is to find feasible strategies for encouragement of depressed HDPs to participate in physical exercise programs.

The use of IT-based technologies to help dietary self-monitoring of HDPs, and therefore to improve IDWG and dietary biomarkers, were recommended based on the findings of two systematic reviews.^{27,28} Technology use may help health care providers (HCPs) to encourage better dietary adherence for instance by sending a daily dietary short message (SMS) to HDPs. Access to smartphone applications could help HCPs when monitoring HDPs' self-management behaviors and skills. The current pace of worldwide digital technology expansion prompts further investment on planning IT-based interventions for improved therapeutic adherence among patients with chronic diseases.

The small sample sizes in the study²⁹ caused statistically insignificant variations in medication adherence or biomarkers of better self-management when IT-based interventions were applied. Further studies are needed with larger sample sizes to examine the beneficial effects of IT-based interventions in relation to other types of interventions in different

subgroups of HDPs with diverse age structure, socio-economic background, and literacy level.

Aromatherapy as an alternative approach to ameliorate the HDPs' complaints was assessed in another systematic review.³¹ Regarding the direct and indirect effects of the anxiety, stress and depression on HDPs' health and willingness to adhere to the prescribed medications, application of the aromatherapy could be considered as a complimentary intervention. The procedure is inexpensive and its application is feasible in many countries. The main methodological limitation in the study of aromatherapy for improved therapeutic regimens adherence was the variety of aromas and their varied dose of application that makes accurate assessment of the procedure application on the other HDPs cumbersome. Overall safety and effectiveness of the applied aromas is also required to be assessed in future studies.

Blended patient-centered education and psychosocial support strategy was suggested to better improve all dimensions of the therapeutic and lifestyle recommendations adherence in terms of prescribed medications, diet, dialysis and fluid restriction as proxy measures of the dialysis clinical outcome and perceived quality of life (QOL) according to the endorsed new quality paradigm⁴¹ of care provision for HDPs.

Limitations of the Umbrella Review

This review has a number of methodological limitations, therefore the results must be interpreted with caution due to the inconsistent methodological quality of the included studies. First, because of the observed heterogeneity mainly in the intervention protocols, outcome measures and study designs of the included studies, it was not rational nor ingenious to quantitatively pool their findings in a meta-analysis. Validities of the quantitatively reported outputs in the included systematic reviews for calculation of point estimates were circumscribed due to the applied different investigative designs and intervention protocols with high susceptibility of bias. So the research team preferred to give an augmented summary of findings. Second, the inherent variation in the included studies' design might cast (RCT, pre-post intervention etc.) prominent imprecision on the findings. Small studies' effects, probable measurement, selection, detection and attrition biases in the retrieved research and logistic or methodological limitations in control of these potential biases are other limitations of this study. Last, despite efforts being made to identify all relevant publications, the probability of selection bias due to limiting the conducted search outputs to publications that have been written in English language, for instance (language bias),

not considering search for grey literature or hand searching (publication bias) and also paucity of key terms used to search the literature (searching bias) should not be ruled out completely.

Conclusion

This umbrella review indicated that various intervention approaches and strategies can be used for HDPs' better therapeutic and lifestyle recommendation adherence with considerable methodological heterogeneity. The pinpointed research evidence also supports the application of multifaceted interventional modalities to reach an improved acquiescence from the patients and their families. Further studies are recommended to address the interactions across various interventions in discordant socio-cultural contexts. Explicit explanations of intervention protocols and sticking to standard reporting protocols in future research would help the understanding of the contextual appropriateness of different interventions and their outputs in terms of HDPs' better therapeutic and lifestyle recommendations adherence.

Ethics and Informed Consent Statements

This article was prepared based on the findings of a research project that had been conducted for partial fulfilment of the requirements to obtain a PhD degree by the first author (LZH). This study was approved by the Medical Ethics Board of Trustees (MEBoT) (approval number: IR.TBZMED.REC.1397.425) affiliated to the Tabriz University of Medical Sciences.

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