

**THE EFFECT OF DIALYSIS SHIFT ON DEPRESSION AND SLEEP DISTURBANCES
IN PATIENTS ON CHRONIC HEMODIALYSIS**

by

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Dedication and Acknowledgements

The success of this project would not have been possible without the guidance and support of Oakland University faculty and DNP chair Zorica Kauric-Klein, APRN-BC, PhD. I greatly appreciate all of your help and understanding throughout this long journey. This project is dedicated to my family who have supported me throughout this long journey. I am blessed to have my husband and my two children in my life.

Abstract

Individuals dialyze during the morning, afternoon, and evening shifts at dialysis units based on the unit's and individual's availability. Studies suggest that the dialysis shift impacts sleep disorders, depressive symptoms, quality of life, and mortality. One of the most common psychological problems in the dialysis population is depression that affects hospitalizations, mortality, and adherence to medications, treatments, and fluid restriction. In addition, sleep disturbances are common among end-stage renal disease (ESRD) patients that further impair quality of life and increase mortality rates. Studies examining depression and sleep disturbances in relation to dialysis shifts are lacking. Therefore, the purpose of this study was to compare the effects of hemodialysis (HD) shifts (morning, afternoon, and evening) on outcome variables of depression and sleep disturbance. Quantitative data was collected with the following surveys: Demographic Data Survey, Patient Health Questionnaire (PHQ-9) and Pittsburgh Sleep Quality Index (PSQI).

The overall level of depression ($M = 4.25$, $SD = 2.52$) and sleep disturbance ($M = 8.31$, $SD = 3.96$) were both considered mild. Patients who dialyzed on the first shift had the least amount of depressive symptoms ($M = 4.25$) and those on the third shift had the most depressive symptoms ($M = 11.67$). Patients who dialyzed on the third shift had significantly higher levels of depression ($p = .002$). In addition, patients who dialyzed on the third shift had the poorest sleep quality ($M = 14.50$), compared to those who dialyzed on the first shift who had the best sleep quality scores ($M = 8.31$) ($p = .013$). A significant positive correlation was found between depression and sleep quality scores ($r = .72$, $p = .008$). These results indicate the dialysis shift can play a significant role in sleep disturbances and depression in patients on HD. Further studies need to be conducted to validate these findings. Furthermore, this study could be the basis for

future studies investigating effective health promotion interventions such as sleep hygiene in order to mitigate depression and sleep disturbances.

Background and Significance

Patients with end-stage renal disease (ESRD) receiving hemodialysis (HD) are complex and affected by multifactorial issues including depression and sleep disturbances. Both depression and sleep disturbances are more common in the ESRD population than the general population and are associated with poor quality of life and increased mortality and morbidity rates (Chilcot et al., 2018; Sharazian et al., 2017). However, studies are lacking in investigating the role of the dialysis shift on these outcome variables.

Depressive symptoms are related to increased rates of hospitalizations, and reduced compliance with medications, fluid and dietary restrictions (Chilcot et al., 2018; Khalil et al., 2012; Sharazian et al., 2017). Depressed individuals who receive HD are 12 percent more likely to be hospitalized and are hospitalized twice as long as non-depressed individuals receiving HD (Chiang et al., 2015; Hedayati et al., 2010). Given that the prevalence of depression is three to four times higher in patients with chronic kidney disease (CKD) and ESRD compared with the general population, future studies should focus on the identification and treatment of depression in this population (Sharazian et al., 2017).

In addition to depression, sleep disorders are prevalent in individuals who receive HD and is estimated to range from 20% to 80% (Anwar & Mahmud, 2018; Chen et al., 2006; Losso et al., 2015; Menon et al., 2015; Sabet al., 2012; Velu et al., 2022). Contributors to sleep disturbance include restless leg syndrome, periodic limb movement, sleep apnea, pruritus, anxiety and depression, circadian rhythm disorders such as delayed- sleep phase syndrome, and poor sleep hygiene including napping during daytime dialysis (Lin et al., 2019; Turk et al., 2018). Impaired sleep duration and quality of sleep have been linked to hypertension, diabetes

and cardiovascular disease (Anothaisintawee et al., 2016; Knutson, 2010). Therefore, further studies are warranted to investigate the causes of sleep disturbances in this population.

Time of the HD shift has been found to be related to depression and sleep quality in this population. Dialysis units usually have three shifts, where the first shift starts at 5:30 a.m., the second shift at 10:00 a.m., and the third shift at 1:00 p.m. Significant inconsistencies were found in the literature between the HD shift and the outcome variables of depression and sleep quality. Therefore, further studies are warranted to investigate the role of dialysis shift on depression and sleep quality. This study explored the effect of the dialysis shift on depression and sleep quality in patients on chronic HD and explored associated variables including age, gender, race, and length of time on HD. By understanding the role of the dialysis shift, earlier identification and interventions may be offered to help manage and treat depression and sleep disturbances in this vulnerable population.

Literature Review

Search Methods

A literature review was conducted to further explore the relationship between the HD shift, depression, and sleep quality. The databases used included Cumulative Index to Nursing and Allied Health (CINAHL) and Embase using the key terms depression, sleep disturbances, sleep disorders, sleep quality, PSQI, PHQ-9, hemodialysis, and hemodialysis shift. The initial search generated 568 studies. Then the search was further restricted to include studies from 2008 to 2022 that yielded 497 studies. The search was limited further to articles that contained the word “HD shift” which generated 35 studies. The pool of articles was further filtered to 28 articles by choosing only those that were written in English, peer reviewed and had cross-sectional and correlational designs, and were most relevant to the topic being explored.

Depression

Depression has been identified as the most common psychiatric illness in patients with ESRD and is associated with poor quality of life and increased mortality (Ibrahim et al., 2013; Shirazian, 2017). Depression is common among people on HD with a prevalence rate between 23% to 49% (Cirillo et al., 2018; Palmer et al., 2013; Stasiak et al., 2014; Trbojevic-Stankovic et al., 2014).

Furthermore, depression negatively impacts multiple aspects in patients with ESRD such as functional impairment, quality of life, and adherence to fluid and dietary restrictions (Khalil et al., 2012; Norozi Firoz et al., 2017; Pretto et al., 2020). In other studies, more than half of individuals on HD exhibited depressive symptoms and were non-adherent to the fluid and diet prescription (Agganis et al., 2010; DiMatteo et al., 2010; Gerogianni & Babatsikou, 2014; Khalil et al., 2012). In patients receiving HD, higher levels of depressive effect, skipping treatments, excessive interdialytic fluid gains, and high phosphate levels were associated with increased mortality (Norozi Firoz et al., 2017). The mortality rate in depressed patients on HD was 5.6 times higher than patients without depression (Diefenthaler et al., 2008). Moreover, depressive patients were 4.5 times more likely to be hospitalized than nondepressed patients ($p < .008$) (Teles et al., 2014). The extensive impact of depression on HD self-care behaviors as well as hospitalizations, morbidity, and mortality rates emphasizes the crucial need for early recognition of depression in order to improve overall outcomes and management of these individuals.

Sleep Disturbances

In addition to depression, sleep disturbances are prevalent in individuals on chronic HD and include insomnia, restless leg syndrome (RLS), sleep apnea, and periodic limb movement disorder (PLMD) (Chu et al., 2017; Santos et al., 2016; Trbojevic-Stankovic et al., 2014). The

incidence of sleep disturbances in patients on HD has been reported to range from 49% to 85% (Al-Jahdali et al., 2010; Harris et al., 2012; Roumelioti et al., 2020; Velu et al., 2022). A study that included 1,643 patients from 335 HD centers reported that 50% had trouble falling asleep, 59% woke during the night, and 49% woke early in the morning; 53% reported one or more of these symptoms all or most of the time (Anand et al., 2013). Sleep disturbances are not only highly prevalent but also multifaceted causing a complexity to diagnose and treat in this population. Furthermore, sleep disturbances compound the fatigue and poor quality of life that may lead to more complications such as depression, higher risk of cardiovascular complications (Morin et al., 2015).

Sleep Disturbances and Depression

Studies have supported the relationship between sleep disturbances and depression in patients on HD. In a cross-sectional study of 301 patients on HD, researchers found that 74.3% of the sample reported poor sleep and 29.5% of the participants had depression associated with reduced sleep quality ($r = .49, p < .001$) (Brekke et al., 2013). In a descriptive correlational study of 310 participants, Norozi Firoz and others (2017) conducted a correlational study of 310 patients on HD and found that 59.6% reported poor sleep quality and 44.8% reported experiencing depression. Using BDI and PSQI to measure depression and sleep quality respectively, a cross-sectional study of 400 patients revealed that depressive symptoms were associated with poor sleep quality ($p < .005$) (Arajuo et al., 2012).

Dialysis Shift and Sleep Disturbances and Depression

A review of the literature regarding the the relationship between HD shift, depression and sleep disturbance are lacking, and the pertinent studies found had conflicting results. Three studies supported decreased sleep quality and/or higher levels of depression in individuals who

dialyzed on the first shift (Cengic et al., 2012; Menon et al., 2015; Teles et al., 2014). A cross-sectional study of 96 patients found that patients with depression were more likely to dialyze during the morning shift ($p = .008$) (Teles et al., 2014). In another study, Menon and colleagues (2015) reported that the morning dialysis shift was also associated with poor sleep quality of 67% ($n = 85$) and more depressive symptoms of 75% ($n = 62$) than the other dialysis shifts. A study of 200 participants conducted by Cengic and colleagues (2012) reported poorer sleep quality and higher prevalence of depression in patients undergoing HD during the morning shift ($p < .006$) when compared to the other shifts. However, Wang et al., (2003) found that the morning dialysis shift was associated with better overall quality of sleep in a cross-sectional observational study of 206 participants on HD ($\beta = .15, p = .01$).

Other studies reported a significant relationship between sleep quality and depression but not dialysis shift (Anwar & Mahmud, 2018; Norozi Firoz et al., 2017; Trbojevic-Stankovic et al., 2014). Anwar & Mahmud (2018) conducted a cross-sectional, descriptive study of 113 patients to investigate the relationship between sleep disturbance and dialysis shift. Eighty-two (72.6%) participants had poor quality of sleep. No statistical differences were found between dialysis shifts and sleep quality. Norozi et al., (2017), found a significant relationship between sleep quality and depression ($p = .001$) but not dialysis shift. Trbojevic-Stankovic and colleagues (2014) completed a study of 222 patients from three HD centers in Central Serbia assessing sleep quality and depression with PSQI and BDI. A statistically significant positive correlation was found between BDI and PSQI ($r = .604; p < .001$), but no significant relationship was found with HD shift. Thus, we can conclude that the relationship between HD shift, sleep quality and depression in patients on HD are conflicting and further studies to investigate the relationship between sleep quality, depression, and HD shift are warranted.

Problem Statement

Patients on HD suffer disproportionately from poor sleep quality and depression and HD shift may be a contributing factor. Research related to the relationship between these variables is conflicting and further studies are warranted.

Objectives

The major purpose of this DNP Project was to determine the relationship between depression, poor sleep quality and HD shift in a sample of patients who dialyze and to further explore the following demographic variables: age, gender, race, depression and sleep quality on these outcome variables. With early detection of sleep disturbances and depression, nurses may provide education on sleep hygiene and offer referral to multidisciplinary team members such as social work at the dialysis units to aid in managing depressive symptoms. By achieving this endpoint, individuals would have improved health and quality of life.

Framework

Nola Pender's Health Promotion Theory (HPT) (1982) guided the development of this DNP Project. The aim of this model is to understand the major determinants of health behaviors for behavioral counseling to increase a patient's wellbeing and health (Pender, 1982). Summarized in Figure 1 (Appendix A), HPT emphasizes three major concepts: individual characteristics and experiences, behavior-specific cognitions and affect, and behavioral outcomes. In order to understand a way to improve the health of an individual and a population, comprehending these three major concepts is crucial.

Individual characteristics and experiences incorporate personal factors and prior related behavior. Personal factors are categorized as biological, psychological, and socio-cultural that shape behavior. For the purpose of this study, personal factors was represented by demographic

variables: age, gender, and race in order to determine the relationship between them and depression, sleep disturbances, and dialysis shift.

Furthermore, behavior-specific cognitions and affect incorporate perceived benefits of action, perceived barriers to action, self-efficacy, activity-related affect, interpersonal influences, and situational influences. This study focused on activity-related affect where individuals on HD may have negative feelings or reactions toward HD leading to depressive symptoms and sleep disturbances in relation to the HD shift.

Lastly, behavioral outcomes consist of a commitment to a plan of action, immediate competing demands and preferences, and health-promoting behavior. This study attempted to identify whether the dialysis shift was a perceived barrier contributing to depressive symptoms and sleep disturbances in individuals who receive HD. By determining the effect of the dialysis shift on these outcome variables, earlier identification and education could be offered to decrease depressive symptoms and sleep disturbances thereby fostering health-promoting behaviors.

Project Methodology

Project Design

The research design for this DNP project was a cross-sectional correlational design.

Project Setting

Participants were recruited from nephrology social media sites on Facebook. In addition, the PI, who is a nephrology NP, informed some of her patients about the study and they had agreed to participate. Since it was difficult to attain an adequate sample size from these two recruitment methods, data was also collected from two outpatient HD units in Southwest Michigan.

Key Personnel

The key personnel for this DNP Project was the Principal Investigator (PI), myself Margaret Clark MSN, FNP-BC and DNP student at Oakland University.

Recruitment and Project Intervention Plan

Twelve participants were recruited electronically through nephrology facebook groups on social media with the use of a flyer (Appendix B) advertising the study. Eight individuals, who were managed by the PI as the Nephrology NP, were also recruited to participate in the study. In addition, data from twenty-one participants from two HD units in Southwest Michigan were also included. The PI provided her email to potential participants. If potential participants indicated interest in participating in the study, the PI screened them to ensure they met the inclusion and exclusion criteria by email. A convenience sample of 41 subjects was recruited for this pilot study of whom sixteen patients dialyzed on the first shift of HD, thirteen patients who dialyzed on the second shift of HD, and twelve patients on the third shift of HD.

Inclusion criteria for the study included: (a) adults whose primary language is English, (b) older than 18 years old; (c) duration of receiving HD greater than three months. The criteria of duration of HD greater than three months was selected to decrease the effect of inadequate dialysis and uremic symptoms that could contribute to symptoms of depression. The exclusion criteria included: (a) hospitalization in the past three months.

If the participants met the inclusion and exclusion criteria to participate in the study, the participants were emailed the qualtrics link to complete the demographic questionnaire, PHQ-9, and PSQI. The PI emailed a reminder to the participants after two weeks of the initial email to complete the questionnaire and surveys. Upon completion, the participants received an email with a Target five dollar egift card. If participants failed to complete the questionnaire and surveys or withdrew early, then no compensation was given.

Data Collection Instruments

The following instruments were used to collect the outcome data: demographic questionnaire (Appendix C), Patient Health Questionnaire (PHQ-9) (Appendix D), and Pittsburgh Sleep Quality Index (PSQI)(Appendix E).

Demographic Questionnaire. This five question multiple-choice questionnaire was developed by the PI. Clinical and demographic data collected was: age, race, gender, length of time on HD, and days of dialysis.

PHQ-9. The PHQ-9 is an instrument used for screening, diagnosing, monitoring, and measuring the severity of depression. The best screening tool to measure depression in this population remains unclear. However, measurement tools such as the Beck Depression Index (BDI), Patient Health Questionnaire-9 (PHQ-9), and Quick Inventory Depression Symptomatology Self-Report (QIDS-SR 16) have been validated for use in the CKD and ESRD populations (Chilcot et al., 2018; Hedayati et al., 2012; King-Wing & Kam-Tao, 2016). Both the PHQ-9 and BDI were found to have good internal and external validity in measuring depression in the ESRD population (Watnick et al., 2005). The PHQ-9 was chosen to measure depression for this study, due to its ease of administration and short time to complete.

The PHQ-9 is a nine-item self-reporting tool that uses a four-point scale from zero to three. Total PHQ-9 scores range from zero to 27, with higher scores indicating more severe depressive symptoms. The scores for the PHQ-9 indicate the following: five to nine (minimal depression), 10 to 14 (mild to moderate depression), 15 to 19 (moderately severe major depression), greater than 20 (severe major depression) (Gillbody et al., 2007). To compensate for possible uremic symptoms, a PHQ-9 cutoff value of 10 or greater was used to diagnose depression in individuals receiving HD, as recommended by Watnick and colleagues (2005). The

PHQ-9 has been found to provide accurate testing for depressive symptoms with a sensitivity of 71 to 92% and a specificity of 92 to 98% (Gillbody et al., 2007; Watnick et al., 2005).

PSQI. This instrument was used to evaluate the following sleep quality indicators: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction over the previous month (Buysse et al., 1989). The PSQI is a validated screening tool with excellent sensitivity (89.6%) and specificity (86.5%) (Buysse et al., 1989; Farhadi Nasab & Azimi, 2008; Farrahi et al., 2009). This tool has been found to be reliable and valid in the HD population (Menon et al., 2015; Mujahid et al., 2022; Sabet et al., 2012). Each component is scored from zero to three, yielding a total PSQI score between zero and 21. Higher scores indicate lower quality of sleep, and a PSQI score greater than five indicates poor sleep quality. The tool has been found to have good internal reliability (Cronbach's $\alpha = 0.8$) (Beck et al., 2004; Mujahid et al., 2022).

Data Collection Procedure

Each participant received an email from the PI, containing links to the demographic, PHQ-9, and PSQI Qualtrics surveys. The total estimated time to complete the surveys was 20 to 30 minutes. If the participants did not complete the surveys within 14 days, a reminder email was sent by the PI to complete the survey. If participants completed the surveys, they were emailed a five dollar Target e-gift card by the PI. If the participant withdrew early or did not complete the surveys, no compensation was given. After completion of the surveys, the PI input the data into her personal computer. The PI was the only individual who had access to the database through a protected password.

Potential Barriers

Potential barriers to this project was that the participants were recruited from social media sites, so there was no way to verify the accuracy of the self-report data. In addition, participants were likely to be from higher socioeconomic and educational status because they had access and knowledge of the internet. Another limitation or barrier for the project was that it was conducted during the recent COVID pandemic, which may have affected depression and sleep quality scores.

Ethical Considerations/Protection of Human Subjects

The study protocol was submitted and approved by the Oakland University Institutional Review Board (IRB) (Appendix S). An informed consent was not required to recruit participants online. All data was kept confidential with no identifiers and stored in a password protected computer to which only the PI had access.

Potential Benefits & Outcomes

This study may provide further data about the relationship between HD shift, depression and sleep outcomes. Knowledge obtained from this DNP project will encourage healthcare professionals to become more aware of the relationship between these variables, and regularly assess these variables in their patients. Early assessment of depression and poor sleep quality will enable early education and interventions to mitigate the effects on depression and sleep quality. Consequently, this could lead to improved health and wellbeing and decreased hospitalization, morbidity and mortality rates in this population.

Timeline

The initial Oakland University IRB approval was obtained in July 2020. The recruitment of participants and data collection took place from March to June 2022. Data Analysis took place

from June to August 2022. Dissemination of the findings took place from August through December 2022.

Budget for Project

See Appendix E for outline and justification.

Evaluation of Plan

The first objectives of this study was met: to determine the relationship between depression, sleep disturbances and HD shift. Future studies with larger sample sizes should be conducted to increase generalizability of findings. Future studies should also recruit participants from both in-person and online modalities in order to improve the generalizability of findings. The recent COVID pandemic may have negatively affected the participants' depressive symptoms and sleep quality. Therefore, future studies should be conducted to determine if the findings are similar to those found in this project.

Project Implementation

A flyer (Appendix B) was used to recruit participants. A total of 41 participants were recruited to participate: 12 from nephrology facebook sites, 8 from the HD unit where the PI was an NP and 21 were recruited from two additional HD units in Southwest Michigan. Of the total 41 participants, sixteen patients dialyzed on the first HD shift, thirteen patients dialyzed on the second HD shift, and twelve patients dialyzed on the third HD shift. After indicating interest in participating in the study, the PI verified inclusion and exclusion criteria were met via email communication.

Participants were emailed the Qualtrics link to complete the demographic questionnaire, PHQ-9, and PSQI surveys. All of the distributed surveys were completed by the participants. If the participants had not completed the survey within two weeks, a follow-up email reminder was

sent to the participant to complete the questionnaire and surveys. Upon completion of the surveys, the participants received an email with a target \$5 e-gift card.

Data Analysis

Data was coded and categorized and entered into a statistical website by the PI (Intellectus Statistics). All data entries were verified, mean and frequency distributions determined, and outliers checked. Descriptive statistics were conducted on all study outcome variables. Summary statistics were calculated for each interval and ratio variable. The assumptions of normality, and homoscedasticity were met for all outcome study variables. Frequencies and percentages were calculated for each nominal variable. Analysis of variance (ANOVA) was conducted to determine the differences in depression and sleep quality between the three shifts. Correlational analyses were conducted to determine if there were any relationships between the outcome variables. Linear regression analyses were performed to predict the amount of variance in depression and sleep quality based on age, gender, race, dialysis shift, and length of time on HD.

Results

The overall results showed that the majority of participants (37.21%) dialyzed on the first shift, were Caucasian (58.14%), male (51.16%), over the age of 56 years old (75%), and had been on HD one to five years (83.72%). The overall frequencies and percentages are presented in Table 1 (Appendix G). The average PHQ-9 depression score for the entire sample was 7 with a score ranging from five to nine indicating a mild level of depression. The average sleep disturbance (PSQI) score for the entire sample was 10.5 with a score ranging from one to 21 indicating a mild level of sleep disturbances. The summary statistics are found in Table 2 (Appendix H).

The majority of patients on the first shift were Caucasians (75%), male (56.25%), between the ages of 56 to 68 (50%), and had been on HD for one to five years (87.5%). The frequencies and percentages are presented in Table 3 (Appendix I).. Participants on HD Shift one had an average depression score of ($M = 4.25$) and sleep disturbance score of ($M = 8.31$) indicated a mild level of depression and sleep disturbances. These scores were lower compared to those of the other two HD shifts. The summary statistics can be found in Table 4 (Appendix J).

Caucasians and Blacks were equally represented (46.15%) on the second HD shift. The majority of the subsample were over 69 years of age (38.5%), male (53.9%), and were on HD for one to five years (92.3%). The frequencies and percentages are presented in Table 5 (Appendix K). The average scores for depression ($M = 6.08$) and sleep disturbances ($M = 9.54$) were slightly higher than first shift but still indicated a mild level of depression and sleep disturbances. The summary statistics can be found in Table 6 (Appendix L).

The majority of the patients on the third shift were Caucasian (58.33%), over the age of 56 years (66%), equally represented by males and females and had been on HD for one to five years (75%). The frequencies and percentages are presented in Table 7 (Appendix M). The third shift had the highest levels of depression ($M = 11.67$) and sleep disturbances ($M = 14.5$) compared to the other dialysis shifts and indicated a moderate level of depression and sleep disturbances. The summary statistics can be found in Table 8 (Appendix N).

An analysis of variance (ANOVA) was conducted to determine whether there were significant differences in PHQ-9 scores according to dialysis shift. The results of the ANOVA were significant and indicated significant differences in PHQ-9 among the different dialysis shifts. The ANOVA was examined based on an alpha value of .05. The results of the ANOVA were significant, $F(2, 38) = 12.45, p < .001$, indicating there were significant differences in

PHQ-9 between the three HD shifts. The eta squared was 0.40 indicating Dialysis Shift explains approximately 40% of the variance in PHQ- 9.

Post-hoc Analyses

A *t*-test was calculated between each group combination to further examine the differences among the variables based on an alpha of .05. The Tukey HSD p-value adjustment was used to correct for the effect of multiple comparisons on the family-wise error rate. For the main effect of Dialysis Shift, the mean of PHQ9 for the second shift ($M = 6.08$, $SD = 3.80$) was significantly smaller than for the third shift ($M = 11.67$, $SD = 5.50$), $p = .003$. For the main effect of Dialysis Shift, the mean of PHQ-9 for the first shift ($M = 4.25$, $SD = 2.52$) was significantly smaller than for the third shift ($M = 11.67$, $SD = 5.50$), $p < .001$. No other significant effects were found.

An ANOVA was also conducted to determine whether there were significant differences in PSQI scores according to dialysis shift. The ANOVA was examined based on an alpha value of .05. The results of the ANOVA were significant, $F(2, 38) = 4.81$, $p = .014$, indicating there were significant differences in PSQI among the levels of Dialysis Shift. The eta squared was 0.20 indicating Dialysis Shift explains approximately 20% of the variance in PSQI. The means and standard deviations are presented in Table 10 (Appendix P).

Post-hoc Analyses

A *t*-test was calculated between each group combination to further examine the differences among the variables based on an alpha of .05. The Tukey HSD p-value adjustment was used to correct for the effect of multiple comparisons on the family-wise error rate. For the main effect of the Dialysis Shift, the mean of PSQI for the first shift ($M = 8.31$, $SD = 3.96$) was

significantly smaller than for the third shift ($M = 14.50$, $SD = 7.65$), $p = .013$. No other significant effects were found.

Correlation analyses were conducted between PHQ-9 and PSQI scores and the demographic variables. A significant positive correlation was observed between PSQI and PHQ-9 ($r = .64$, $p < .001$). This suggests that as sleep disturbances increase, depression increases and visa versa. The results of the correlation are presented in Table 11 (Appendix Q). No significant relationships were found between the demographic variables of age, length of time on HD, gender, or race and the outcome variables of PHQ-9 and PSQI.

A linear regression analysis was conducted to assess whether race, dialysis shift, age, gender, and length of time on HD significantly predicted PHQ-9. The results of the linear regression model were significant, $F(6,34) = 6.42$, $p < .001$, $R^2 = .53$, indicating that approximately 53.10% of the variance in PHQ-9 is explainable by Age and Dialysis Shift. The 43 to 55 age category was the only one that significantly predicted PHQ9, $B = -8.83$, $t(34) = -2.92$, $p = .006$. HD Shift one and two did not significantly predict PHQ-9 scores, however, Dialysis Shift 3 did significantly predict PHQ-9, $B = 5.66$, $t(34) = 3.81$, $p < .001$. Table 12 (Appendix R) summarizes the results of the regression model.

A linear regression analysis was also conducted to assess whether dialysis shift, race, length of time on HD, age and gender predicted PSQI. The results of the linear regression model were not significant, $F = 2.18$, $p = .052$, $R^2 = .39$, indicating Dialysis Shift, Race, Age, and Gender did not explain a significant proportion of variation in PSQI. Since the overall model was not significant, the individual predictors were not examined further.

Discussion

The data from this study showed that individuals who dialyzed on the first shift had better sleep quality and less depressive symptoms than the second and third shifts. Studies also supported that individuals who dialyze on the first shift had better sleep quality (Menon et al, 2015; Wang et al., 2013). However, the findings in this study are inconsistent from those found in other studies which found that patients who dialyzed during the first shift reported poorer sleep quality and higher levels of depression compared to patients who dialyzed on the evening shift (Cengic et al., 2012; Menon et al., 2015; Teles et al., 2014).

Interestingly, patients in the 43 to 55 age range had significantly lower depression scores than the other age groups. This finding is inconsistent with previous findings which found that patients on HD with an average of 50 had consistently higher levels of depression (Shanmukham et al., 2022).

Findings from this study also found a strong correlation between depression and sleep quality scores. This suggests an individual's level of depression increases when his or her sleep quality decreases. Other studies found similar relationship between sleep quality and depression, however HD shift was not found to be related to these outcome variables (Anwar & Mahmud, 2018; Arajuo et al., 2012; Brekke et al., 2013; Norozi Firoz et al., 2017).

Thus, we can conclude that there is a relationship between depression and sleep quality as validated through other study findings. The relationship between the HD shift, depression and sleep quality is still unclear and further studies should be conducted. Findings from this study can help healthcare professionals be aware of the relationship between sleep and depression, and encourage education and interventions to improve these outcomes such as education on sleep hygiene, and recommending counseling and pharmacologic management for depression.

Interventions such as these may help improve sleep quality and promote early assessment and treatment of depression thereby improving quality of life for this vulnerable population.

Limitations and Barriers

Findings from this study were limited due to the small sample size. A pilot study is limited by the small sample size and the feasibility results do not generalize beyond the inclusion and exclusion criteria of the pilot (Leon et al., 2011). In addition, participants who complete surveys by the online methodology are likely to have increased knowledge and computer ability which may not be reflective of the general HD population. Another limitation is self-report bias when completing surveys. Self-report surveys may not be accurate and may reflect social desirability bias. The recent COVID pandemic may have increased depressive symptoms and decreased sleep quality by impacting not only the participants' psychological health but also their physical health. Therefore, further studies with larger sample sizes should be conducted to determine if the findings remain consistent. .

Recommendations and Sustainability

Future studies should control for variables such as uremia and sleep disorders that may be affecting the outcome variables of depression and sleep quality. Data related to HD clearance levels and missed HD treatments should be collected as it can affect depression and sleep quality. Given that sleep apnea is also prevalent in this population, future studies could investigate sleep apnea symptoms and collaborate with sleep medicine to perform sleep studies. Sustainability could be maintained by obtaining data from multiple dialysis units. This would allow for a larger sample size and improve generalizability of findings. Future studies would also benefit from the use of both an in-person and electronic survey distribution to further broaden the depth of the data. The study of depression and sleep quality could be applied to other chronically ill

populations such as individuals with congestive heart failure (CHF), diabetes, and chronic obstructive pulmonary disease (COPD).

Implications for Practice and Career Development

The exploration of the relationship of dialysis shift, depressive symptoms and sleep disturbances in patients undergoing HD will contribute to the body of nursing knowledge in the care of patients with CKD and undergoing dialysis. Early assessment of sleep disturbances and depression can provide patients with early identification and interventions to provide more effective coping strategies. Furthermore, nurses can provide education on sleep hygiene to mitigate sleep disturbances that are prevalent in this vulnerable population. The role of nursing is to collaborate with patients, families, and multidisciplinary team members to promote optimal health and well-being of individuals. Therefore, the focus should be on goal-directed behavior and self-care through education to achieve appropriate outcomes necessary to decrease morbidity and mortality rates in this population.

Furthermore, doctorally-prepared nurses have the opportunity to generate new knowledge that can innovate practice with evidence-based-research. Advanced practice nurses (APRNs) have the opportunity to improve clinical decision making and overall outcomes for both patients and nurses through leadership, quality improvement, and health policies. The findings from this study can generate future studies to further examine the relationship between these variables and to test health promoting interventions such as education in order to improve sleep and depression outcomes in this vulnerable population.

Achieving DNP Essentials and Personal Goals

All eight of the DNP Essentials were met with the development, implementation, and dissemination of this project. The author developed the necessary competencies to transition into a doctorally prepared APRN with the application of the DNP Essentials. With the implementation of Essential I and II, the author was able to identify a gap in knowledge, apply nursing theory, and develop evidence-based-research in order to improve patient care. Essential III emphasized the ability to translate research into practice, utilizing the application of clinical scholarship, employing analytical methods for evidence-based practice. Essential IV was fulfilled with the interprofessional collaboration of the DNP chair, the statistician, and the IRB. Essential VI was achieved with the use of technology to obtain and analyze data for this study and to enhance communication with both participants and team members. The importance of advocating for patients and understanding the framework of Essential V has been incorporated into this project. The author was able to more deeply understand the concepts surrounding Essential VII that will be needed to improve population health especially in the dialysis population. Essential VIII was achieved by completing this project to improve patient outcomes and deliver evidence-based care. This project has equipped the author with the knowledge and skills to assess and implement an evidence-based study to improve the quality of patient care and patient outcomes. This DNP project has laid the path for future research studies, health policy development, and educational opportunities for both patients and nurses.

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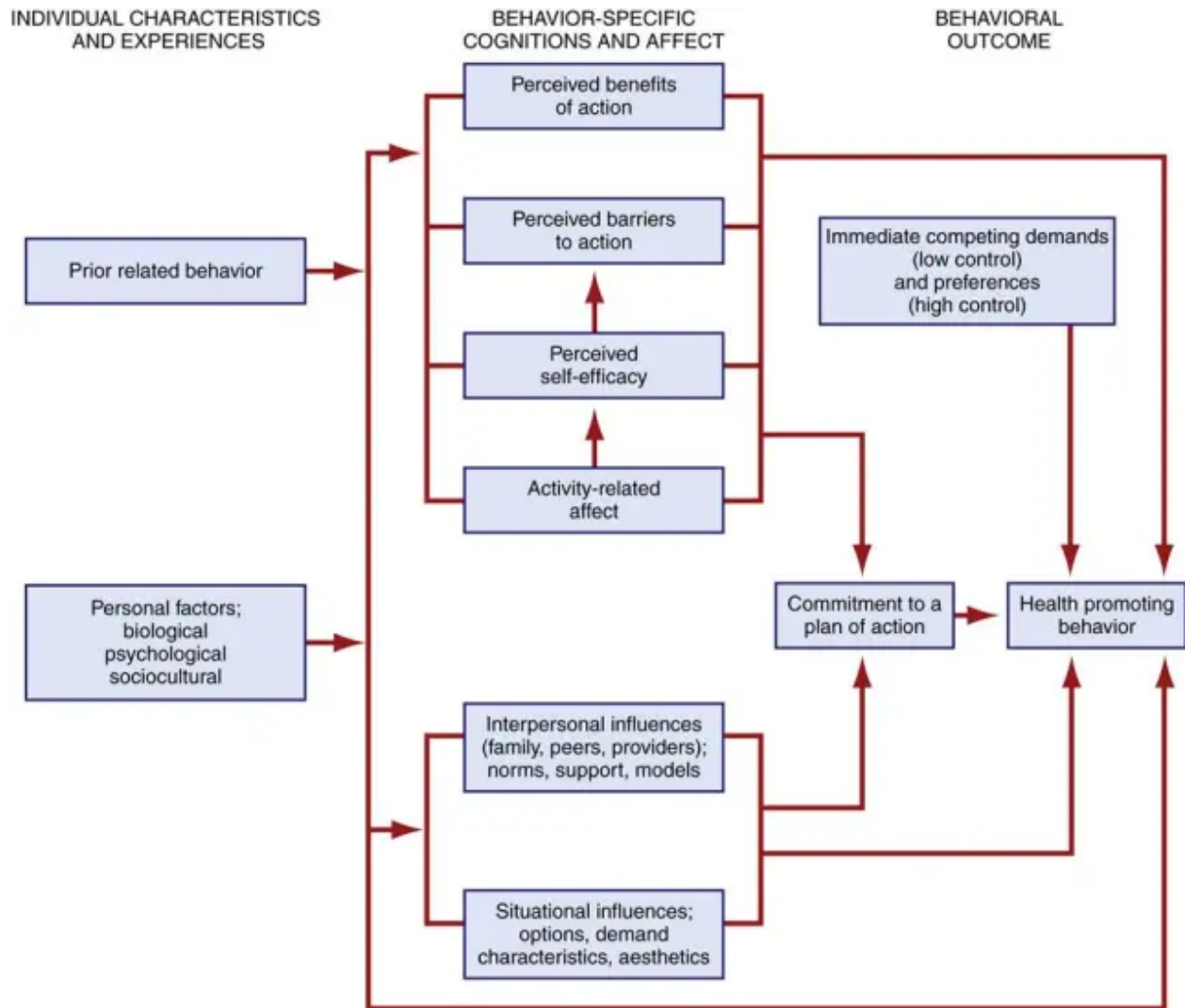
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Appendix A

Figure 1

The Health Promotion Model

Note. From *Health Promotion in Nursing Practice*, (5th ed., p. 50) by N. J. Pender, C. L. Murdaugh, & M. A. Parsons, 2006, Prentice Hall.

Appendix B

Recruitment Flyer

Do You Suffer From Sleep Disturbances and/or Depression?



If So, We Are Conducting a Study To Determine the Relationship Between Dialysis Shift and Sleep Disturbances and Depressive Symptoms.

Looking for 36 Participants

- 12 Who Start Dialysis after 5 AM
- 12 Who Start Dialysis after 10 AM
- 12 Who Start Dialysis after 1 PM

You May Qualify if You:

- Are older than 18 years old
- Receive Hemodialysis three times a week in center
- Been on Hemodialysis for at least 3 months

Participation Involves:

- One questionnaire and 2 short surveys that would be completed online
- Upon completion, you will receive \$5 egift card

If You Are Interested:

- Please Contact Margaret Clark NP at meclark2@oakland.edu or via Facebook messenger

Appendix C

Demographic Questionnaire

8/16/2021

Qualtrics Survey Software

CODE _____

Demographic Questionnaire

1. What is your gender?

- ☐ Male
- ☐ Female
- ☐ Non-binary / third gender
- ☐ Prefer not to answer

2. Are you married or have a long term significant other?

- ☐ No
- ☐ Yes
- ☐ Prefer not to answer

3. What age category are you?

- ☐ 18-30
- ☐ 31-42
- ☐ 43-55
- ☐ 56-68
- ☐ >69
- ☐ Prefer not to answer

4. What race do you identify with?

- ☐ Black
- ☐ White

8/16/2021

Qualtrics Survey Software

- ☐ Asian
- ☐ Native Hawaiian/Pacific Island
- ☐ Prefer not to answer

5. What is your highest level of education completed?

- ☐ Less than high school
- ☐ High School
- ☐ More than high school
- ☐ Prefer not to answer

6. Are you currently working?

- ☐ Yes
- ☐ No
- ☐ Prefer not to answer

7. How Long Have you been on dialysis?

- ☐ Less than 1 year
- ☐ 1 to 5 years
- ☐ More than 5 years
- ☐ Prefer not to answer

8. What time do you start hemodialysis?

- ☐ Before 0900 am
- ☐ 0900 am to 1:00pm
- ☐ After 1:00 pm
- ☐ Prefer not to answer

8/16/2021

Qualtrics Survey Software

9. How long is your current hemodialysis treatment that is ordered?

- ☐ Less than 3 hours
- ☐ 3-3.25 hours
- ☐ 3.5-4 hours
- ☐ More than 4 hours
- ☐ Prefer not to answer

10. What days do you receive hemodialysis

- ☐ Monday, Wednesday, Friday
- ☐ Tuesday, Thursday, Saturday
- ☐ Prefer not to answer

Powered by Qualtrics

Appendix D

Patient Health Questionnaire (PHQ-9)

PATIENT HEALTH QUESTIONNAIRE (PHQ-9)

NAME: _____ DATE: _____

Over the last 2 weeks, how often have you been
bothered by any of the following problems?
(use "✓" to indicate your answer)

	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself—or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed. Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead, or of hurting yourself	0	1	2	3

add columns + +

(Health care professional: For interpretation of TOTAL, TOTAL:
please refer to accompanying scoring card).

10. If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?	Not difficult at all	_____
	Somewhat difficult	_____
	Very difficult	_____
	Extremely difficult	_____

Appendix E

Pittsburgh Sleep Quality Index (PSQI)

Pittsburgh Sleep Quality Index (PSQI)

Instructions: The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions.

During the past month,

1. When have you usually gone to bed? _____
2. How long (in minutes) has it taken you to fall asleep each night? _____
3. When have you usually gotten up in the morning? _____
4. How many hours of actual sleep did you get that night? (This may be different than the number of hours you spend in bed) _____

5. During the past month, how often have you had trouble sleeping because you...	Not during the past month (0)	Less than once a week (1)	Once or twice a week (2)	Three or more times a week (3)
a. Cannot get to sleep within 30 minutes				
b. Wake up in the middle of the night or early morning				
c. Have to get up to use the bathroom				
d. Cannot breathe comfortably				
e. Cough or snore loudly				
f. Feel too cold				
g. Feel too hot				
h. Have bad dreams				
i. Have pain				
j. Other reason(s), please describe, including how often you have had trouble sleeping because of this reason(s):				
6. During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep?				
7. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?				
8. During the past month, how much of a problem has it been for you to keep up enthusiasm to get things done?				
	Very good (0)	Fairly good (1)	Fairly bad (2)	Very bad (3)
9. During the past month, how would you rate your sleep quality overall?				

Component 1	#9 Score	C1 _____
Component 2	#2 Score (<15min (0), 16-30 min (1), 31-60 min (2), >60 min (3)) + #5a Score (if sum is equal 0=0; 1-2=1; 3-4=2; 5-6=3)	C2 _____
Component 3	#4 Score (>7(0), 6-7(1), 5-6(2), <5 (3))	C3 _____
Component 4	(total # of hours asleep)/(total # of hours in bed) x 100 >85%=0, 75%-84%=1, 65%-74%=2, <65%=3	C4 _____
Component 5	# sum of scores 5b to 5j (0=0; 1-9=1; 10-18=2; 19-27=3)	C5 _____
Component 6	#6 Score	C6 _____
Component 7	#7 score + #8 score (0=0; 1-2=1; 3-4=2; 5-6=3)	C7 _____

Add the seven component scores together _____ **Global PSQI Score** _____

Reprinted from *Journal of Psychiatric Research*, 28(2), Buysse, D.J., Reynolds III, C.F., Monk, T.H., Berman, S.R., & Kupfer, D.J. The Pittsburgh Sleep Quality Index: A New Instrument for Psychiatric Practice and Research, 193-213, Copyright 1989, with permission from Elsevier Science.

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Appendix F**Budget Justification**Supplies

PHQ-9, PSQI, Initial Questionnaires, Flyers:

Online distributions for potential participants_____	\$0
Gift Card Incentive \$5 for 41 participants_____	\$205
Statistics Intellectus_____	\$100
<u>Total_____</u>	<u>\$305</u>

Appendix G

Table 1*Overall Frequencies and Percentages*

Variable	<i>n</i>	%
Dialysis Shift		
1	16	37.21
2	13	30.23
3	12	27.91
Missing	1	2.33
Race		
Prefer not to answer	1	2.33
White	25	58.14
Black	15	34.88
Missing	1	2.33
Age		
18-30	1	2.33
31-42	2	4.65
43-55	6	13.95
56-68	16	37.21
>69	16	37.21
Missing	1	2.33
Gender		
Female	19	44.19
Male	22	51.16
Missing	1	2.33
Length of time on HD		
Less than 1 year	4	9.30
1 to 5 years	36	83.72
Greater than 5 years	2	4.65
Missing	0	0.00

Appendix H

Table 2

Overall Average Scores of PHQ9 and PSQI

Variable	<i>M</i>	<i>SD</i>	<i>n</i>	<i>SE_M</i>	Min	Max	Skewness	Kurtosis
PHQ9	7.00	4.98	41	0.78	0.00	20.00	0.62	-0.30
PSQI	10.51	5.89	41	0.92	1.00	27.00	0.90	0.72

Note. '-' indicates the statistic is undefined due to constant data or an insufficient sample size.

Appendix I

Table 3*Frequencies and Percentages of 1st Shift*

Variable	<i>n</i>	%
Race		
Prefer not to answer	0	0.00
White	12	75.00
Black	4	25.00
Missing	0	0.00
Length of Time on HD		
Less than 1 years	2	12.50
1 to 5 years	14	87.50
Greater than 5 years	0	0.00
Missing	0	0.00
Age		
18-30	1	6.25
31-42	0	0.00
43-55	0	0.00
56-68	8	50.00
>69	7	43.75
Missing	0	0.00
Gender		
Female	7	43.75
Male	9	56.25
Missing	0	0.00

Note. Due to rounding errors, percentages may not equal 100%.

Appendix J

Table 4

Overall Average Scores of PHQ9 and PSQI for 1st Shift

Variable	<i>M</i>	<i>SD</i>	<i>n</i>	<i>SE_M</i>	Min	Max	Skewness	Kurtosis
PHQ9	4.25	2.52	16	0.63	0.00	9.00	0.15	-0.89
PSQI	8.31	3.96	16	0.99	2.00	15.00	0.18	-1.07

Note. '-' indicates the statistic is undefined due to constant data or an insufficient sample size.

Appendix K

Table 5*Frequencies and Percentages of 2nd Shift*

Variable	<i>n</i>	%
Race		
Prefer not to answer	1	7.69
White	6	46.15
Black	6	46.15
Missing	0	0.00
Length of Time on HD		
Less than 1 year	1	7.69
1 to 5 years	12	92.31
Greater than 5 years	0	0.00
Missing	0	0.00
Age		
18-30	0	0.00
31-42	1	7.69
43-55	3	23.08
56-68	4	30.77
>69	5	38.46
Missing	0	0.00
Gender		
Female	6	46.15
Male	7	53.85
Missing	0	0.00

Note. Due to rounding errors, percentages may not equal 100%.

Appendix L

Table 6

Overall Average Scores of PHQ9 and PSQI for 2nd Shift

Variable	<i>M</i>	<i>SD</i>	<i>n</i>	<i>SE_M</i>	Min	Max	Skewness	Kurtosis
PHQ9	6.08	3.80	13	1.05	0.00	13.00	0.01	-0.81
PSQI	9.54	4.37	13	1.21	3.00	18.00	0.61	-0.31

Note. '-' indicates the statistic is undefined due to constant data or an insufficient sample size.

Appendix M

Table 7

Frequencies and Percentages of 3rd Shift

Variable	<i>n</i>	%
Race		
Prefer not to answer	0	0.00
White	7	58.33
Black	5	41.67
Missing	0	0.00
Length of Time on HD		
Less than 1 year	1	8.33
1-5 years	9	75.00
Greater than 5 years	2	16.67
Missing	0	0.00
Age		
18-30	0	0.00
31-42	1	8.33
43-55	3	25.00
56-68	4	33.33
>69	4	33.33
Missing	0	0.00
Gender		
Female	6	50.00
Male	6	50.00
Missing	0	0.00

Note. Due to rounding errors, percentages may not equal 100%.

Appendix N

Table 8

Overall Average Scores of PHQ9 and PSQI for 3rd Shift

Variable	M	SD	n	SE_M	Min	Max	Skewness	Kurtosis
PHQ9	11.67	5.50	12	1.59	0.00	20.00	-0.73	0.03
PSQI	14.50	7.65	12	2.21	1.00	27.00	0.10	-0.67

Note. '-' indicates the statistic is undefined due to constant data or an insufficient sample size.

Appendix O**Table 9***Mean and SD of PHQ9 based on HD Shift*

Combination	<i>M</i>	<i>SD</i>	<i>n</i>
1	4.25	2.52	16
2	6.08	3.80	13
3	11.67	5.50	12

Note. A '-' indicates the sample size was too small for the statistic to be calculated.

Appendix P

Table 10

Mean and SD in PSQI among HD Shifts

Combination	<i>M</i>	<i>SD</i>	<i>n</i>
1	8.31	3.96	16
2	9.541	4.37	13
3	14.50	7.65	12

Note. A '-' indicates the sample size was too small for the statistic to be calculated.

Appendix Q

Table 11

Overall Correlation results between PHQ9 and PSQI

Combination	<i>r</i>	95.00% CI	<i>n</i>	<i>p</i>
PHQ9-PSQI	.64	[.41, .79]	41	< .001

Appendix R

Table 12*Linear Regression PHQ9 and Variables*

Variable	<i>B</i>	<i>SE</i>	95.00% CI	β	<i>t</i>	<i>p</i>
(Intercept)	12.34	5.42	[1.26, 23.42]	0.00	2.28	.030
RaceW	-1.24	4.58	[-10.60, 8.12]	-0.12	-0.27	.789
RaceB	-1.75	4.55	[-11.06, 7.56]	-0.17	-0.39	.703
Dialysis Shift 1	-2.41	1.66	[-5.81, 0.99]	-0.24	-1.45	.157
Dialysis Shift 3	5.94	1.70	[2.46, 9.41]	0.55	3.49	.002
Age 18-30	-6.55	5.58	[-17.97, 4.87]	-0.21	-1.17	.250
Age 43-55	-9.20	3.38	[-16.12, -2.29]	-0.66	-2.72	.011
Age 56-68	-5.29	3.22	[-11.88, 1.30]	-0.52	-1.64	.111
Age>69	-4.55	3.12	[-10.92, 1.83]	-0.45	-1.46	.156
GenderM	0.86	1.31	[-1.82, 3.55]	0.09	0.66	.516
how_long_been_on_hd1	2.00	2.42	[-2.94, 6.94]	0.12	0.83	.414
how_long_been_on_hd3	-1.05	3.25	[-7.71, 5.61]	-0.05	-0.32	.749

Note. Results: $F(11,29) = 3.28, p = .005, R^2 = .55$

Appendix S

Institutional Review Board Approval



Institutional Review Board

July 23, 2020

Protocol #: IRB-FY2020-145

Research Team:
Margaret Clark
Zorica Kauric-Klein

Based on applicable federal regulations, the following study, "The Effect of the Dialysis Shift on Depression and Sleep Disturbance in Patients on Chronic Hemodialysis" has been determined to be Exempt, with the following categories Category 2.(ii). Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording).

Any disclosure of the human subjects' responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, educational advancement, or reputation.

Letter and Consent Document(s):

This letter along with the IRB date stamped consent document can be found in Cayuse in the [Submission Details](#) page under [Letters](#) and [Attachments](#), respectively.

The IRB date stamped consent document must be downloaded and used in consenting participants.

Please note that Oakland University has mandated a temporary stoppage of all in-person human subjects research procedures.

Modifications:

Any changes to this exempt project must be reviewed by the IRB prior to initiation by submitting a MODIFICATION request. Do not collect data while the changes are being reviewed. Data collected during this time cannot be used in research.

Record Retention:

Exempt projects will be retained by the IRB office for three years after the last action on the project.

You are approved to start the research. Please retain a copy of this notification for your records.

If you have any questions, please contact the IRB office.

Thank you.

The Oakland University IRB