# Factors Contributing to Depression and Cognitive Impairment Among Patients on Hemodialysis

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## Abstract

Depression and cognitive impairment are the most common complications of patients on hemodialysis. The objective of this study is to identify contributing factors to depression and cognitive impairment in hemodialysis patients. This is a cross-sectional study involving 110 hemodialysis patients in Hospital Kuala Lumpur. The samples were recruited through universal sampling. Patients were assessed with Beck Depression Inventory and Montreal Cognitive Assessment. This study found that 18.2% patients had depression and 48.2% had cognitive impairment. Factors associated with depression were unmarried status, low education level and cognitive impairment. Factors associated with cognitive impairment were low education level, depression and unemployment.

Keywords: hemodialysis, depression, cognitive, ESRD


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## 1.0 Introduction

Chronic Kidney Disease (CKD) including end stage renal disease (ESRD) has become a worldwide pandemic. This disease is one of the leading causes of hospitalization and death in the world (Goh, Ong, and Lim 2014, Grams, M. E. et. al. 2018, Kim, KM et. al. 2019) and occurs when the kidney has been damaged or loses its ability to excrete waste from the body. According to the Malaysian National Clinical Practice Guidelines, ESRD occurs when the kidney no longer functions for 3 months or more (Goh, Ong, and Lim 2014, Agarval, R 2016). Hemodialysis is a type of renal replacement therapy. It helps the patient with ESRD to live longer but it does not cure the disease.

The prevalence of CKD has been increasing over the years with the global all-age prevalence of CKD increased to 29·3% since the 1990 to 2017 (Chronic Kidney Disease Collaboration 2020). It was estimated that the prevalence of CKD was16.8% in America, and between 12.1% to 17.5% in Asian countries (Ibrahim, Norhayati et al 2016). According to the 21st Report of The Malaysian Dialysis & Transplant Registry, the number of new dialysis patients has increased linearly over the past decade (Goh, Ong, and Lim 2014). Most of this is due to the increasing incidence of Diabetic Kidney Disease. This steep increase has affected people as well as the healthcare system of Malaysia (Goh, Ong, and Lim 2014).

Patients with CKD do experience depression and dialysis patients with depression have a lower quality of life, more functional impairments, greater occurrence of comorbid conditions and psychopathologic states, lower adherence to drug treatment, and an increased likelihood of long term body pain (Cukor et al. 2009; Hedayati et al. 2006; Kutner et al. 2007, Rebollo Rubio, A et al. 2017, Al-Rabadi, Katibh et al. 2019). Prevalence of depression among hemodialysis patients in western countries ranges from 19% to 47% as measured by the Beck Depression Inventory (BDI) (Smith, Hong, and Robson 1985; Watnick et al. 2003). Moreover, in Malaysia depression among dialysis patients ranges from 19.8% (Othman et al. 2014), 21.1% (Ibrahim et al. 2013) and 36.3% (Bujang et al. 2015). The prevalence of depressed patient increased proportionally with the CKD stages. (Ibrahim, Norhayati et al 2016)

Studies over the past decades have identified important risk factors that are associated with depression in ESRD dialysis patients. These include having a history of depression and anxiety, female gender, less than 24 months of dialysis, younger age, living alone and unemployment (Craven, Rodin, and Littlefield 1988; Drayer et al. 2006, Caleb Weihao Huang et al. 2021). Malaysian data have also suggested low diastolic blood pressure, positive history of ischemic heart disease and stroke as risk factors of depression in ESRD patients (Othman et al. 2014).

Cognitive impairment in the dialysis population has also been found to be prevalent ranging from 30% to 60% (Murray 2008; Sehgal, O'Rourke, and Snyder 1997). Research on ESRD patients and cognitive impairment found few risks factors. Being elderly is a risk factor, and having uremia worsens cognitive function (Chikotas, Gunderman, and Oman 2006; Meyer and Hostetter 2007; Raff, Meyer, and Hostetter 2008; Vanholder et al. 2008 Wang, Mengjing et al 2021) Additionally, uremic states also reduce concentration, worsen

memory and intellectual functioning (Bae and Park 2008; Pliskin et al. 1996). Another very common condition in patients going through dialysis is anemia. It reduces oxygen and thus increases the chance of cerebrovascular diseases which could lead to the worsening of cognitive impairment (Bae and Park 2008). Furthermore, ESRD patients are commonly diagnosed with hypertension and diabetes, which may impair cognitive function and lead to vascular dementia (Saczynski et al. 2008; Pépin, M., & Villain, C. 2020).

Better understanding the nature of depression and cognitive impairment can contribute to preventing its common occurrences. These steps would not only improve health benefits, but would also help in reducing the total human, economic, and social burden to the medical field and caregivers. This study aims to investigate the relationship between and the factors associated with depression and cognitive impairment in hemodialysis patients.

## 2.0 Literature Review

### 2.1 Dialysis and Depression

Many studies have found that neuropsychiatric conditions including depression, anxiety disorders, and cognitive impairment are prevalent in patients with CKD. Patients with CKD, especially in those at ESRD, do experience depression. According World Health Organisation (WHO), "depression is a common mental disorder, characterized by sadness, loss of interest or pleasure, feelings of guilt or low self-worth, disturbed sleep or appetite, feelings of tiredness and poor concentration" (WHO, 2018). Dialysis patients with depression have a lower quality of life, more functional impairments, greater occurrence of comorbid conditions and psychopathologic states, lower adherence to drug treatment, an increased likelihood of long term body pain, and at the end, higher mortality (Cukor et al., 2009; Hedayati et al., 2006; Kutner et al., 2007; Simoes e Silva et al., 2019; Khan et al., 2019). Prevalence of depression among hemodialysis patients in western countries ranges from 19% to 47% as evaluated using a screening questionnaire or by a clinical interview (Smith, Hong, and Robson, 1985; Watnick et al., 2003; Palmer et al., 2013). Moreover, in Malaysia depression among dialysis patients ranges from 19.8% (Othman et al., 2014), 21.1% (Ibrahim et al., 2013), 36.3% (Bujang et al., 2015) and even reach 84.9% in a prospective follow-up study (Khan et al., 2019).

Patients with CKD themselves, prone to have depression due to combination of behavioural and biological mechanisms that are unique for individuals with CKD. Potential behavioural mechanisms include burdens of illness and restrictions, lack of social support, adverse health behaviours, and poor qualiy of life. Potential biological mechanisms include illness comorbidities, inflammation, altered autonomic activity, and hormonal abnormalities such as high level of cortisol (Shirazian et al., 2017; Shirazian, 2019).

Studies over the past decades have identified important risk factors that are associated with depression in ESRD dialysis patients. These include having a history of depression, female gender, less than 24 months of dialysis, younger age, marital status, ethnicity, unemployment, quality of life, acceptance of the illness, and anxiety (Craven, Rodin, and

Littlefield, 1988; Drayer et al., 2006, Marthoenis et al., 2020). Malaysian data have also suggested low diastolic blood pressure, positive history of ischemic heart disease and stroke as risk factors of depression in ESRD patients (Othman et al., 2014).
In view of all these evidences, depression has been a prevalent occurrence among hemodialysis patients. It warrants an immediate understanding of its contributing factors. In particular, presence and absence of social support need to be identified as it could be key to prevention and intervention plans for management of depression in dialysis patients (Ratti et al., 2017).

### 2.2 Dialysis and Cognitive Impairement

Cognitive impairment in the dialysis population has also been found to be prevalent ranging from 30% to 60% (Murray, 2008; Sehgal, O'Rourke, and Snyder, 1997; Simoes e Silva et al., 2019). Memory and language were the most severe impaired domains in the mild cognitive impairment group, attention and visuospatial function domains were the most serious impaired domains in the major cognitive impairment group (Luo et al., 2020). Research on ESRD patients and cognitive impairment found few risks factors. Being elderly is a risk factor, and dialysis patients also undergo hypoxemia, large fluid and osmolar shifts, fluctuating uremic toxin titers, and a proinflammatory state. All these factors can potentially affect cognitive function (Chikotas, Gunderman, & Oman, 2006; Meyer & Hostetter, 2007; Raff, Meyer, & Hostetter, 2008; Vanholder et al., 2008; Simoes e Silva et al., 2019).

An evolving concept of brain-renal axis has shown that due to the vascular and hemodynamic similarities between the brain and the kidneys, it is reasonable to hypothesize that the microvascular damage in the kidneys mirrors that in the brain. CKD has been recognized as a risk factor for stroke, vascular dementia, and other subclinical cerebrovascular diseases. Reduced kidney function has also been independently associated with worse microstrucrural integrity of brain white matter (Sedaghat et al., 2015). Finally, nonvascular risk factors such as polypharmacy, sleep disorders, and depression may represent an additional link between CKD and cognitive decline. A recent study indicated that for every 10ml decrease in the estimated GFR below 60 ml/min/1.73m2, there is an 11% increase in the risk of cognitive impairment (Tian et al., 2019; Simoes e Silva et al., 2019).

Better understanding the nature of depression and cognitive impairment can contribute to preventing its common occurrences among CKD patients. These steps would not only prevent poor quality of life, but would also improve health benefits and help in reducing the total human, economic, and social burden to the medical field and caregivers. This study aims to investigate the relationship between and the factors associated with depression and cognitive impairment in hemodialysis patients.

## 3.0 Methodology

### 3.1 Sampling

This is a cross-sectional, convenient sampling study. Convenient sampling was used in view of limited number of hemodialysis patients available at the hemodialysis unit that consented to join the study. The study was conducted from 28th July 2015 until 31st October 2015. Sample size was calculated based on prevalence of depression among hemodialysis patients estimated to be 8% (Ibrahim, N., Desa, A., & Kong, N. (2011)). The calculated sample size with confidence interval at 95% and absolute precision at 5% was 124. Sample was only taken in Hospital Kuala Lumpur as it was national referral center.

### 3.2 Inclusion Criteria

Those who met the inclusion criteria were screened and signed the informed consent. The inclusion criteria included: patients aged 18 to 70 years old, those who have been undergoing hemodialysis for a minimum of 3 months before study began, patients who have given informed consent and patients who are able to answer the questionnaire independently or with assistance. Exclusion criteria included previously diagnosed with dementia or delirium, patients with profound or severe mental retardation, those who refused to give consent, patients who are unable to communicate in English or Malay, onset of any new major medical illnesses diagnosed in the last 2 weeks of recruitment which required admission to the hospital, i.e., stroke, heart disease, pneumonia etc.

### 3.3 Questionnaires

Socio-demographic data included age, sex, marital status, smoking status, number of children, employment, education level, caretaker type, year of ESRD diagnosis, months on hemodialysis, cause of end stage renal failure. We used the validated Malay version of the Beck Depression Inventory (BDI). The recommended optimal cut-off score for BDI in patients undergoing dialysis is 16 or more with specificity a of 87.1% and sensitivity of 88.9% (Chilcot, Wellsted, and Farrington 2008). Hence, the suggested cut-off points according to Chilcot, Wellsted, and Farrington (2008) are: normal: 0-9, mild depression: 10-15, moderate depression: 16-23, severe depression: >24. The validated Malay version of Montreal Cognitive Assessment (MOCA-BM) was used to assess cognitive impairment. Furthermore, 1 point was added to the total MOCA score if the patients had 12 or fewer years of formal education. In our study, the cut-off point of 24 or lower indicated cognitive impairment in patients undergoing dialysis (Tiffin-Richards et al., 2014).

### 3.4 Analysis

The socio-demographic data, severity of depression, prevalence of depression and prevalence of cognitive impairment were analyzed using descriptive statistics. Chi-square test was used to measure the association between these characteristics and having depression and cognitive impairment.

## 4.0 Results

### 4.1 Socio-demograpic variables

From total of 124 patients, only 110 patients were recruited in the study due to exclusion criteria such as no consent given, age more than 70 years old, deaths before questionnaire were filled up and medical illnesses that warrants ward admission. The response rate was 89%.

Table 1. Socio-Demograpic Variables

| Characteristics | N (%) | Median (IQR) | Mean (SD) |
|---|---|---|---|
| Age | | | 48 (13) |
| Age | | | |
| 19-29 | 13 (11.8) | | |
| 30-39 | 17 (15.5) | | |
| 40-49 | 24 (21.8) | | |
| 50-59 | 31 (28.2) | | |
| 60-69 | 25 (22.7) | | |
| Gender | | | |
| Male | 65 (59.1) | | |
| Female | 45 (40.9) | | |
| Race | | | |
| Malay | 46 (41.8) | | |
| Chinese | 45 (40.9) | | |
| Indian | 15 (13.6) | | |
| Other | 4 (3.6) | | |
| | | | |
| Smoking status | 13 (11.8) | | |
| Smoker | 95 (86.4) | | |
| Non-smoker | | | |
| Education | | | |
| Low: Primary level | 34 (31.2) | | |
| High: Secondary level and more | 75 (68.8) | | |
| Marital status | | | |
| Ever married | 68 (61.8) | | |
| Never married | 42 (38.2) | | |
| Employment | | | |
| Unemployed | 70 (63.6) | | |
| Pensioner | 5 (4.5) | | |
| Professional | 29 (26.4) | | |
| Teacher | 3 (2.7) | | |
| Driver | 3 (2.7) | | |
| Carers | | | |
| Alone | 15 (13.8) | | |
| Family | 91 (83.5) | | |
| Welfare | 3 (2.8) | | |
| Cause of renal failure | | | |
| Unknown | 43 (39.4) | | |
| Hypertension | 35 (32.1) | | |
| IgA Nephropathy | 4 (3.7) | | |
| Polycystic Kidney Disease | 3 (2.8) | | |
| Nephrotic Syndrome | 7 (6.4) | | |

| | |
|---|---|
| Renal Tubular Acidosis | 1 (0.9) |
| MGN-mononephritis syndrome | 1 (0.9) |
| SLE nephropathy | |
| Gout | 3 (2.8) |
| Diabetes Mellitus | 1 (0.9) |
| Trauma | 8 (7.3) |
| Renal Stone | 2 (1.8) |
| | 1 (0.9) |

From Table 1, it could be seen that there was a total of 110 patients, from which more than half (59.1%) are males and less than half (45%) are females. The mean (SD) age of patients is 48 (13) years old. Malays and Chinese have an almost similar percentage of 41.8% and 40.9% respectively followed by a smaller group of Indians (13.6%) and Others (3.6%). Most of the patients are non-smokers at the time of interview (86.4%) while smokers among the patients is 11.8%. Most of the patients received education at secondary level or more (68.8%) compared to a smaller group of patients who received education up to primary level or less (31.2%). More than half (61.8%) of the patients have ever been married and 38.2% are those who were never married. Majority of patients are unemployed (63.6%) and a large majority (83.5%) of patients stays with their family as their carers. Median number of children among ever-married patients is 1 child. Most common cause of renal failure is unknown (39.4%), followed by Hypertension (32.1%).

### 4.2 Depression and cognitive impairments

In Table 2 based on cut - off BDI score of ≥16 is considered as clinical depression (Chilcot, Wellsted, and Farrington, 2008). Hence, the prevalence of depression among hemodialysis patients in Hospital Kuala Lumpur is 18.2%.

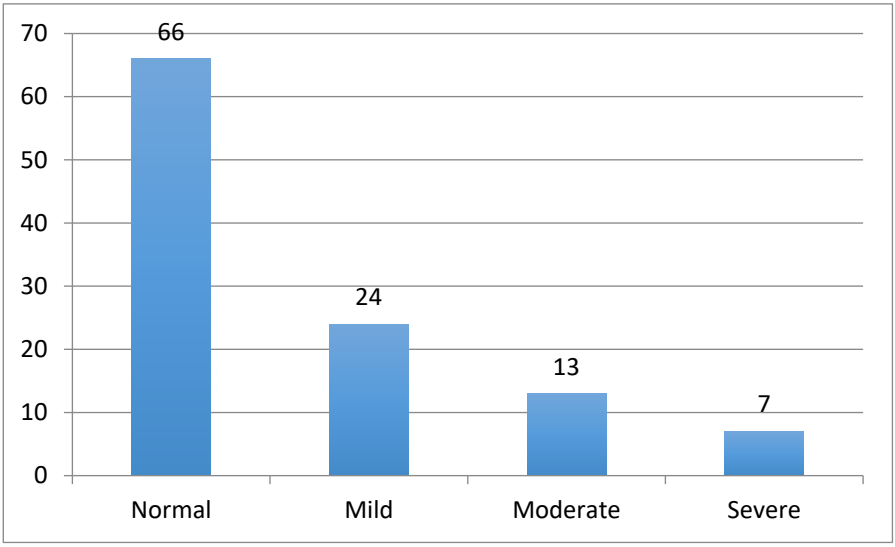
Table 2. Prevalence Of Depression And Cognitive Impairment

| | N | % |
|---|---|---|
| Depression | 20 | 18.2 |
| No Depression | 90 | 81.8 |
| | | |
| Cognitive Impairment | 53 | 48.2 |
| No Cognitive Impairment | 57 | 51.8 |

### 4.3 Severity of Depression

In Figure 1, based on BDI, it was found that 66 patients (60%) have no depressive symptoms (score= 0-10), 24 patients (21.8%) have mild depression (score=10-15), 13 patients (11.8%) have moderate depression (score=16-23) and 7 patients (6.4%) have severe depression (score= 24-63). Based on cut-off score from Tiffin-Richards et al. (2014), MOCA scores of 24 or less are considered to be cognitively impaired. 53 patients (48.2%) have cognitive impairment while 57 (51.8%) has no cognitive impairment.

Figure 1. Severity of Depression with Beck Depression Inventory




### 4.4 Factors associated with Depression

Table 3 shows the univariate analysis of factors associated with depression in hemodialysis patients. For patients who were unmarried, there was significant association with depression. Whereby they have almost 4-times the risk of getting depression compared to those who are ever married (OR=3.90, CI=1.41-10.83, P value = 0.01). Moreover patients who received education up to primary level or less were 3 times more likely to developed depression while on hemodialysis (OR=3.06, CI=1.11, 8.43, P value=0.03). Furthermore, patients with cognitive impairment have twice the risk of having depression compared to those with no cognitive impairment (OR 2.32, CI=0.85, 6.36, P value=0.096).

Table 3. Factors associated with Depression

| Items | Depression n (%) | | $X^2$ | p value | OR | 95% CI |
|---|---|---|---|---|---|---|
| | Yes | No | | | | |
| Gender | | | | | | |
| Male | 10(15.4%) | 55 (84.6%) | 0.84 | 0.36[a] | 0.64 | 0.24, 1.68 |
| Female | 10 (22.2%) | 35 (77.8%) | | | | |
| Age group (years) | | | | | | |
| Less than 50 | 9 (16.7%) | 45 (83.3%) | 0.43 | 0.84[a] | 0.9 | 0.33, 2.42 |
| More than 50 | 10 (18.2%) | 45 (81.8%) | | | | |
| Race | | | | | | |
| Malay | 6 (13.0%) | 40 (87%) | 1.66 | 0.44[a] | | |
| Chinese | 9 (20.0%) | 36 (80%) | | | | |
| Indian | 4 (26.7%) | 11 (73.3%) | | | | |
| Marital Status | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Unmarried | 13 (31%) | 29 (69%) | 7.45 | 0.01[a] | 3.90 | 1.41, 10.83 |
| Ever married | 7 (10.3%) | 61 (89.7%) | | | | |
| Employment | | | | | | |
| Unemployed | 14 (20%) | 56 (80%) | 0.43 | 0.51[a] | 1.41 | 0.49, 4.03 |
| Employed | 6 (15%) | 34 (85%) | | | | |
| Education | | | | | | |
| Up to Primary | 10 (29.4%) | 24 (70.6%) | 4.93 | 0.03[a] | 3.06 | 1.11, 8.43 |
| Secondary and above | 9 (12%) | 66 (88%) | | | | |
| Carer | | | | | | |
| Non-family | 5 (27.8%) | 13 (72.7%) | 1.60 | 0.30[b] | 2.12 | 0.65, 6.88 |
| Family | 14 (15.4%) | 77 (84.6%) | | | | |
| Cognition | | | | | | |
| Cognitive impairment | 13 (24.5%) | 40 (75.5%) | 2.77 | 0.096[a] | 2.32 | 0.85, 6.36 |
| No cognitive impairment | 7 (12.3%) | 50 (87.7%) | | | | |

*a= Pearson Chi Square Test, p<0.05*
*b= Fisher's exact test, p<0.05*

### 4.3 Factors associated with cognitive impairment

Table 4 shows the univariate analysis of factors associated with cognitive impairment in hemodialysis patients. For patients who were unemployed, 41 (58.6%) were found to be cognitively impaired compared to only 12 (30%) in those who are employed who are cognitively impaired. There is a significant association between patients who are unemployed with cognitive impairment. Whereby they have almost 3-times the risk of having cognitive impairment compared to those who are employed (OR=3.30, CI=1.44-7.54, P value<0.01). Moreover patients who only attended school up to primary level or less, 27 (79.4%) were found to have cognitive impairment compared to 25 (33.3%) in those who attended school up to secondary level or more. This association was significant, whereby those who attended school up to primary level or less, were almost 8 times more likely to developed cognitive impairment while on hemodialysis (OR=7.71, CI=2.95-20.15, P value=0.096). Depression patients had twice the risk of getting cognitive impairment in hemodialysis patients (OR=2.32; CI=0.85-6.36; p value=0.096).

Table 4. Factors associated with Cognitive Impairment

| Items | Cognitive Impairment n (%) | | $X^2$ | p value | OR | 95% CI |
|---|---|---|---|---|---|---|
| | Yes | No | | | | |
| Gender | | | | | | |
| Male | 30 (46.2%) | 35 (53.8%) | 0.26 | 0.61[a] | 0.82 | 0.38, |
| Female | 23 (51.1%) | 22 (48.9%) | | | | 1.76 |
| Age group (years) | | | | | | |
| Less than 50 | | | | | | |
| More than 50 | 24 (44.4%) | 30 (55.6%) | 0.46 | 0.57[b] | 0.78 | 0.36, |
| | 28 (50.9%) | 27 (49.1%) | | | | 1.64 |
| Race | | | | | | |
| Malay | 19 (41.3%) | 27 (58.7%) | 1.51 | 0.47[a] | | |
| Chinese | 24 (53.3%) | 21 (46.7%) | | | | |
| Indian | 8 (53.3%) | 7 (46.7%) | | | | |
| Marital Status | | | | | | |
| Never married | 19 (45.2%) | 23 (54.8%) | 0.24 | 0.63[a] | 0.83 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Ever married | 34 (50%) | 34 (50%) | | | | 0.38, 1.79 |
| Employment | | | | | | |
| Unemployed | 41 (58.6%) | 29 (41.4%) | 8.32 | <0.01[a] | 3.30 | 1.44, |
| Employed | 12 (30%) | 28 (70%) | | | | 7.54 |
| Education | 27 (79.4%) | 7 (20.6%) | 19.91 | <0.01[a] | 7.71 | 2.95, |
| Low | 25 (33.3%) | 50 (66.7%) | | | | 20.15 |
| High | | | | | | |
| Smoking Status | | | | | | |
| Nonsmoker | 44 (46.3%) | 51 (53.7%) | 2.4 | 0.12[a] | 0.38 | 0.11, |
| Smoker | 9 (69.2%) | 4 (30.8%) | | | | 1.33 |
| Carer | | | | | | |
| Non-family | 11 (61.1%) | 7 (38.9%) | 1.55 | 0.21[a] | 1.91 | 0.68, |
| Family | 41 (45.1%) | 50 (54.9%) | | | | 5.39 |
| BDI | | | | | | |
| Depressed | 13 (65%) | 7 (35%) | 2.77 | 0.096a | 2.32 | 0.85, |
| Not depressed | 40 (44.4%) | 50 (55.6%) | | | | 6.36 |

*a= Pearson Chi Square, p<0.05*

## 5.0 Discussion

### 5.1 Hemodialysis and Depression

Depression is the most common psychiatric illness in patients with end-stage renal disease (ESRD). Patients receiving dialysis had impairment in social, occupational, and recreational activities resulted in significant reduction in quality of life (QoL). Depression may result in adverse clinical outcomes by affecting compliance with dialysis and medication regimes, alteration of immune system function, predisposed to cardiovascular complications and worsening of nutritional status that contributed to high mortality rate (Ma and Li, 2016). Depression with frailty which is highly prevalent in elderly patients receiving dialysis also caused a high mortality (Sy et al. 2019). The association between depression and mortality risk of dialysis population has been extensively studied. A large scale study and meta-analysis found a significant association between depression and mortality rate in dialysis patients. Those who failed to show a significant association are generally small with various limitations in methodologies (Ma and Li, 2016). In this study, the prevalence of depression in hemodialysis patients was 18.2% using the BDI (cut-off point of 16). Based on BDI scores, 66 patients (60%) have no depressive symptoms (score=0-10), 24 patients 24 patients (21.8%) have mild depression (score=10-15), 13 patients (11.8%) have moderate depression (score=16-23) and 7 patients (6.4%) have severe depression (score=24-63). Ma and Li_(2016) quoted from various studies and meta-analysis concluded that the prevalence of depression in dialysis population is ranging from 22.8 to 39.3 % depending on the diagnostic criteria, assessment tool and population characteristic. Thus, the prevalence of depression found in our study is lower than the world-wide range; and only a small percentages (6.4%) of them have severe depression. Unfortunately we don't have a recent (less than 5 years) local data to compare.

This study found a significant association between patients who are unmarried and those with primary level of education or lower. The odds of having depression in unmarried

patients when compared to the ever married group of patients was 3.9 times higher (OR=3.90, CI=1.41-10.83, P value=0.01). This attributed to good social support received in married patients and may explained that marriage is protective against depression. Spousal social support was a buffer against the patient's level of depression. We found those with a high education level were less likely to develop depression as compared to low level; Those with a low education level had 3 times the risk of developing depression (OR=3.06, CI=1.11-8.43, P value=0.03). People in low socioeconomic group tend to have low education level and monthly incomes. With the current high cost of living, especially in the urban areas; financially they are struggling to cope with their daily life which may precipitate for depression.

A higher rate of depression (41%) was found in a study of hemodialysis and peritoneal dialysis patients in Australia (Kwan et al. 2019). The risk factors for depression after adjustment for sociodemographic factors are prescribing more than 10 medications, having more than 3 admission in the last 12 months and past history of depression. Kokoszka et al. (2016) detected a much high rate of depression (78.5%) in dialysis patients; Major Depressive Disorder (MDD) (29%), Dysthymia (28%) and Depression with Melancholia (21.5%). There was a significant differences in acceptance of illness between diagnostic subgroup; where the highest acceptance was those with no disorders, followed by MDD, Dysthymia, and the worst was Depression with Melancholia. The authors then concluded that low mood in depressed patients undergoing hemodialysis is related to an increased in maladaptive attitudes towards Chronic Kidney Diseases (CKD).

Anxiety is another common symptoms associated with depression in dialysis patients which has not been assessed in this study. The common cause of anxiety are exposure to invasive procedure accompany dialysis such as insertion of needle to arterio-venous fistula, inserted of central venous catheter and unpredictable attitudes of the medical staff at the the dialysis centre (Dzuibeka et al. 2016). Schouten et al. (2019) found that anxiety symptoms alone or in association with depression are a clinically relevant risk factors for morbidity and mortality in dialysis patients. Anxiety symptoms are independently associated with increased risk for mortality within 1 year of hospitalisation. Non-adherence to different aspect of ESRD is also closely linked to depression and anxiety (Alosaimi et al. 2016). High prevalence of depression and anxiety was found in other studies. In Brazil, Britol et al (2019) found that depression and anxiety symptoms were detected in 41.7% and 32.3% of dialysis patients respectively, The prevalence of depression and anxiety among hemodialysis patient in Iran was 31.5% and 41.7% respectively. There are no significant correlation between depression and anxiety in this group of patients (Najafi et al. 2016). At the initiation of renal replacement therapy, state of anxiety and depression were detected in 26.6% and 27% of ESRD patients respectively (Rubio et al. 2017). These states are significantly related to the emotional component of the QoL. Meanwhile, Gerogianni et al. (2019) demonstrated a significant association between the level of anxiety and depression among patients and caregivers; and stressed the important of individualized assessment of dialysis patients and their caregivers A previous study by Periera et al. (2017) attributed

this problem to the disturbance of the caregivers daily life such as restricted physical activities, strained relationship and frustration with the situation.

Since depressive disorders are prevalent in dialysis patients with CKD, Kokoszka et al. (2016) recommended for routine screening of depression in dialysis patients. According to Ma and Li (2016), currently the three most commonly used validated questionnaires in this regard are Beck Depression Inventory (BDI), Patient Health Questionnaire (PHQ-9) and Center for Epidemiologic Studies Depression Scale (CESDS). Our study used the Malay version of Beck Inventory (BDI), which is one the three commonly used screening tools in this regards. Since anxiety disorder is also highly prevalent in patients with ESRD, most of studies tend to incorporate diagnostic tools which measured anxiety symptoms such as Hospital Anxiety Depression Scale (HADS) and Patients Health Questionnaires Anxiety and Depression Scale (PHQ-HDS). In a validated study, Chilcot et al. (2018) concluded that PHQ-HDS appears to have good structural validity in hemodialysis patients to measure a total distress scale, a complete assessment of depression and anxiety.

Worldwide, the number of ESRD patients is growing rapidly in developed and developing countries, contributed by aging populations and a pandemic of chronic noncommunicable diseases especially diabetes mellitus and hypertension. Malaysia also followed the same trend, the growth of ESRD patient continued at an alarming rate since the last 20 years (Bujang et al. 2017). Thus, we like to stress the importance of having a standard screening tool for depression and anxiety for ESRD patients in Malaysia. The tools should be locally validated and applicable to Malaysian multi-racial society with various socioeconomic background.

**5.2 Hemodialysis and cognitive Impairment**

On the other hand, this study found that patients who are cognitively impaired have twice the risk of developing depression (OR=2.32; CI=0.85-6.36; P value=0.096). Those with MOCA score of less than 24 reported more depressive symptoms compared to those with no cognitive impairment. Those on hemodialysis carry vascular risk factors putting them at risk of white matter lesions and, in the state of uremia, can lead to cognitive impairment and depression. Cognitive impairment has been found to lower Quality of Life (QoL) in hemodialysis patients, which may be one of the causes of depression (Jung et al. 2013). It is estimated that about 30% to 70% of ESRD patients on maintenance hemodialysis are cognitively impaired (Bugnicourt, Godefroy, Chillon, Choukroun, & Massy, 2013; Griva et al., 2010; Kurella, Chertow, Luan, & Yaffe, 2004; Murray et al., 2006; Sehgal et al., 1997). In this study the prevalence of cognitive impairment was found to be 48% when assessed with MOCA (Table 2).

This study showed those with education level up to primary level or less had nearly 8 times the risk of developing cognitive impairment compared to those patients with education up to secondary level or more (OR=7.71, CI=2.95-20.15, P value=0.096). On top of vascular changes in the brain leading to cerebrovascular disease in CKD patients, other factors that increase the risk of cognitive impairment in CKD include education level, depression and psychiatric diseases (Drew et al. 2015). Participants in this study have

lower education background hence it may have affected their understanding of the importance of healthy lifestyle. It includes prevention of more vascular insults to the brain structure. A study in China found that mild cognitive impairment has higher risk of turning into major cognitive impairment in patients on hemodialysis (Pei et al., 2018).

Form Table 4, about 65% of depressed patients in the study had cognitive impairment and they had twice the risk of developing cognitive impairment (OR=2.32; CI=0.85-6.36; P value=0.096). Cognitive impairment and dementia is prevalent in dialysis patients (Agganis et al., 2010; Dong et al., 2016; Kalirao et al., 2011; Murray, 2008). Depression in dialysis patients is comparable to those with late-life depression because the effect is more prominent on executive function, and becomes a risk factor for cognitive impairment (Agganis et al. 2010). Even mild depression mild depression is closely associated with global and specific cognitive impairment in dialysis patients (Dong et al.,2016). Since depression can be treated, it becomes a modifiable risk factor for patients on dialysis in preventing or halting further progression of cognitive impairment. Depression if screened early and consistently on top of screening for cognitive impairment may help to reduce the risk of cognitive impairment.

## 6.0 Conclusion & Recommendation

This study contributes to the understanding of the contributing factors of depression and cognitive function among patients on hemodialysis. Further research in a local setting is needed to head towards the direction of understanding the reciprocal relationship between depression and cognitive impairment in hemodialysis patients. It is important to understand that depression and cognitive impairment are two complicated issues in hemodialysis patients. Both conditions are under diagnosed and undertreated. These two conditions, independently, lead to many other complications in patients on maintenance hemodialysis.

Nephrologists who are treating this group of patients should conduct routine and periodic screening for depression and cognitive function, and subsequently refer the suspected patients with co-morbid depression or cognitive impairment to appropriate mental health professionals, such as psychiatrists, geriatricians or neurologists for further management. It is important to have a multi-disciplinary approach towards managing patients with chronic illness such as those on hemodialysis.

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## Paper Contribution to Related Field of Study

This paper finding contributes to the care and wellbeing of patients on hemodialysis.

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