

Evaluation of the Use of Intradialytic Exercise and Cognitive Behavior Therapy for Improving Patients' Quality of Life Undergoing Hemodialysis: A Systematic Review

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ABSTRACT

Chronic kidney disease not only impacts physical status but also psychological status leading to low quality of life. Patients with chronic kidney disease often receive hemodialysis as replacement therapy for kidney function. Studies preventing the deterioration of quality of life were published in the literature. However, none discusses the combination therapy between intradialytic exercise and cognitive behavior therapy. Therefore, the review aims at evaluating these combination therapies in patients with hemodialysis. The study used a systematic literature review design to identify all articles on intradialytic exercise and cognitive behavior therapy. The results highlighted that there is an improvement in quality of life when implementing combination therapies. Furthermore, it helps to accelerate the medical approach to chronic kidney disease. Further study should focus on the use of therapies among patients with different stages of kidney failure.

Keywords: *Chronic Kidney Injury; Patients' Quality of Life; Cognitive Behavior Therapy; Intradialytic Exercise; Hemodialysis Care*

INTRODUCTION

A kidney injury requires long-term dialysis or transplantation. Chronic kidney disease reduces kidney function, causing uraemia, which affects all organs (Lu *et al.*, 2021). The CKD was caused by diabetic nephropathy (DN; 27.1%), hypertensive nephropathy (HTN; 28.5%), and chronic glomerulonephritis (CGN; 36.8%) (Sui *et al.*, 2020). CKD was predicted to affect 8% to 16% of the total population in the world (Chen *et al.*, 2019). What's more, the global incidence of CKD is 13.4% (11.7-15.1%) with 4.902 to 7.083 million people having to undergo renal replacement treatment (Lv & Zhang, 2019). Patients with hemodialysis may have impaired quality of life (QoL) (Kefale *et al.*, 2019; Pretto *et al.*, 2020). HQL is an index of various elements such as mortality, morbidity, functional limitations, and well-being that can be used as an integrative measure that unites mortality and morbidity (Marquez *et al.*, 2020). Since the patient is at high risk of fatality, QoL becomes an important component as it is a parameter of successful intervention.

Studies focusing on the QoL of patients with CKD were published in online databases. For example, intradialytic exercise is safe and may improve the physical quality of life (Pu *et al.*, 2019). Intradialytic exercise improves HRQL and depression in hemodialysis patients (Lin *et al.*, 2021). Exercise has positive effects on QoL; however, it is still not continuously prescribed (Poornzaari *et al.*, 2019). In elderly hemodialysis patients, 6-month intradialytic training increases physical function (Yabe *et al.*, 2021). Intradialytic exercise improves QoL but not kidney specific QoL (Hu *et al.*, 2022). Related to cognitive behavior therapy in CKD, several studies were completed. The use of cognitive behavioral therapy (CBT) is an effective strategy for decreasing depressive symptoms among patients with CKD

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(Zegarow *et al.*, 2020). CBT is more effective for improving therapeutic adherence and QoL (Valsaraj *et al.*, 2021). CBT includes mindfulness meditation for enhanced QoL (e.g., mental health) and biomarker levels in patients with kidney injury (Reynolds & Jahromi, 2022).

Evaluation results in the use of intradialytic exercise and CBT separately for patients with hemodialysis. However, none of the studies discussed the combination of these therapies in the literature. Several studies merely use intradialytic training without integrating it with CBT. The combination accelerates the reduction of clinical symptoms because of dialysis. It also improves QoL by managing negative thoughts and lowering despair and anxiety. So, the study seeks to assess the efficacy of intradialytic exercise and CBT in the patient group. We expected that the result of the study would help the nurses deal with QoL health issues.

METHODOLOGY

Study Design

The current study was carried out in accordance with the guidelines of the preferred reporting items for systematic reviews and meta-analysis (PRISMA). The search involved online databases including PubMed, ScienceDirect, EBSCO, Springer, Google, and Google Scholar.

Search Strategy and Inclusion/Exclusion Criteria

The search criteria were studies on intradialytic training and CBT on CKD, English, and Bahasa language, review studies are the primary source, whole research design and 2020–2022 publications. Keywords were as follows: '*intradialytic training*', '*CBT for kidney disease*', '*intradialytic training for chronic kidney injury*', '*CBT for CKD*', '*Quality of life intradialytic training CKD*', '*intradialytic and CBT for CKD patients' quality of life*'.

Ethical Consideration

The article under consideration is a systematic review, therefore, the researcher's text is not applicable.

RESULTS

Search Result

A PRISMA flow diagram showed 342 articles (Figure 1). Article (title, journal, year) and research information were used to evaluate study data. Minimizing duplication was the search criteria. The researcher screened titles and abstracts using a computerized search for the study's principal purpose in four steps. All intradialytic exercise and CBT trials (n = 342) were collected.

The first phase eliminated 154 articles owing to duplication, irrelevance, and editorial and book chapters. After screening titles and abstracts (n = 97), the remaining articles (n = 188) were discarded. Third, screening complete text by criterion (n = 91), then excluding articles that did not satisfy criteria (n = 77). Fourth, 14 articles discussing intradialytic exercise and CBT were included, compared then analyzed (Table 1).

Characteristics of the Selected Studies

A total of 14 studies were identified. Overall, the articles obtained examined patients with hemodialysis using various research methods, namely 8 studies using randomized controlled trials, 3 studies using quasi-experimental studies, and 3 studies using systematic reviews. There were 12 studies that used comparison therapy and 2 studies that did not use it.

The countries studied are Slovenia (Bogataj *et al.*, 2022), Greece (Grigoriou *et al.*, 2021), Egypt (Elghoneimy *et al.*, 2022), Taiwan (Lin *et al.*, 2021), UK (Lin *et al.*, 2021), Spain (de Villar *et al.*, 2020), Brazil (do Valle *et al.*, 2020), Iran (Zhianfar *et al.*, 2020), America (Jakubowski *et al.*, 2020), India (Valsaraj *et al.*, 2021), Netherlands (Tommel *et al.*, 2022). Another 3 studies are systematic review (Salhab *et al.*, 2020; Ling *et al.*, 2020; Othman *et al.*, 2020).

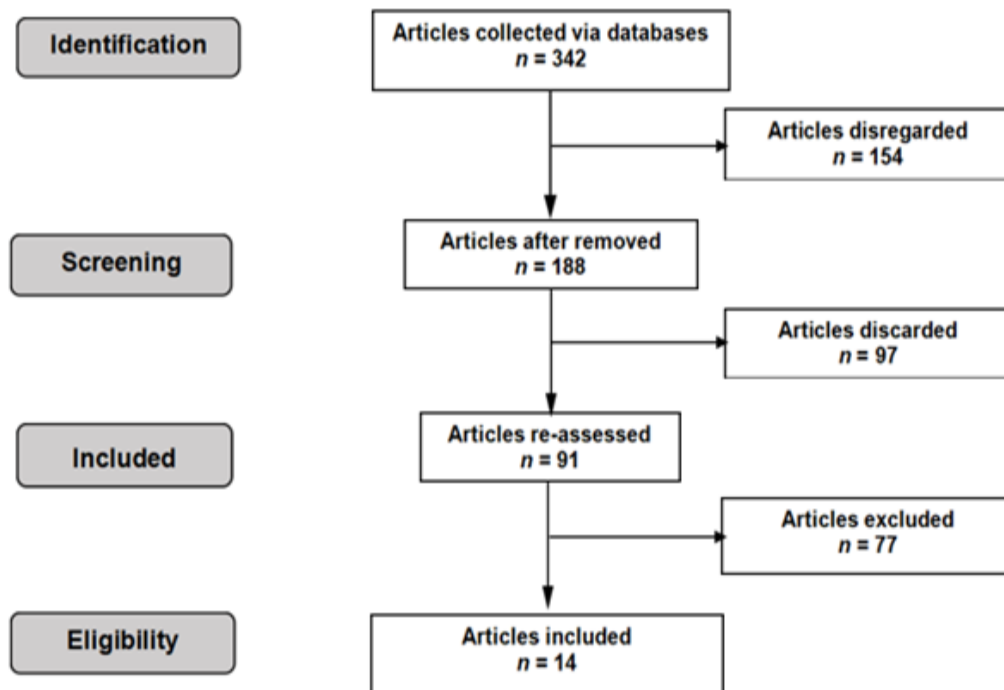


Figure 1: Article Selecting Process

Themes

Table 1 delineated the attributes of the scholarly articles included in this literature review. The present study conducted a thematic analysis of the myths identified in the reviewed literature. The findings revealed that all of the myths could be classified into distinct overarching themes: Author and year of publication, Participants, Method, Comparison therapy (if any) and Outcomes.

DISCUSSION

Hemodialysis patients often have physical and cognitive problems. HD patients must attend hospitals or dialysis clinics three times a week, requiring major lifestyle modifications. A significant proportion of patients with HD experience a high symptom burden, which encompasses a range of distressing symptoms such as fatigue, anorexia, cognitive impairment, peripheral edema, and myoclonus, leading to a diminished quality of life. This phenomenon affects approximately 92% of the HD population (Caydam & Eren, 2019). Studies highlighted that significant deterioration of cognitive function in patients with hemodialysis was also evaluated (Drew *et al.*, 2019). Greater attention by care providers to the common and bothersome clinical symptoms positively impacts QoL for patients with hemodialysis (Lockwood *et al.*, 2019). Even though several severe symptoms can be managed by working directly with the hemodialysis team, many patients still feel that they need to handle symptom management to improve QoL. The symptoms that occur are the symptoms experienced by the patient, so it's not surprising that identifying symptoms is a high priority (Goodridge *et al.*, 2019). In addition, knowledge and comprehension of the prevalence of symptoms in hemodialysis may guide the development of medical and nursing interventions targeting the symptoms. Despite the well-documented advantages of therapies, there is a broad desire for effective solutions delivering long-term results for patients on hemodialysis. This study shows that specific interventions may help reduce the clinical symptoms of hemodialysis, such as intradialytic exercise and CBT.

Table 1: Study Finding

No	Author and year of publication	Participants	Method	Comparison therapy (If any)	Outcomes
1	Bogataj <i>et al.</i> , (2022)	Patients with hemodialysis	A randomized controlled trial	Regular treatment	The implementation of Intradialytic Cognitive and Exercise Training has been shown to be effective in mitigating cognitive impairments.
2	Grigoriou <i>et al.</i> , (2021)	Patients with hemodialysis	Quasi-experimental study	Usual treatment	Exercise training improved symptoms
3	Elghoneimy <i>et al.</i> , (2022)	Patients with hemodialysis	Quasi-experimental study	Daily care	Improvement in QoL
4	Lin <i>et al.</i> , (2021)	Patients with hemodialysis	A randomized controlled trial	Regular care	Improvement in QoL
5	Greenwood <i>et al.</i> , (2021)	Patients with hemodialysis	A randomized controlled trial	Usual care	QoL was not improved after 6-months intervention
6	de Villar <i>et al.</i> , (2020)	Patients with hemodialysis	A randomized controlled trial	Routine care	Positive changes on QoL
7	Salhab <i>et al.</i> , (2020)	Patients with hemodialysis	Systematic review	None	Intradialytic exercise improves QoL
8	do Valle <i>et al.</i> , (2020)	Patients with hemodialysis	A randomized controlled trial	Regular treatment	Positive effect on QOL
9	Zhianfar <i>et al.</i> , (2020)	Patients with hemodialysis	A randomized controlled trial	Daily care	CBT improves QoL
10	Ling <i>et al.</i> , (2020)	Patients with hemodialysis	Systematic review	None	CBT improves QoL
11	Jakubowski <i>et al.</i> , (2020)	Patients with hemodialysis	Quasi-experimental study	Ordinary care	CBT improves QoL
12	Valsaraj <i>et al.</i> , (2021)	Patients with hemodialysis	A randomized controlled trial	Regular maintenance	CBT led to significant improvements in QoL
13	Othman <i>et al.</i> , (2020)	Patients with hemodialysis	Systematic review	None	CBT in reducing depression (parameter of QoL)
14	Tommel <i>et al.</i> , (2022)	Patients with hemodialysis	A randomized controlled trial	Usual care	CBT in reducing depression (parameter of QoL)

The implementation of intradialytic exercise has been shown to enhance physical well-being and diminish sedentary behavior among individuals undergoing hemodialysis (McAdams-DeMarco *et al.*, 2018; Grigoriou *et al.*, 2021; Elghoneimy *et al.*, 2022). According to the American College of Sports Medicine (ACSM), individuals with chronic kidney disease (CKD) who are undergoing hemodialysis are recommended to initiate exercise routines with low-intensity workouts lasting for approximately 10 to 15 minutes (Liguori & American College of Sports Medicine, 2020). Effect of low physical activity routinely can cause morbidity and mortality, performing exercise is very important as documented by studies.

Intradialytic exercise is performed by using pedalling and stepping devices when the patient seats in a hemodialysis chair (Greenwood *et al.*, 2021; de Villar *et al.*, 2020). Organized exercise on a cycle ergometer during hemodialysis has been found to reduce patients' physical problems (Salhab *et al.*, 2020; do Valle *et al.*, 2020). Based on these findings, clinical nurses must routinely and continually assess intradialytic exercise frequency to significantly benefit hemodialysis patients. Nurses working in a hemodialysis care plan manage the patients including checking the patient's vital signs, discussing the recent condition, and teaching the disease and its treatment as well.

Another promising intervention to improve the QoL of patients with hemodialysis is cognitive behavioral therapy

(CBT). The patients are at high risk for cognitive disturbance due to their older age and having risk factors of cardiovascular disease and stroke (Karakizlis *et al.*, 2021). One recent study in dialysis patients emphasized that kidney-related cognitive impairment was noticeable for executive functions including working memory, attention, and impulse control (Bogataj *et al.*, 2022). Patients with CKD often experience severe psychological problems like depression, anxiety and difficulties finding coping. Therefore, cognitive testing before dialysis initiation and periodically should be warranted. Considering the potential efficacy and safety of Cognitive Behavioral Therapy (CBT) for individuals undergoing Hemodialysis (HD), healthcare providers in the renal department ought to contemplate CBT as a viable treatment alternative. According to Ling *et al.*, (2020), the integration of Cognitive Behavioral Therapy (CBT) into standard care may present challenges due to inadequate participant access to this form of therapy and a scarcity of CBT providers. Therefore, the author of this paper has examined two potential solutions to this problem, which will be detailed below.

The efficacy of internet-based cognitive-behavioral therapy (CBT) as a treatment option for Hemodialysis (HD) patients experiencing low quality of life (QoL) can be deemed noteworthy. All of the studies included in the current review utilized conventional, in-person cognitive-behavioral therapy (CBT). Geographic distance, scarcity of professional therapists, and the elevated cost of therapy are obstacles that impede the implementation of face-to-face cognitive behavioral therapy (Jakubowski *et al.*, 2020). Internet-based cognitive behavioral therapy (CBT) has been demonstrated as a viable approach to address the aforementioned obstacles and narrow the treatment disparities. Additionally, as per a recently updated meta-analysis carried out by Othman *et al.*, (2020), The effects of internet-guided cognitive behavioral therapy (CBT) and traditional face-to-face CBT are comparable. Nonetheless, the lack of available evidence pertaining to internet-based cognitive behavioral therapy (CBT) for comorbid depression among patients undergoing Hemodialysis (HD) was observed. Hence, additional research may be conducted to explore the efficacy of Cognitive Behavioral Therapy (CBT) in individuals undergoing Hemodialysis (HD) treatment.

Moreover, Cognitive Behavioral Therapy (CBT) may potentially safeguard the cognitive functions of patients from degeneration. Empirical evidence suggests that Cognitive Behavioral Therapy (CBT) is effective in mitigating cognitive impairments (Zhianfar *et al.*, 2020; Ling *et al.*, 2020; Jakubowski *et al.*, 2020). Integrating cognitive behavioral therapy (CBT) with renal replacement therapy, such as hemodialysis, appears to be a logical approach to enhance the overall welfare of the patient (Valsaraj *et al.*, 2021; Othman *et al.*, 2020; Tommel *et al.*, 2022). Additionally, the aforementioned four studies on the implementation of Cognitive Behavioral Therapy (CBT) demonstrate a rise in Quality of Life (QoL) and a reduction in depression, both of which are indicative of QoL (Zhianfar *et al.*, 2020; Ling *et al.*, 2020; Jakubowski *et al.*, 2020; Valsaraj *et al.*, 2021; Othman *et al.*, 2020; Tommel *et al.*, 2022). Yet, the concept of quality of life pertains to an individual's subjective evaluation of their standing in life, taking into account their cultural background, personal values, and aspirations, as well as other relevant factors such as expectations and standards. The evaluation of the management of chronic kidney disease patients undergoing hemodialysis is increasingly taking into account the factor of quality of life (Yonata *et al.*, 2022).

CONCLUSION

Intradialytic exercise and CBT are promising therapies to prevent deterioration in QoL. Even though there is limited evidence to support this, a combination of these therapies will assist nurses in reducing health issues when performing hemodialysis. Patients and nurses should work together to achieve the best outcomes. Evaluation of the therapy's effectiveness after hemodialysis is important for the nursing care process. Finally, studies involving family members should be initiated using different dosages and populations.

Recommendation

1. For Health Services

It is recommended that health services enhance their educational offerings pertaining to the significance of assessing the efficacy of intradialytic exercise and cognitive behavior therapy in enhancing the quality of life of hemodialysis patients.

2. For Educational Institutions

The researchers hope that this study can serve as a point of reference for students, particularly those pursuing nursing at Universitas Muhammadiyah Lamongan, to undertake further research and enhance their understanding of health science, particularly in the domain of healthcare.

3. For the Community

It is hoped that the present study aims to serve as a valuable resource for the community by examining the effectiveness of intradialytic exercise and cognitive behavior therapy in enhancing the quality of life of hemodialysis patients.

4. For Researchers

The researcher hopes that the conducted study will contribute to the existing body of knowledge on the assessment of the effectiveness of intradialytic exercise and cognitive behavior therapy. Additionally, the researcher anticipates that future studies will explore other factors that affect the utilization of intradialytic exercise and cognitive behavior therapy, in order to determine the key factors that enhance the quality of life of hemodialysis patients.

Suggestion

The optimal results can be attained through the cooperation of patients and nurses. Evaluation of the therapy's effectiveness after hemodialysis is important for the nursing care process and studies involving family members should be initiated using different dosages and populations.

Conflict of Interest

The authors declare that they have no conflict of interests.

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REFERENCES

- Bogataj, Š., Trajković, N., Pajek, M., & Pajek, J. (2022). Effects of Intradialytic Cognitive and Physical Exercise Training on Cognitive and Physical Abilities in Hemodialysis Patients: Study Protocol for a Randomized Controlled Trial. *Frontiers in Psychology, 13*. <https://doi.org/10.3389/fpsyg.2022.835486>
- Caydam, O. D., & Eren, G. (2019). Assessment of Symptoms and Quality of Life in Patients with Haemodialysis. *Advanced Nursing & Patient Care International Journal, 2*(5), 180035. <https://doi.org/https://chembiopublishers.com/ANPCIJ/>
- Chen, T. K., Knicely, D. H., & Grams, M. E. (2019). Chronic Kidney Disease Diagnosis and Management. *JAMA, 322*(13), 1294. <https://doi.org/10.1001/jama.2019.14745>
- de Villar, L. O.-P., Martínez-Olmos, F. J., Pérez-Domínguez, F. de B., Benavent-Caballer, V., Montañez-Aguilera, F. J., Mercer, T., & Segura-Ortí, E. (2020). Comparison of intradialytic versus home-based exercise programs on physical functioning, physical activity level, adherence, and health-related quality of life: pilot study. *Scientific Reports, 10*(1), 8302. <https://doi.org/10.1038/s41598-020-64372-y>
- do Valle, F. M., Valle Pinheiro, B., Almeida Barros, A. A., Ferreira Mendonça, W., de Oliveira, A. C., de Oliveira Werneck, G., de Paula, R. B., & Moura Reboredo, M. (2020). Effects of intradialytic resistance training on physical

activity in daily life, muscle strength, physical capacity and quality of life in hemodialysis patients: a randomized clinical trial. *Disability and Rehabilitation*, 42(25), 3638–3644. <https://doi.org/10.1080/09638288.2019.1606857>

- Drew, D. A., Weiner, D. E., & Sarnak, M. J. (2019). Cognitive Impairment in CKD: Pathophysiology, Management, and Prevention. *American Journal of Kidney Diseases*, 74(6), 782–790. <https://doi.org/10.1053/j.ajkd.2019.05.017>
- Elghoneimy, H., El-Deeb, A., Younis, G. E.-L., Abd El-Kader, M., & El-Wakil, H. (2022). The effect of intradialytic aerobic training on physical performance and quality of life among hemodialysis patients. *Journal of the Egyptian Society of Nephrology and Transplantation*, 22(2), 86. https://doi.org/10.4103/jesnt.jesnt_35_21
- Goodridge, D., Bandara, T., Marciniuk, D., Hutchinson, S., Crossman, L., Kachur, B., Higgins, D., & Bennett, A. (2019). Promoting chronic disease management in persons with complex social needs: A qualitative descriptive study. *Chronic Respiratory Disease*, 16, 147997311983202. <https://doi.org/10.1177/1479973119832025>
- Greenwood, S. A., Koufaki, P., Macdonald, J. H., Bhandari, S., Burton, J. O., Dasgupta, I., Farrington, K., Ford, I., Kalra, P. A., Kean, S., Kumwenda, M., Macdougall, I. C., Messow, C.-M., Mitra, S., Reid, C., Smith, A. C., Taal, M. W., Thomson, P. C., Wheeler, D. C., ... Mercer, T. H. (2021). Randomized Trial—PrEscription of intraDialytic exercise to improve quAlity of Life in Patients Receiving Hemodialysis. *Kidney International Reports*, 6(8), 2159–2170. <https://doi.org/10.1016/j.ekir.2021.05.034>
- Grigoriou, S. S., Krase, A. A., Karatzaferi, C., Giannaki, C. D., Lavdas, E., Mitrou, G. I., Bloxham, S., Stefanidis, I., & Sakkas, G. K. (2021). Long-term intradialytic hybrid exercise training on fatigue symptoms in patients receiving hemodialysis therapy. *International Urology and Nephrology*, 53(4), 771–784. <https://doi.org/10.1007/s11255-020-02711-8>
- Hu, H., Liu, X., Chau, P. H., & Choi, E. P. H. (2022). Effects of intradialytic exercise on health-related quality of life in patients undergoing maintenance haemodialysis: a systematic review and meta-analysis. *Quality of Life Research*, 31(7), 1915–1932. <https://doi.org/10.1007/s11136-021-03025-7>
- Jakubowski, K. P., Jhamb, M., Yabes, J., Gujral, S., Oberlin, L. E., Bender, F. H., & Steel, J. L. (2020). Technology-assisted cognitive-behavioral therapy intervention for end-stage renal disease. *Translational Behavioral Medicine*, 10(3), 657–663. <https://doi.org/10.1093/tbm/ibz077>
- Karakizlis, H., Thiele, S., Greene, B., & Hoyer, J. (2021). Cognitive performance in dialysis patients - “when is the right time to test?” *BMC Nephrology*, 22(1), 205. <https://doi.org/10.1186/s12882-021-02333-x>
- Kefale, B., Alebachew, M., Tadesse, Y., & Engidawork, E. (2019). Quality of life and its predictors among patients with chronic kidney disease: A hospital-based cross sectional study. *PLoS One*, 14(2), e0212184. <https://doi.org/10.1371/journal.pone.0212184>
- Liguori, G., & American College of Sports Medicine. (2020). *ACSM's Guidelines for Exercise Testing and Prescription* (11th Editi). Lippincott Williams & Wilkins.
- Lin, C.-H., Hsu, Y.-J., Hsu, P.-H., Lee, Y.-L., Lin, C.-H., Lee, M.-S., & Chiang, S.-L. (2021). Effects of Intradialytic Exercise on Dialytic Parameters, Health-Related Quality of Life, and Depression Status in Hemodialysis Patients: A Randomized Controlled Trial. *International Journal of Environmental Research and Public Health*, 18(17), 9205. <https://doi.org/10.3390/ijerph18179205>
- Ling, C., Evans, D., Zhang, Y., Luo, J., Hu, Y., Ouyang, Y., Tang, J., & Kuang, Z. (2020). The effects of cognitive behavioural therapy on depression and quality of life in patients with maintenance haemodialysis: A systematic review. *BMC Psychiatry*, 20(1), 369. <https://doi.org/10.1186/s12888-020-02754-2>
- Lockwood, M. B., Chung, S., Puzantian, H., Bronas, U. G., Ryan, C. J., Park, C., & DeVon, H. A. (2019). Symptom Cluster Science in Chronic Kidney Disease: A Literature Review. *Western Journal of Nursing Research*, 41(7),

1056–1091. <https://doi.org/10.1177/0193945918808766>

- Lu, P.-H., Yu, M.-C., Wei, M.-J., & Kuo, K.-L. (2021). The Therapeutic Strategies for Uremic Toxins Control in Chronic Kidney Disease. *Toxins*, *13*(8), 573. <https://doi.org/10.3390/toxins13080573>
- Lv, J.-C., & Zhang, L.-X. (2019). Prevalence and Disease Burden of Chronic Kidney Disease. In *Advances In Experimental Medicine and Biology* (pp. 3–15). Springer Nature Singapore Pte Ltd. https://doi.org/10.1007/978-981-13-8871-2_1
- Marquez, D. X., Aguiñaga, S., Vásquez, P. M., Conroy, D. E., Erickson, K. I., Hillman, C., Stillman, C. M., Ballard, R. M., Sheppard, B. B., Petruzzello, S. J., King, A. C., & Powell, K. E. (2020). A systematic review of physical activity and quality of life and well-being. *Translational Behavioral Medicine*, *10*(5), 1098–1109. <https://doi.org/https://doi.org/10.1093/tbm/ibz198>
- McAdams-DeMarco, M. A., Konel, J., Warsame, F., Ying, H., Fernández, M. G., Carlson, M. C., Fine, D. M., Appel, L. J., & Segev, D. L. (2018). Intradialytic Cognitive and Exercise Training May Preserve Cognitive Function. *Kidney International Reports*, *3*(1), 81–88. <https://doi.org/10.1016/j.ekir.2017.08.006>
- Othman, A. A., Jaafar, W. M. W., Zainuddin, Z. N., & Yusop, Y. M. (2020). Effectiveness of cognitive behaviour therapy on depression among haemodialysis patients: A systematic review of literature. *Cogent Psychology*, *7*(1), 1794680. <https://doi.org/10.1080/23311908.2020.1794680>
- Poornaari, M., Roshanzadeh, M., Mohammadi, S., Tajabadi, A., Dehghani, K., & Parsa, S. (2019). Effect of Isotonic Exercise on the Frequency of Muscle Cramps in Hemodialysis Patients: A Clinical Trial. *Medical - Surgical Nursing Journal*, *8*(1), e85770. <https://doi.org/10.5812/msnj.85770>
- Pretto, C. R., Winkelmann, E. R., Hildebrandt, L. M., Barbosa, D. A., Colet, C. de F., & Stumm, E. M. F. (2020). Quality of life of chronic kidney patients on hemodialysis and related factors. *Revista Latino-Americana de Enfermagem*, *28*, 1–11. <https://doi.org/10.1590/1518-8345.3641.3327>
- Pu, J., Jiang, Z., Wu, W., Li, L., Zhang, L., Li, Y., Liu, Q., & Ou, S. (2019). Efficacy and safety of intradialytic exercise in haemodialysis patients: a systematic review and meta-analysis. *BMJ Open*, *9*(1), e020633. <https://doi.org/10.1136/bmjopen-2017-020633>
- Reynolds, A., & Jahromi, A. H. (2022). Improving Postoperative Care Through Mindfulness-Based and Isometric Exercise Training Interventions: Systematic Review. *JMIR Perioperative Medicine*, *5*(1), e34651. <https://doi.org/10.2196/34651>
- Salhab, N., Karavetian, M., Kooman, J., Fiaccadori, E., & El Khoury, C. F. (2020). Effects of intradialytic aerobic exercise on hemodialysis patients: a systematic review and meta-analysis. *Journal of Nephrology*, *32*(4), 549–566. <https://doi.org/10.1007/s40620-018-00565-z>
- Sui, Z., Wang, J., Cabrera, C., Wei, J., Wang, M., & Zuo, L. (2020). Aetiology of chronic kidney disease and risk factors for disease progression in Chinese subjects: A single-centre retrospective study in Beijing. *Nephrology*, *25*(9), 714–722. <https://doi.org/10.1111/nep.13714>
- Tommel, J., Evers, A. W. M., van Hamersvelt, H. W., van Dijk, S., Chavannes, N. H., Wirken, L., Hilbrands, L. B., & van Middendorp, H. (2022). E-HEALTH treatment in Long-term Dialysis (E-HELD): study protocol for a multicenter randomized controlled trial evaluating personalized Internet-based cognitive-behavioral therapy in dialysis patients. *Trials*, *23*(1), 477. <https://doi.org/10.1186/s13063-022-06392-9>
- Valsaraj, B. P., Bhat, S. M., Prabhu, R., & Kamath, A. (2021). Follow-Up Study on the Effect of Cognitive Behaviour Therapy on Haemodialysis Adherence. *Sultan Qaboos University Medical Journal [SQUMJ]*, *21*(1), e58-65. <https://doi.org/10.18295/squmj.2021.21.01.008>

- Yabe, H., Kono, K., Yamaguchi, T., Ishikawa, Y., Yamaguchi, Y., & Azekura, H. (2021). Effects of intradialytic exercise for advanced-age patients undergoing hemodialysis: A randomized controlled trial. *PLoS One*, *16*(10), e0257918. <https://doi.org/10.1371/journal.pone.0257918>
- Yonata, A., Islamy, N., Taruna, A., & Pura, L. (2022). Factors Affecting Quality of Life in Hemodialysis Patients. *International Journal of General Medicine*, *15*(August), 7173–7178. <https://doi.org/10.2147/IJGM.S375994>
- Zegarow, P., Manczak, M., Rysz, J., & Olszewski, R. (2020). The influence of cognitive-behavioral therapy on depression in dialysis patients – meta-analysis. *Archives of Medical Science*, *16*(6), 1271–1278. <https://doi.org/10.5114/aoms.2019.88019>
- Zhianfar, L., Nadrian, H., Jafarabadi, M. A., Espahbodi, F., & Shaghghi, A. (2020). Effectiveness of a multifaceted educational intervention to enhance therapeutic regimen adherence and quality of life amongst iranian hemodialysis patients: A randomized controlled trial (MEITRA study). *Journal of Multidisciplinary Healthcare*, *13*, 361–372. <https://doi.org/10.2147/JMDH.S247128>