Cognitive Function and Adherence of Older Adults Undergoing Hemodialysis

CNE Continuing Nursing Education

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As the number of older adults undergoing hemodialysis increases, it is important for nurses to consider cognitive impairment as a contributing factor to non-adherence. The purpose of this exploratory study was to identify cognitive markers that nurses can use to alert them to potential problems with adherence among older adults undergoing hemodialysis. Stories of the health challenge of making lifestyle change were analyzed with a linguistic analysis software program. A standardized instrument (3MS) that measures global cognitive function was administered. Determination of adherence level was the last activity of data collection. In this sample (n = 63), 39.7% of the participants had evidence of cognitive impairment (3MS score less than 80); 58.2% of the 39.7 % had evidence of non-adherence. There was a significant relationship between word use and cognitive function (p < .01). Cognitive impairment is prevalent among older adults undergoing hemodialysis and words might be a proxy for recognizing this.

Goal

To describe a study on the cognitive function and adherence to treatment plans by older patients on hemodialysis.

Objectives

1. Describe a study done to determine concerns with adherence in older persons on hemodialysis.
2. Identify cognitive markers that alert to potential problems of adherence in older patients on hemodialysis.
3. Summarize a study on cognitive function and adherence in older patients on hemodialysis.

Over the next four decades, a demographic tidal wave is expected to overwhelm an already burdened health care system. The initial shock will occur as the oldest baby boomers begin to retire (Administration on Aging [AOA], 2006). By 2030, individuals 65 years and older are expected to account for approximately 20% of the U.S. population (71 million) (Centers for Disease Control, 2007). As this demographic shift emerges, there will be a predicted increase in the occurrence of age-related diseases and disabilities (Bonnie & Wallace, 2003; Szczech & Lazar, 2004). Coresh, Astor, Greene, Eknoyan, and Levey (2003), using data from the National Health and Nutrition Examination (NHANES III), concluded that there are approximately 8 million individuals with chronic kidney disease (CKD) who have an estimated glomerular filtration rate (eGFR) less than 60 ml/min/1.73 m^2. Ultimately, this may lead to end stage renal disease (ESRD) in which renal replacement therapy (RRT) will be required. The number of older adults undergoing hemodialysis is expected to increase (Kurella, Covinsky, Collins, & Chertow, 2007). As this change occurs, there may be a need to identify adherence challenges in older adults.

The purpose of this article is to discuss research that identifies potential cognitive markers that may alert practicing nephrology nurses to adherence challenges in older adults undergoing hemodialysis.

Introduction

The incidence of ESRD among individuals less than 65 years old is leveling off, but the number of older adults (over 65 years old) diagnosed with ESRD continues to rise (Collins et al., 2005). Individuals 75 years and older constitute 16% of the prevalent dialysis population. Between 1994 and 2004, the number of individuals diagnosed with ESRD increased by 43%; however the growth of older adults starting RRT exceeded 80% (United States Renal Data System [USRDS], 2006). Nephrology nurses face many challenges as they strive to achieve optimal health outcomes for this population. Although health care professionals, including nurses, use established practice guidelines to support this goal, it is also essential that individuals adhere to the prescribed behavioral regimens.

Depending on what adherence markers are used, approximately 50% of individuals undergoing hemodialysis do not adhere to the prescribed

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behavioral regimen (Kutner, 2001). There are many factors that influence adherence (Morgan, 2000) such as psychological factors, personal beliefs, and the need to exert some control over life direction (Christensen & Ehlers, 2002; Kutner, 2001); but these do not adequately explain nonadherence to the prescribed behavioral regimens. There are no gold standards that define the best way to assess nonadherence to the prescribed behavioral regimens, but phosphorus and fluid weight gain are often used as adherence markers (Kaveh & Kimmel, 2001; Saran et al., 2003) and more importantly there are no adherence markers that are specific to older adults undergoing hemodialysis.

Some adherence markers used for the hemodialysis population are: (a) skipping one or more dialysis sessions or shortening dialysis treatment by at least 10 minutes; (b) dietary behaviors as indicated by biochemical markers such as predialysis phosphorus and potassium and interdialytic weight gain (IWG) greater than 5.7% of estimated dry weight (EDW) (Hailey & Moss, 2000; Kimmel, 2001; Leggat et al., 1998; Leggat, 2005; Saran et al., 2003); and (c) adherence to medication guidelines (Curtain, Svarstad, Andress, Keller, & Sacksteder, 1997; Leggat, 2005; Moran, Christensen, & Lawton, 1997).Various disciplines such as nursing and behavioral medicine have investigated possible explanations for non-adherence in individuals undergoing hemodialysis, but adherence has not been readily linked to cognitive function in published manuscripts. One study (n = 147, mean age = 54.4 years) examined the relationship between fluid adherence and cognitive function in patients undergoing hemodialysis. The findings support no difference in mean levels of cognitive performance between those who were adherent and those who were not (Evans, Wagner, & Welch, 2004). The authors suggest that non-significant findings may be the result of limited sensitivity of the tool (Cognistat) used to measure cognitive function or inadequate sample size to detect a difference. Despite study limitations, this study poses an important topic for further study in an ever-growing population of older adults.

The prevalence of cognitive impairment in the hemodialysis population remains underestimated (Kurella, Chertow, Luan, & Yaffe, 2004), probably because early manifestations are not obvious and thus not recognized by health care providers, including nurses. Recent research suggests that some people with kidney disease have cognitive impairment and those with ESRD are more likely to be cognitively impaired than those in the earlier stages of kidney disease (Kurella et al., 2004). Older adults undergoing hemodialysis have several risk factors for vascular dementia such as older age, hypertension, and diabetes (Brouns & DeDeyn, 2004; Fukunishi et al., 2002; Kurella et al., 2004; Lass, Buscombe, Harber, Davenport, & Hilson, 1999; Murray et. al., 2006; Pereira, Weiner, Scott, & Sarnak, 2005). In addition, longstanding pathologies occurring in people with kidney disease can influence cognitive function (Daugirdis, Blake, & Ing, 2007; Pereira et al., 2005). Depression, which often co-exists with chronic disease (Harman, Edlund, Fortney, & Kallas, 2005; Himelhoch, Weller, Wu, Anderson, & Copper, 2004; Taylor, McQuiod, & Krishman, 2004) and commonly occurs in the older adult (Carson & Margolin, 2005), may have an effect on cognitive function. While evidence supports a relationship between long-standing kidney disease and cognitive impairment, the evidence linking cognitive impairment and adherence is limited and demands further attention.

Cognitive impairment may impact individuals in several realms of their lives, including decision making, ability to adhere to a behavioral regimen such as dietary modification, and medication compliance (Pereira et al., 2005). Cognitive impairment may impact an individual's comprehension of medical procedures as well as the ability to provide informed consent. Educational interventions may not yield optimal results because cognitively impaired individuals have decreased ability to encode and store new information (Pereira et al., 2005).

Some people undergoing hemodialysis may be cognitively impaired and, as a result, have limitations to their ability to follow a prescribed behavioral regimen, thus creating a need for new approaches to care. Identification of specific cognitive markers and age-specific adherence markers could provide practicing nephrology nurses with clinical guidance to improve the health outcomes for older adults undergoing hemodialysis.

The overall purpose of this exploratory study was to identify cognitive markers that practicing nephrology nurses can use to alert them to potential problems with adherence and to identify a practice-friendly conversational approach for alerting nephrology nurses to the need for a more comprehensive assessment of cognitive function, which might reveal cognitive impairment as a contributing factor for nonadherence.

The specific research questions were:

1. What is the frequency of cognitive impairment for older adults undergoing hemodialysis?
2. What is the frequency of nonadherence in cognitive impaired older adults undergoing hemodialysis?
3. What is the relationship between word-use (word count, big words [more than 6 letters], words per sentence and cognitive process words) during usual nursing practice conversation and cognitive function?

Methods

Design and Sample

The research was approved by the university institutional review board for protection of human subjects. An exploratory study was conducted using a convenience sample. Six outpatient hemodialysis sites located in

Southeast Florida were chosen. To be in compliance with HIPAA, recruitment of participants began with charge nurses identifying older adults who were eligible to be in the study. All data, except health and socioeconomic data, were collected once the individual was undergoing hemodialysis and when it was determined the individual was stable (based on vital signs, report from the nurses, and self-report of well-being). This was approximately 30 minutes after the start of hemodialysis. To promote confidentiality, a privacy screen was offered to each participant during data collection.

To be included in the study, participants had to be at least 60 years old, diagnosed with ESRD; undergoing hemodialysis for at least 1 year; have no diagnosis of cognitive impairment; able to read and speak English; and willing to have a conversation about their health challenges and have it audiotaped.

The instruments will be discussed in the order they were administered.

Measurement

Words and health. One way to conceptualize language skills is through word use. If language can be assessed as an indicator of cognitive function related to behavioral adherence for individuals undergoing hemodialysis, health care providers, including nephrology nurses, have one more approach for addressing and working with people who are non-adherent to a behavioral regimen. Story Theory (Smith & Liehr, 2003) guided conversation about the health challenge of making lifestyle changes. Linguistic Inquiry and Word Count (LIWC) analysis (Pennebaker, Francis, & Booth, 2001) was used to calculate percentage of story words used in word categories (word count, big words, words per sentence, and cognitive process words) relevant for assessment of cognitive function. Eighty-five percent (85%) of the words used in the stories of health challenges were captured with the LIWC analysis. Content validity of the LIWC program has been tested by having expert judges independently rate essays and compare ratings to the computer categories (Pennebaker & King, 1999). Reliability was assessed using individual writing samples. Factor structure of LIWC principal components were replicated in multiple studies. The reliability coefficient for the cognitive process word category was .76; word count, big words, and words per sentence alpha reliabilities were .85, .78, and .88 respectively (Pennebaker & King, 1999).

Global cognitive function. The Modified Mini-Mental State (3MS) exam was used to explore global cognitive function. It measures global cognitive function with aspects that assess orientation, attention, immediate and short-term recall and language. The 30-point Mini Mental State Exam (MMSE) (Folstein, Folstein, & McHugh, 1975) is traditionally used as a screening tool for cognitive impairment both in research and clinical settings. However, the 3MS is considered a sensitive indicator for mild cognitive impairment (Teng & Chui, 1987). The interrater agreement for the 3MS compared to the MMSE was .98 ($p <$ .001). A score less than 80 was reported to have a sensitivity of 91% and specificity of 97% for detecting possible dementia in the general population (Teng & Chui, 1987). The 3MS has been used in recent studies to assess cognitive function in individuals diagnosed at various stages of CKD (Kurella et al., 2004).

Depression. Older adults with depression may present with complaints about changes in cognitive function; therefore, it is important to screen for depression (Rosenblatt, 2005). The 15-item Geriatric Depression Scale (GDS) (Sheikh & Yesavage, 1986), which has frequently been used as a brief depression screening instrument both in clinical practice as well as in research (Carson & Margolin, 2005), was used to screen for depression. Alpha reliability for short form GDS has been reported as .84 in previous studies (Sheikh & Yesavage, 1986). In this study, the alpha reliability was .85.

Sociodemographic and health data. Sociodemographic data such as gender, martial status, race/ethnicity, education, employment, and living arrangements were collected directly from each participant. Medical records were reviewed to obtain health data such as first hemodialysis treatment, cause for ESRD, co-morbidities, medications, Kt/V as a measure of dialysis adequacy, serum albumin and protein catabolic rate as markers of nutritional status.

Adherence markers. Adherence or non-adherence was defined by previously studied health indicators including attendance at dialysis treatments, serum phosphorus, and IWG (Breiterman White, 2004; Kaveh & Kimmel, 2001; Leggat et al., 1998; Saran et al., 2003). For participants to be identified as non-adherent, they had at least one of the following: skipped one or more hemodialysis treatments; shortened one or more hemodialysis treatments by at least 10 minutes; had one or more predialysis serum phosphorus (PO_4) levels greater than 7.5 mg/dl, or one or more occurrences of IWG of more that 5.7% of EDW. Participants identified as adherent had none of the aforementioned criteria.

Health data to determine adherence were collected retrospectively for a 1-month time period prior to data collection. The number of skipped and shortened outpatient hemodialysis treatments was quantified during this time. A treatment missed because of hospitalization and/or scheduled missed treatment (vacation or approved by health care provider) was not considered skipping a treatment. IWG was calculated by subtracting previous postdialysis weight (kg) from current treatment weight. The dialysis flow sheet was evaluated to determine if the patient achieved EDW at the end of the previous treatment to assure a true reading of IWG. For participants with more than one value, the mean IWG was used. Predialysis serum phosphorus was obtained as a single measure.

Data Analysis

The first two research questions were addressed with descriptive statistics. A Pearson Product Moment Correlation ($p < .05$) was used for the third research question.

Results

Prior to addressing the research questions, the relationship between depression and cognitive function was analyzed. There was not a significant relationship ($r = .06$, $p = .64$) between cognitive function (3MS) and depression (total score on the GDS). Therefore, depression was not incorporated into further analysis.

Participants characteristics. Sixty-four participants were enrolled in the study; however data for one participant was lost due to a problem with the analysis of the story data. Demographic characteristics and health indictors of the 63 participants in the sample, which were ascertained by using a patient interviews and medical record reviews, are listed in Table 1. The sample consisted of ethnically diverse males and females with a mean age of 72.71 years (SD = 7.8). The majority completed high school and had either attended college or attained an undergraduate degree and/or higher. The majority of the participants (60.3%) reported being married.

Cognitive impairment. A score of less than 80 on the 3MS is indicative of cognitive impairment; 39.7% ($n = 25$) of the participants had evidence of cognitive impairment (3MS score less than 80). Each person who scored less than 80 on the 3MS was evaluated in relation to adherence (see Table 2). The majority (58.2%) with cognitive impairment were non-adherent using established markers of adherence. There were significant correlations between word use and cognitive function ($r = .33$; $p < .01$); words per sentence ($r = .41$, $p < .01$), and big words ($r = .37$, $p < .01$).

Adherence markers. None of the participants in this study missed a treatment or shortened the treatment time by 10 minute or more. The most prevalent adherence marker for the non-adherent group with evidence of global cognitive impairment was IWG. Serum phosphorus may not be as sensitive a marker of adherence in the older population because it can be impacted by several things such as residual kidney function, acid-base status, diet, appetite, dialysis prescription, and parathyroid hormone levels (Unruh, Hartunian, Chapman, & Jaber, 2002). In addition, elevated phosphorus levels can be an indication of improved nutritional status as well as poor adherence with self-administration of medication (Unruh et al., 2002). Social support and the complexity of the behavioral regimen strongly affect medication adherence (McGraw & Drennan, 2004); these warrant attention in a future study.

Table 1
Participant Demographic Characteristics

Demographic Characteristics	Descriptive Statistics ($n = 63$)
Age	
Age/yrs[a]	72.71(7.75)
Range/yrs	61 to 90
Gender	
Female %	44.4
Male %	55.6
Ethnic/Cultural %	
Anglo	63.5
Afro-Caribbean	19.0
African American	11.1
Hispanic	6.3
Education	
Less than High School %	17.5
High School Graduate %	34.6
Undergraduate &/or above %	47.6
Time on Dialysis in years[a]	
In years	3.73 (3.8)
Range/yrs	1 to 15
Martial Status %	
Married	60.3
Widowed	23.8
Divorced	14.3
Single	1.6
Living Arrangements %	
With Family	77.8
Institution (ILF/ALF)	11.1
Self	11.1

Note: [a]Mean (standard deviation)

Discussion

Empirical evidence has revealed that cognitive impairment is prevalent among older adults undergoing hemo-

Table 2
Participants with Evidence of Global Cognitive Decline and Related Non-adherent Indicator(s)

3MS Score Less than 80 = Decline (*n* = 25)	Age (yrs)	Adherent	Non-adherent	Non-adherent Cognitive Indicator(s)
40	79	X		
46	71		X	IWG
48	68		X	IWG
54	76	X		
57	86	X		
60	87	X		IWG/PO_4
62	82		X	IWG
64	70		X	
64	75	X		
65	75	X		IWG
68	68		X	IWG
68	68		X	
70	81	X		IWG
70	69		X	PO_4
72	64		X	IWG
72	72		X	
72	70	X		
72	77	X		
73	74	X		IWG
74	65		X	IWG
75	85		X	IWG
76	68		X	IWG
76	68		X	IWG
78	90		X	IWG
79	73		X	

Note: Non-adherent is PO_4 of 7.5 mg/dl or greater and/or IWG 5.7% above EDW

dialysis (Kurella et al., 2004; Sehgal, Grey, DeOreo, & Whitehouse. 1997) and this evidence is supported with the data from this study. The findings indicate that many of the participants had impaired global cognitive function and that the non-adherent group had the lowest scores on measures of global cognitive function (see Table 2), even though there were not significant differences between groups. This cohort had many risk factors for vascular dementia such as hypertension, diabetes, and older age (Fukunishi et al., 2002; Kurella et al., 2005; Lass et al., 1999; Pereira et al., 2005), which contributed to a foundational data base regarding risk factors and cognitive impairment in older adults undergoing hemodialysis. In clinical practice, neurological evaluation, neuropsychological testing, and brain neuro-imaging may assist with diagnostic determination. For the purpose of this study, diagnosis was not essential; however, as the number of older adults undergoing hemodialysis increases, it is important to recognize the risk factors for cognitive impairment and to continue to refine understanding of the link between cognitive impairment and adherence.

Despite the occurrence of cognitive impairment in this population, nephrology nurses and staff members often do not detect it. One possible reason is that the individual is at a mild stage of impairment when subtle cognitive changes are more difficult to observe. Several of the participants in this study were able to converse without exhibiting an overt decline in language ability.

These data indicate that the structural components of word use are significantly related to cognitive function. Therefore, these structural elements may be a practical way to assess cognitive function in this population. Although statistical significance was achieved between word use and cognitive function ($p < .01$), the meaning of this is difficult to interpret. The use of big words may be a structural indicator, which is a useful proxy for assessing cognitive function in practice settings. At the very least, these findings generate questions regarding possible cognitive impairment when there is increased IWG in the older adult undergoing hemodialysis.

It has been established that approximately 50% of individuals undergoing hemodialysis have difficulty adhering to the prescribed regimen (Kutner, 2001), leading to increased mortality (Leggat et al., 1998). Although there are no gold standards for measuring adherence (Kaveh & Kimmel, 2001; Saran et al., 2003), phosphorus levels, IWG, missed treatments, or shortening the treatment by 10 minutes or more are often used to quantify adherence. None of these participants missed or shortened treatments, leading to questions about the sensitivity of these markers for older adults. A relationship exists between age and race and markers of adherence; younger, black patients are more likely to skip treatments and have higher potassium and phosphorus levels (Unruh et al., 2002). Little is known about the older adult receiving hemodialysis; therefore, standardized measures of adherence used in the younger hemodialysis population may not be sensitive markers in older adults undergoing hemodialysis.

As a demographic tidal wave begins to emerge and as the number of older adults undergoing hemodialysis

increases, it is essential to think about the uniqueness of older adults undergoing hemodialysis. This study provides preliminary support for abandoning a "one-size-fits-all" approach and shifting to a more individualistic approach where the criteria of adherence are questioned and nephrology nurses consider cognitive impairment as one possible contributing factor to non-adherence.

Even in busy hemodialysis settings, nephrology nurses can administer brief screening instruments (Chodosh et al., 2004) such as the 3MS to measure global cognitive changes. Once such changes are identified, the nephrology nurse can make recommendations to health care providers for further evaluation. Many health care providers are unaware that cognitive impairment exists in their patients (Chodosh et al., 2004). Failure to recognize cognitive impairment prevents the patient from undergoing early and appropriate treatment. Therefore, it is imperative that health care professionals, including nephrology nurses, consider cognitive impairment as a possible factor that relates to an individual's inability to follow the prescribed behavioral regimen.

Implications for Future Research

The study findings have considerable implications for further research. The study provides important preliminary data, which will enable calculation of effect size and sample size estimates to achieve power in future research. A redesign of the study with a larger sample size, use of instruments that measure of global cognitive function, such as the 3MS, analysis of big words, and applying measures (e.g., medication adherence) that evaluate an individual's ability to follow the prescribed regimen may result in relevant findings.

Implications for Nephrology Nurses

Medication adherence among older adults is a complex issue because there are many reasons why this population doesn't take prescribed medications (Long, Kee, Graham, Saethang, & Dames, 1997; McGraw & Drennan, 2004). Considerations of self-administration of medications may contribute significantly to understanding of the connection between adherence and cognitive function. An investigation exploring nephrology nurses' ability to recognize possible cognitive impairment through conversational approaches and/or administration of the 3MS in the hemodialysis settings could change practice for people who are undergoing hemodialysis, particularly individuals labeled as non-adherent.

Conclusion

This preliminary work has offered a descriptive foundation and generated further questions for research. Future research will include cognitive markers described in this study in an attempt to identify meaningful markers of adherence and identify a sensitive practical standardized instrument that nephrology nurses can use in the hemodialysis setting. Meanwhile, nephrology nurses are called upon to consider each individual's ability to follow prescribed behavioral regimens, seeking to understand unique patient factors that promote adherence.

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Nephrology Nursing Journal Editorial Board Statements of Disclosure

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Paula Dutka, MSN, RN, CNN, disclosed that she is a consultant for Hoffman-La Roche and Coordinator of Clinical Trials for Roche.

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Holly Fadness McFarland, MSN, RN, CNN, disclosed that she is an employee of DaVita, Inc.

Karen C. Robbins, MS, RN, CNN, disclosed that she is on the Speakers' Bureau for Watson Pharma, Inc.

Sally S. Russell, MN, CMSRN, disclosed that she is on the Speakers' Bureau for Roche/Abbott Labs.

ANSWER/EVALUATION FORM

Cognitive Function and Adherence of Older Adults Undergoing Hemodialysis

Debra J. Hain, DNS, ARNP, GNP, BC

1.4 Contact Hours
Expires: February 20, 2010
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1. What would be different in your practice if you applied what you have learned from this activity?

_____

_____

_____

_____

_____

_____

GOAL **To describe a study on the cognitive function and adherence to treatment plans by older patients on hemodialysis.**

New Posttest Format

Please note that this continuing nursing education activity does not contain multiple-choice questions. We have introduced a new type of posttest that substitutes the multiple-choice questions with an open-ended question. Simply answer the open-ended question(s) directly above the evaluation portion of the Answer/Evaluation Form and return the form, with payment, to the National Office as usual.

Evaluation	Strongly disagree				Strongly agree
2. By completing this offering, I was able to meet the stated objectives					
a. Describe a study done to determine concerns with adherence in older persons on hemodialysis.	1	2	3	4	5
b. Identify cognitive markers that alert to potential problems of adherence in older patients on hemodialysis.	1	2	3	4	5
c. Summarize a study on cognitive function and adherence in older patients on hemodialysis.	1	2	3	4	5
3. The content was current and relevant.	1	2	3	4	5
4. This was an effective method to learn this content.	1	2	3	4	5

5. Time required to complete reading assignment: _____ minutes.

I verify that I have completed this activity _____
(Signature)