# Combating Cognitive Dysfunction among CKD Patients: Need for Effective Treatment Module

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#### Abstract

CKD (Chronic kidney disease) is a non-communicable usually caused and manifested by diabetes and hypertension. It worsens over time and leads to both physical and psychological health problems. Over 10% of people globally have CKD, a critical and rapidly progressing illness. Depression, cognitive dysfunction, and a poor quality of life are all associated with deteriorated renal function. Chronic kidney disease (CKD), a causative agent for morbidity and mortality, becoming a more serious health concern globally. According to recent research, there is a 20 to 50% prevalence of cognitive dysfunction in the CKD population, with a 70% increase among the older population of patients undergoing maintenance Hemodialysis. There is a high incidence of cognitive disorders and impairment in the CKD population, with anxiety, depression, and stress being reported by 63.9%, 60.5%, and 51.7% of patients with CKD, respectively. In individuals with chronic renal failure, cognitive function is impeded by a lack of mental and physical exercise. The multiple benefits of frequent, appropriate physical activity for health are well supported by research. Hemodialysis patients are reported to be more likely to experience cognitive abnormalities in numerous studies. Studies have shown a strong link between increased physical activity and a lower risk of cognitive decline and dementia. People with reduced kidney function can benefit from exercising regularly just like those without this condition. Therefore, the challenge is to develop an integrated treatment model for physical activity and exercise that is safe, feasible, and sustainable for chronic kidney disease patients and also educate patients on adherence. The goal of the study is to highlight the critical role of intervention module and its implementation as effective preventive and treatment measure for patients in all stages of CKD. This review is to educate patients, their caregivers, and kidney care specialists about the importance of physical activity and exercise in all phases of CKD as well as the implementation of recommendations that have been clinically proven to be effective in both preventing and treating cognitive dysfunction not only in healthy people but also in patients suffering from kidney disease or deteriorated kidney function.

**Keywords**: Kidney Disease, Cognitive Function, Cognitive Dysfunction and Chronic Kidney Disease, Cognitive Impairment in CKD, Physical Activity and Cognitive Function, Interventions for Cognitive dysfunction in CKD



**Conceptual Framework** 

## 1. Introduction

A broad word used to describe the various ways that people think is "cognitive functioning." It speaks of talents like memory, executive functioning, language, visual-spatial skills, attention, and fine motor dexterity. Cortical and sub-cortical brain areas supporting various cognitive activities are separate. The term "cognitive dysfunction," which is often used, has been defined in a number of different ways, but generally, it describes a combination of impaired brain activities that influence learning, memory, and sensory processing. The latter is characterized by a loss of independence in carrying out activities of daily living and varies from mild cognitive impairment (MCI) to severe dementia (American Psychiatric Association, 2013). According to some researchers, moderate cognitive impairment (MCI), despite being basically unstable (patients may improve or revert to normal cognition), is a distinct clinical entity despite having a 1.9% yearly conversion rate from mild cognitive impairment (MCI) (Marcos et al., 2015). Various domains make up the cognitive function. Cognitive abilities like executive function-the ability to plan and complete difficult tasks-and attention, memory, language, visuospatial perception, and social cognition are frequently tested. The Diagnostic and Statistics Manual's most current revision states that these domains are used to assess dementia patients for clinical syndrome (DSM-5). The DSM-5 defines the commonly used term "mild cognitive impairment" (MCI), or more precisely "mild neurocognitive disorder," as a "moderate cognitive decline from a previous level in more than one cognitive domain" that is not brought on by delirium or another mental disease and does not affect

independence in daily activities. On the other hand, dementia (also known as a "major neurocognitive disorder") is characterized by "substantial decline," which often spans two domains and is severe enough to prevent independence in daily tasks. Thus, the functional impact of the cognitive impairment dictates the final diagnostic formulation, emphasizing the significance of examining not only cognitive domains but also how these impairments affect day-to-day functioning. Poor compliance with therapy or withdrawal from it, are two common reasons why cognitive dysfunction is linked to low quality of life. These issues will have a significant impact on the disease's total morbidity as well make it difficult to treat the underlying disease effectively. Early diagnosis, the identification of factors impacting these disorders, and early management holistically helps the treating team better assist the patients in enhancing their physical, mental, and social well-being. It is widely accepted that individuals with chronic kidney disease (CKD) typically experience some degree of cognitive decline and that kidney disease is associated to a faster deterioration in cognitive and mental function in these individuals than in individuals with healthy kidneys (Bossola et al., 2011). Cognitive impairment significantly increases morbidity in CKD patients, even though cerebrovascular illness is the main cause of death in these individuals (Pliskin et al., 1996). Patients with cognitive impairment who have chronic inflammation and probable neurotoxins, such as parathyroid hormone and products of nitrogen metabolism, are kept in their disease (Kurella et al., 2004). Numerous neuropsychiatric symptoms, including delirium, dementia, anxiety, depression, withdrawal from dialysis, sleep difficulties, and suicidal tendencies, are brought on by cognitive impairment in these patients. The Behavioral Risk Factor Surveillance System for 2013 was used to identify 3,797 people with mental illness in total. For the purpose of examining a moderated mediation effect, analyses were performed using multiple regression, structural equation modeling, and bootstrapping. Lessened psychological anguish is a mediator by which medical comorbidity influences health-related quality of life (HRQOL). Increased levels of physical activity lessened the detrimental effects of medical comorbidity on HRQOL through reducing the effect of medical comorbidity on psychological distress. Increased physical exercise may help persons with mental illness feel less distressed psychologically and have better HRQOL, according to study findings. The findings suggest that comprehensive psychiatric rehabilitation and the integration of physical activity interventions into services are two things that stakeholders and providers of mental health care should think about. According to the research, mental health service providers and other interested parties should think about including physical activity therapies into their offerings and full-scale psychiatric rehabilitation (Moon et al., 2020).

## 2. Cognitive Dysfunction and Renal Dysfunction: Association between the both

Numerous neuropsychiatric symptoms, including delirium, dementia, anxiety, depression, withdrawal from dialysis, sleep difficulties, and suicidal ideation, are brought on by cognitive impairment in the renal patients. Independent of age, education, and even after adjusting for many possible confounders, such as demographic traits and pertinent co-morbidities, the severity of CKD is linked with the severity of cognitive impairment (Kurella et al., 2005). People with mild CKD are largely affected by executive function and attention, but individuals who have severe renal dysfunction have much worse general cognitive capacity, executive function, and episodic memory (Zammit et al., 2015). In a review, Addison (1839) discussed various clinical manifestations of renal illness, such as intellectual and behavioral dullness and sluggishness. The relationship

between renal disease and cognitive performance has long been understood, as is the reciprocal activity between the kidney and the brain. With replacement therapy, cognitive impairment is typical in renal failure (Murray et al., 2006). Instead of just the severity of the CKD stage, the length of renal disease may have an impact on cognition (Viggiano et al., 2019). A 2019 study found that the prevalence of dementia per 1000 patients-years in the group without CKD was 1.4 and 10.7 in the community with end-stage renal failure (Kuo et al., 2019). According to a study, people with ESRD performed worse on memory, psychomotor activities, concentration, and attention tasks than controls with same age, gender, and educational levels (Owolabi et al., 2016). The association between CKD and cognitive function has previously been studied. Patients with CKD showed impaired cognitive function, making it a substantial physical risk factor that was independent in the development of cognitive impairment, according to an analysis of a cross-sectional and longitudinal study involving 54,779 individuals (Etgen et al., 2012).

### 3. Physical activity and Cognitive Function in CKD

Lack of physical and mental activity leads to deterioration in cognitive functioning among chronic kidney patients. Hemodialysis patients are reported to be more likely to experience cognitive abnormalities in numerous studies. Over many years, kidney function gradually deteriorates as a result of chronic kidney disease (CKD). An increased risk of hospitalization for mental illness, depression, and poor quality of life is linked to decreased renal function. It can be argued that kidney damage has been occurring for longer than three months if there are structural or functional issues with the kidneys. Depending on the severity of the CKD, the GFR (Gross Filtration Rate) may or may not decline. Typically, it shows either as pathological abnormalities or as changed markers of renal injury. The illness may show up as changes in blood or urine composition, or it may also show up as a variety of imaging abnormalities, such as hyperechoic kidneys or a loss of corticomedullary distinction on ultrasound (Matovinovi, 2009). According to MMSE and MoCA scores, the study's findings showed that, out of 100 patients, 68 and 75 patients, respectively, had cognitive impairment. He therefore proposed that a better treatment standard may result from increasing clinicians' understanding of cognitive impairment in CKD patients and its potential implications on medication, fluid, and meal compliance. Early intervention will enhance the patient's quality of life. The overall morbidity of the disease would be significantly impacted by cognitive dysfunction, which is linked to poor quality of life and always makes it harder to treat the underlying disease effectively due to variables like poor compliance or medication withdrawal. Early diagnosis and action can help prevent these illnesses by identifying the many factors that may be affecting them. Using MoCA, Joseph et al. (2019) examined cognitive impairment and its relationships in patients undergoing Hemodialysis for chronic renal disease and found that 44% of the patients had cognitive impairment. This study found a substantial association between cognitive function and socioeconomic position as well as the global cognitive score. Cognitive impairment is common in CKD patients and adversely impacts both quality of life and other health-related outcomes, according to Bronas et al. (2017). Clinicians must immediately start taking preventive and therapeutic interventions after realizing the need for early cognitive impairment screening. Intriguingly, it appears that a variety of mechanisms contribute to the decline in cognitive function, with vascular dysfunction being a significant one in the unique metabolic environment of CKD that naturally leads a patient to a higher pace of cognitive decline. Despite inconsistent findings in the literature, this study investigating exerciseinduced improvements in cognition in a population without CKD is encouraging. Exercise training should be studied more as an alternative therapy approach because it has been demonstrated to improve cognitive results and quality of life in Patients with chronic kidney disease. A study by Jain et al. (2020) examined the severity of cognitive impairment at various stages of CKD and the relationship between this dysfunction's contributing factors. On 100 patients who met the criteria for eligibility and had CKD Stages III to V, a cross-sectional design study was carried out. The mini-mental state examination (MMSE) and the Montreal cognitive assessment (MoCA) tests were used to assess cognitive status. Exercise training should be studied more as an alternative therapy approach because it has been demonstrated to improve cognitive results and quality of life in CKD patients.

In 2012, Thimmaiah et al. looked into Cognitive Dysfunction in patients undergoing Hemodialysis. He claimed that 24 hours after starting dialysis treatment, people with renal insufficiency typically perform much worse on neuropsychological tests of memory and concentration. The study's objective was to identify cognitive deterioration in renally insufficient Hemodialysis patients. A total of 60 volunteers—30 renal failure patients and 30 healthy controls—were collected. The sample was matched on age, sex, and socioeconomic status. They came to the conclusion that once Hemodialysis was started, cognitive performance greatly improved and was dramatically decreased in individuals with renal insufficiency. Although end-stage renal disease (ESRD), which has been linked to cognitive impairment, is a form of chronic kidney disease (CKD), the relationship between CKD and cognitive impairment is less clear in less severe forms of CKD. The goal of this investigation was to assess cognition in patients with varying degrees of CKD severity. The relationship between increasing Nephropathy and progressive cognitive deterioration may have significant therapeutic implications. Increasing CKD severity is associated with a gradual decline in cognitive function. The association proposed here has to be confirmed, and additional study is needed to clarify the various causes of cognitive impairment in these patients. To address cognitive impairment in CKD, a number of therapies must be developed and evaluated (Madan et al., 2006).

## 4. Combating Cognitive Dysfunction With Physical and Mental Activities

The National Renal Foundation and Renal Illness: Improving Global Outcomes have issued specific guidelines for physical activity in kidney disease patients in consideration of the growing recognition of the significant relationship between a sedentary lifestyle and negative clinical outcomes. With chronic renal disease, public health is a concern, and it's still unclear what kind of exercise is best to recommend to these people. The most compelling research to date on the beneficial impact of different types of physical activity on clinical outcomes in dialysis patients and those with chronic renal disease is the subject of this discussion. Exercise has been proven to be an effective, non-pharmacological therapeutic option for improving cognitive function in Hemodialysis patients. The current study can help healthcare professionals encourage Hemodialysis patients to engage in regular physical exercise and help develop special guidelines for these people (Fukushima et.al, 2019). More study is desperately required, and a review published in 2014 by Gould et al. discuss the present level of research in this area as well as the major advantages of exercise for CKD patients who are not yet receiving Hemodialysis. Another area of study involves the potential role of exercise in the rehabilitation and treatment of disease. The importance of exercise in the diagnosis, management, and rehabilitation of many

chronic diseases is widely acknowledged; however, rehabilitation programmes for chronic kidney disease (CKD) are significantly less accessible than those for cardiology and respiratory services, despite the importance of exercise in CKD being underutilized. There are currently many studies demonstrating the usefulness and sustainability of exercise training programmes for dialysis patients, but few have looked at how well exercise works for those with CKD who are not yet reached the end stage kidney disease requiring dialysis (Gould et al., 2014).

## 5. Conclusion:

Patients tend to indulge sedentary lifestyle after diagnosis which leads to further risk of lifestyle-related diseases like diabetes, hypertension, and cardiovascular diseases. It also deteriorates their mental health and leads to depression, anxiety, and cognitive dysfunction which are the most commonly diagnosed mental health disorders in this population. Chronic kidney disease (CKD) and dialysis patients are known to practice sedentary lifestyles and get little exercise, which is linked to elevated risk of mortality and morbidity in this patient population. Based on their understanding of the significant correlation between a sedentary lifestyle and unfavorable clinical outcomes, stakeholders should offer targeted physical activity recommendations to individuals with renal disease. As a CKD patient, a person faces a lot of social, emotional, financial, and mental challenges, keeping them in the pink of health is a major challenging task but still possible with effort. Educating and counseling this population group will not only help individuals but their primary caregivers and family will also be much relieved and unburden the stress. Therefore, to combat all these problems physical activity and exercise rehabilitation can be utilized as the best non-pharmacological solution, as it is safe unlike any drug and also cost-effective. Following a review of the relevant literature, it can be concluded that a non-pharmacological intervention strategy is urgently required to reduce the higher incidence of cognitive dysfunction among the susceptible population of chronic renal disease. The challenge of developing an integrated treatment model for physical activity and exercise that is safe, effective, and sustainable for people with chronic renal disease should be addressed in the future in order to enhance quality of life and reduce vulnerability among CKD patients.

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