Renal Failure

ISSN: 0886-022X (Print) 1525-6049 (Online) Journal homepage: informahealthcare.com/journals/irnf20

Development and psychometric evaluation of the Chronic Kidney Disease Screening Index

Amani A. Khalil, Hanan M. Al-Modallal, Maysoon S. Abdalrahim, Diana H. Arabiat, Mona A. Abed & Ruqayya S. Zeilani

To cite this article: Amani A. Khalil, Hanan M. Al-Modallal, Maysoon S. Abdalrahim, Diana H. Arabiat, Mona A. Abed & Ruqayya S. Zeilani (2014) Development and psychometric evaluation of the Chronic Kidney Disease Screening Index, Renal Failure, 36:8, 1200-1207, DOI: 10.3109/0886022X.2014.928969

To link to this article: https://doi.org/10.3109/0886022X.2014.928969

Published online: 30 Jun 2014.

Submit your article to this journal

Article views: 2024

View related articles

View Crossmark data

Citing articles: 3 View citing articles

Full Terms & Conditions of access and use can be found at
https://informahealthcare.com/action/journalInformation?journalCode=irnf20

RENAL FAILURE

http://informahealthcare.com/rnf
ISSN: 0886-022X (print), 1525-6049 (electronic)

Ren Fail, 2014; 36(8): 1200–1207
© 2014 Informa Healthcare USA, Inc. DOI: 10.3109/0886022X.2014.928969

informa
healthcare

CLINICAL STUDY

Development and psychometric evaluation of the Chronic Kidney Disease Screening Index

Amani A. Khalil[1], Hanan M. Al-Modallal[2], Maysoon S. Abdalrahim[1], Diana H. Arabiat[1], Mona A. Abed[2], and Ruqayya S. Zeilani[1]

[1]Faculty of Nursing, The University of Jordan, Amman, Jordan and [2]Faculty of Nursing, Hashemite University, Zarqa, Jordan

Abstract

Objective: Public understanding of chronic kidney disease (CKD) is important to ensure informed participation in CKD prevention programs. This study aimed to develop and to test the psychometric profile of the CKD Screening Index that measures patient's knowledge, attitudes, and practices regarding CKD prevention and early detection. *Methods*: A cross-sectional design was implemented and a total of 740 Jordanian patients recognized at risk for CKD were recruited by convenience sampling from out-patient departments. Development and psychometric validation of the CKD Screening Index were conducted in four phases: (1) item generation, (2) pilot study, (3) preliminary psychometric validation study to examine factor structure, and (4) final psychometric validation with 740 participants. *Results*: On factor analysis, 24 items categorical knowledge items loaded into one factor and yielded a Guttman Split-Half Coefficient of 0.80. In a separate factor analysis, 15 items were loaded on two attitude factors (Cronbach alpha coefficient = 0.69), and nine items loaded on two practice factors (Cronbach alpha coefficient = 0.68). The CKD Screening Index associated significantly and negatively with depressed and anxious patients compared to their counterparts. *Practice implications*: This promising CKD Screening Index can be used for an early identification of patients at risk for CKD, thus, allowing the development of interventions to raise these patients' awareness. Future studies are needed on other populations with different cultural background to support reliability and validity of this new instrument.

Keywords

Attitudes, chronic kidney disease, Jordanian patients, knowledge, practices

History

Received 15 November 2013
Revised 22 April 2014
Accepted 17 May 2014
Published online 27 June 2014

Introduction

Chronic kidney disease (CKD) is an accelerating public health problem. Despite the advanced medical services, around 26 million American are with CKD, 1 million at high risk, and most of these people are not aware that they have CKD or at risk.[1] The incidence of CKD is 150 patients per 1 million population in the developing world, and this figure is expected to double up by the year 2030.[2] Internationally, diabetes mellitus, hypertension, cardiovascular disease and having family history with CKD are the main identifiable risk factors to develop CKD.[1] In Jordan, the percentage of patients diagnosed with end-stage of renal disease (ESRD) receiving hemodialysis increased to reach 31% of the Jordanian population in 2011 when compared to the incidence in 2005.[3] Based on these global statistics, it is expected that patients with chronic illnesses reside in Jordan are less attentive of being at risk for CKD. In addition, there is no Jordanian registry system to detect patients at risk for CKD. While many global studies have measured CKD knowledge and attitudes toward CKD prevention and early detection, a reliable and validated measure is not existed.[4,5]

Jordan as a developing country is limited in resources and educational programs to improve people awareness regarding the risk of CKD.[5,6] Most of the hospitals in Jordan experienced a decrease in the visits percentage of out-patients having chronic illnesses for more than a 15% in 2011 compared to the percentage in 2010.[3] Delayed patients awareness about the risk factors of CKD causes under recognized cases, subsequently, unintentional non-adherence to treatment regimens and appalling health outcomes.[6,7] Moreover, studies showed that patients with chronic diseases as heart failure and ESRD were highly affected by psychological distress such as depression and anxiety. The association between physical and psychological morbidity may further worsen patients' health outcomes.[8] However, there is lack of evidence on the pathways that may lead to psychosocial problems and worsening of outcomes among patients with CKD.[9] Given the high prevalence of CKD and ESRD in Jordan, it is crucial to develop a reliable and valid instrument to screen for patients' awareness toward CKD prevention. The authors of the present study developed the CKD Screening Index to assess knowledge, attitude and practices toward prevention and early detection of CKD. Lack of knowledge,

Address correspondence to Dr. Amani A. Khalil, PhD, RN, Faculty of Nursing, the University of Jordan, Amman 11962, Jordan. Tel: +962-797781741; Fax: +9626 5300244; E-mail: a.khalil@ju.edu.jo

and negative attitudes and behaviors may delay seeking medical attention, accelerate the happening of ESRD, attenuate the occurrence of psychological problems and increase dialysis-related cost.[8,10]

No studies have been conducted in Jordan that screen the occurrence of CKD among high risk population or intervene with them.[10] However, others conducted a screening tool for patients with acute coronary syndrome (ACS) to assess for knowledge, attitudes and beliefs towards ACS symptoms.[11] Globally, there are many studies that investigated the CKD in terms of its prevalence, its relation to other chronic disease such as heart diseases, the risk factors associated with increasing the incidence of CKD.[12,13] Interventional studies in western communities used mass media campaigns to reduce the incidence of CKD. Public education programs were implemented around the world side by side with active objective screening to assess the presence of risk factors for CKD, detect patients at risk for CKD and retard the aggressive progression of CKD.[5,14] Other recent studies revealed that risk factors such as sedentary life style, obesity and smoking were significantly associated with worsening the degree of kidney failure.[14,15] However, few researches assessed patients' knowledge and attitudes toward CKD.[12,15]

This study was conducted to develop the CKD Screening Index and then to investigate the psychometric properties of this newly developed instrument. The CKD Screening Index was developed based on an action research theory that indicates aspects (knowledge, attitudes, and practices) to be inquired when implementing change related to patients' health care preventive practices. The hypotheses tested to examine convergent and divergent construct validity were the following: Hypothesis 1—the CKD Screening Index negatively associates with the Brief Symptoms Inventory-depression and anxiety subscales; and Hypothesis 2—there is no association between CKD Screening Index and the participants' heights.[21]

Methods

Design

A descriptive, cross-sectional study was used to examine the psychometric profile of CKD Screening Index. The CKD Screening Index which was developed by the authors of this study was used to address the knowledge, attitudes and practices of patients towards CKD prevention and early detection.[16] The development and evaluation of the CKD Screening Index involved several steps, including (1) item generation, (2) pilot study to assess the content and face validity of the instrument, (3) preliminary psychometric validation study to examine factor structure and to reduce the number of items, and (4) final psychometric validation with 740 participants using convergent and divergent validity. After obtaining informed consent from the participants, baseline clinical and demographic data were obtained by interviewing the patients and auditing medical records. Data on knowledge, attitudes, and practices were collected as baseline at the time of participants' enrollment into this study.

This study was the first step to describe the psychometric profile of the CKD Screening Index. This index then could be used in an educational program study. The trial later will examine the impact of an educational intervention on knowledge, attitudes, and practices and biological markers of renal dysfunction compared to a control group.

Participants

A total of 740 outpatients were recruited conveniently in the study through a random selection of the hospitals from different regions in Jordan, in the period from September 2012 to March 2013. The sample was intended to be representative of diverse participants with different demographic characteristics.

All patients who fit the eligibility criteria were recruited from clinics admission registry. The eligibility criteria were: (1) aged 18 years and older, (2) able to read or understand Arabic, (3) had a previous history of at least one of the following: diabetes mellitus, hypertension, family history of CKD, chronically on analgesia, or aged more than 65 year.

The exclusion criteria were: (1) diagnosed with CKD as reported by the patients, or documented in the medical files, (2) diagnosed with mental or severe cerebral vascular diseases that may affect cognitive ability.

Setting

Hospitals were selected from the three regions in Jordan were; the Northern, Middle, and Southern regions. The participating hospitals were selected randomly from a list that contains all hospitals of the three sectors and the number of the involved hospitals was equally divided. Finally, seven governmental, one private, and two educational hospitals were included from the mentioned regions in Jordan.

Instrument development

Item generation

The items were drafted from a literature review. A comprehensive review of literature addressing instruments regarding knowledge, attitudes and practices toward CKD prevention and early detection and other chronic illnesses was conducted using online biomedical and nursing databases. The search revealed no valid and reliable tool that can assess patient's awareness, knowledge, attitudes and practices toward CKD prevention and its early detection. In developing the CKD Screening Index a theoretical framework was adopted to increase the meaningfulness of the measure. Based on an action research process, Kurt Lewin (1951) offered an extensive explanation of human behavior through his Force-Field Model of Change.[17] The model provided a framework for planning to introduce change into the health care setting. Lewin's operational framework for change provided an understanding of individual behavior as determined by motivation and intention. A collaborative relationship between the researcher and the patient is needed based on the knowledge differences. Many phases should be implemented based on Lewin's framework; uncover the problem, planning, evaluation to be conducted simultaneously, solve the problem and generate new knowledge.[18]

Subsequently, the authors arranged a series of discussion sessions to select the most suitable items to be included in the

instrument. The authors as doctoral prepared nurse experts performed the translation and the back-translation of the instrument based on the literature. Content validity of the CKD Screening Index was assessed by a panel of two nephrology nurses who worked in the hemodialysis unit for more than 20-year, one physician from the department of nephrology, college-educated patients diagnosed with CKD on hemodialysis for more than 10 years. The panel of the experts offered solid suggestions for improving the instrument. They were asked to score each item on a rating scale for its relevance in representing the issue of interest. They were also allowed to add, revise, or delete some of the items if necessary.

Pilot study

Content validity was established by validating the translation process and conducting pretesting. A pilot study was conducted to ensure the feasibility and understandability of the CKD Screening Index and to ensure pretesting validity. Approximately 10% of the total study population (50 patients) was randomly selected from primary health sectors. Patients in the pilot study were excluded from the larger study sample. This piloting was conducted to test the adequacy, wording, and formatting of the item statements in the CKD Screening Index. Feedback from the patients in this piloting suggested that the language was clear and understandable. Four items were added to provide more details to the knowledge dimension. Some of the items were revised to ensure that wording is precise and understandable. Other items were negatively worded to avoid stereotype responses in the knowledge subscale.

The knowledge domain has 30 items with multiple-choice selections that included, correct, incorrect, and an unsure response. An unsure option prevents the patients to guess if they were unsure of an answer. ''Unsure'' responses then were treated as incorrect answers. A score of 1 was given for the correct answers and zero for the incorrect answers. The correct responses were summed to provide total score that assessed the patients' knowledge level toward prevention and early detection of CKD. The attitude scale measures an individual judgment and evaluation of health behavior in 18 items that were presented on a 5 Likert scale anchored with 1 (strongly disagree) to 5 (strongly agree). The practice domain has 12 items on a 4 Likert scale anchored with 1 (not at all) to 4 (always). Finally, a 60-item pool was established consisting of 30 for knowledge, 18 for attitudes, and 12 for practices.

Psychometric validation

Reliability testing

Reliability means that the index is consistent, stable and measures the warranted concepts. The internal consistency of the CKD Screening Index was estimated by computing Guttman Split-Half and Cronbach's alpha coefficients for the knowledge and attitudes and practices subscales, respectively. Item analysis was performed by assessing item means, standard deviations, and item-total correlation below 0.10 or above 0.70.[20]

Validity testing

Factors analysis of the index was estimated through exploratory factor analysis. Factor analysis were performed using scree plot, the criterion of interpretability, an eigenvalue >1, and 5% variance explained by each factor. The knowledge items were extracted separately and rotated using a Varimax procedure because the factors were uncorrelated. The 18 attitudes and 12 practices items were extracted together in a single analysis and rotated using Promax procedure because these factors were correlated.

Convergent and discriminant construct validity had been tested using correlations. Correlation between the CKD Screening Index and supported related constructs such as depressive and anxiety symptoms was measured for convergent validity. Discriminant validity represents a low correlation between the CKD Screening Index total score and dissimilar construct such as height of the patients which was measured differently.[20]

Measures used for construct validity

Depressive and anxiety symptoms. The Brief Symptom Inventory (BSI) was used to assess the presence of depressive and anxiety symptoms among the participants in the present study. The BSI is a 53-item self-reporting instrument designed for people with psychiatric disturbances.[22] However, it had been used widely among patients with medical conditions, substance abuse treatment, and other settings with high reliability and validity.[22,23] The BSI is a multi-dimensional measure that covers nine dimensions such as, depression and anxiety. The depression and anxiety subscales were answered on a 5-point Likert-type scale (0–4) which range from ''Not at all'' to ''Extremely''. Depression subscale reflects the broad range of manifestations of clinical depression. Anxiety contains symptoms associated with the presence of manifest anxiety. Depression and anxiety subscales showed high correlation with the Beck depression Inventory-II and Control Attitude Scale among patients with CKD receiving hemodialysis and with patients with heart failure.[8,25]

Statistical analysis

Descriptive statistics were used to provide informative description of the three subscales of the CKD Screening Index. Reliability testing was presented using Guttmann Split-Half Coefficient for the knowledge subscale (dichotomous variable) Cronbach's alpha value of the attitudes and practices subscales.[26] Validity of the scale was measured using principal components analysis with Oblimin rotation. Convergent and discriminant (divergent) validity were implemented to examine construct validity. Convergent validity was examined using independent samples *t*-test to find mean differences in knowledge, attitudes, and practices scores between participants who are depressed and those who are not. Depression and anxiety variables were used to examine convergent validity because it was hypothesized that non-depressed and non-anxious participants have higher scores on the knowledge, attitudes, and practices subscales compared to depressed and anxious participants. Discriminant validity, on the other hand, was examined using simple linear regression

to compare changes in total scores of knowledge, attitudes, and practices based on participants' height. Further, the ''height'' variable was used to examine discriminant validity because we hypothesized that there is no significant relationship between knowledge, attitudes, and practices with participants' height. Significance level of <0.05 was considered.

Ethical considerations

Prior to data collection, ethical approvals were obtained from the ethical committee of Faculty of Nursing at the University of Jordan and the ethical board of the targeted institutions. Then, participants were invited to participate based on the inclusion and exclusion criteria after signing the consent forms.

Results

A total of 740 participants were recruited to the study. The mean age was 54.6 ± 12.5, ranging from 18 to 90. The majority of the sample (82%) were married, two-third 440 (60%) were unemployed, 393 (53%) had less than high school education, and only 128 (17%) participants were current smokers. Nearly half of the sample had monthly income of less than 300 JD ($210), 34% earn more than 300 JD, and 17% of the sample did not declare their income. The average of the participants' height was 1.60 ± 0.10 m.

Around 60% of the participants were recruited from governmental hospitals, 30% from educational hospitals, and 10% from private hospitals in different cities in Jordan Amman, Zarqa, Al Karak, Al Mafraq, Rweeshid and Irbid. These percentages reflect participation rate of the patients from each sector. Cardiac outpatients clinics provided the study with 235 (32%) of the participants and 373 (50%) were from medical out-patients clinics. Participants diagnosed with hypertension were 526 (71%) of the sample, 399 (54%) had diabetes mellitus, 102 (14%) had heart failure, and 223 (30%) had rheumatoid arthritis.

The knowledge subscale

To examine sampling adequacy of the current study, Kasier–Meyer–Olkin test was conducted. A result of 0.88 was yielded for the Kasier–Meyer–Olkin test; indicating suitability of data for factor analysis. Guttman split-half was used for the knowledge subscale as a dichotomous variable and revealed a value of 0.70. Items number 6, 10, 16, 20, 22, and 30 were negatively correlated (negatively worded) with the rest of items within the knowledge subscale. For this reason, these items were removed from the scale and split-Half testing was repeated. Guttmann Split-Half Coefficient for the remaining 24 items increased to become 0.80.[19] For the future studies, the excluded version will be considered instead of the original version of the index.

Determination of the number of components (Factors) within the knowledge subscale was examined using Eigen values of 1 or more and investigation of the Scree plot provided by the analysis output (Table 2). Both results indicated presence of one component (factor) within the knowledge subscale explaining 22.9% of the variance. Therefore, rotation was waived. Mean knowledge subscale level among the participants was 19.27 ($SD = 2.6$). Table 1 provides participants' responses to the 24 items of the knowledge subscale.

The attitudes subscale

Adequacy of sampling was proved by the value of 0.81 yielded by Kasier–Meyer–Olkin test. Cronbach's alpha for the Attitudes subscale as reported by our participants was 0.50. Investigation of the factor analysis results indicated that items number 9, 15, and 16 were negatively correlated with the other items within the attitudes subscale. The Scree plot, on the other hand, indicated presence of three factors within the attitudes subscale explaining 38.6% of the variance. The three negatively-correlated items were removed from the subscale as they were double loaded and analysis was repeated. Cronbach's alpha after removal of the three items increased to become 0.69.

Examination of the Scree plot indicated presence of two factors within the attitudes Subscale (Table 2). These factors explained 33.6% of the variance. Oblimin rotation was implemented as we assumed that factors within the Attitudes subscale are correlated. Factor loadings of rotated items indicated that five items loaded on Factor I and three items loaded on Factor II. Items within Factor I presented actions/applications (e.g., I should search for new information to improve my health) and items of Factor II presented seeking help/assistance (e.g., I will go to a health care provider if I have signs and symptoms of kidney disease). Factors I and II were significantly correlated ($r = 0.38$, $p < 0.001$) (Table 3). Item scores within Factor I ranged between 5 and 25 ($M = 22.14$, $SD = 2.6$) and item scores within Factor II ranged between 3 and 15 ($M = 12.5$, $SD = 2.1$).

Practices subscale

Kasier–Meyer–Olkin measure of sampling adequacy was 0.76. Cronbach's alpha for the practices subscale was 0.68. Scree plot output indicated presence of two factors explaining 36.7% of the variance. Factor loading yielded by Oblimin rotation showed that six of the 12 items loaded on Factor I and another three items loaded on Factor II. Examination of the nature of items within each factor indicated that Factor I presented lifestyle (e.g., I exercise regularly such as walking and jogging) and Factor II presented compliance (e.g., I keep my weight within normal range). Correlation between Factor I and Factor II was 0.33 ($p < 0.0001$) (Table 3). Item scores within Factor I ranged between 6 and 24 ($M = 14.9$, $SD = 3.9$) and item scores within Factor II ranged between 3 and 12 ($M = 10.5$, $SD = 1.7$)

Construct validity

Construct validity was examined using convergent and discriminant validity. With regard to the convergent validity, participants who were not depressed scored higher on the three components of CKD Screening Index compared to depressed participants. All p values were <0.05. Further, participants who exhibited anxiety scored higher compared to non-anxious participants, on the attitudes and practices subscales of the CKD Screening Index. There was no significant difference on the mean knowledge subscale

Table 1. Participants' responses to the knowledge subscale.

Items I know that:	Responding ''Yes'' *N* (%)	Responding ''No'' *N* (%)	Responding ''Unsure'' *N* (%)
(K 1) The kidneys regulate body water and chemicals in my blood such as sodium, potassium, phosphorus, and calcium.	616 (83.2)	103 (13.9)	21 (2.8)
(K 2) The kidneys remove drugs and toxins introduced into my body.	582 (78.6)	143 (19.3)	15 (2.0)
(K 3)The kidneys release hormones into blood to regulate blood pressure, produce red blood cells, and promote strong bones.	287 (38.8)	444 (60.0)	9 (1.2)
(K 4) CKD is a serious illness.	623 (84.2)	98 (13.2)	19 (2.6)
(K 5) CKD is an irreversible illness.	374 (50.5)	353 (47.7)	13 (1.8)
(K 7) Becoming an old person will decrease the function of my kidneys.	493 (66.6)	228 (30.8)	19 (2.6)
(K 8) Having increased blood pressure make me more likely to get CKD.	467 (63.1)	262 (35.4)	11 (1.5)
(K 9) Having diabetes mellitus make me more likely to get CKD.	551 (74.5)	169 (22.8)	20 (2.7)
(K 11) Having a family member with CKD will increase my chances of getting CKD.	257 (34.7)	475 (64.2)	8 (1.1)
(K 12) Having high lipid in my blood will increase my chances of getting CKD.	432 (58.4)	298 (40.3)	10 (1.4)
(K 13) Being a smoker increase my chances of getting CKD.	470 (63.5)	258 (34.9)	12 (1.6)
(K 14) Becoming an obese person (fatty) will increase my chances of getting CKD.	486 (65.7)	238 (32.2)	16 (2.2)
(K 15) Having untreated anemia will increase my chances of getting CKD.	412 (55.7)	314 (42.4)	14 (1.9)
(K 17) Undergoing certain procedures such as cardiac catheterization and CT scan that require injection of dye increases my chances of getting CKD.	318 (43.0)	405 (54.7)	17 (2.3)
(K 18) Having kidney stones and recurrent urinary tract infection increases my chances of getting CKD.	595 (80.4)	128 (17.3)	17 (2.3)
(K 19) Doing routine checkup of lab tests such as creatinine and serum urea nitrogen will decrease my chances of getting CKD.	535 (72.3)	194 (26.2)	11 (1.5)
(K 21) Having CKD gives trouble in concentrating.	354 (47.8)	376 (50.8)	10 (1.4)
(K 23) Having CKD gives me sleeping trouble.	445 (60.1)	285 (38.5)	10 (1.4)
(K 24) Having CKD gives me muscle cramps at night	348 (47.0)	379 (51.2)	13 (1.8)
(K 25) Having CKD gives me swollen feet and ankles and Puffiness around the eyes in the morning.	550 (74.3)	176 (23.8)	14 (1.9)
(K 26) Having CKD gives me dry and itchy skin.	351 (47.4)	375 (50.7)	14 (1.9)
(K 27) CKD gives me more often urination.	360 (48.6)	368 (49.7)	12 (1.6)
(K 28) There are five stages for CKD, and every stage need management plan.	255 (34.5)	470 (63.5)	15 (2.0)
(K 29) People in the final stage of CKD need dialysis as a life-long treatment.	323 (43.6)	401 (54.2)	16 (2.2)

Note: K, knowledge; CKD, chronic kidney disease.

between anxious and non-anxious participants. See Table 4 for details. Discriminant validity indicated absence of significant relationships between participants' scores on the three components of CKD Screening Index and their height. See Table 5 for details. It was found that being old, male gender, higher educational levels, patients with ischemic heart disease, patients with family history of hypertension were associated with better scores on at least one of the components of the CKD Screening Index.[16]

Discussion

The aim of this study was to develop a measurement tool to evaluate knowledge, attitudes and practices towards CKD prevention and early detection, and to investigate its reliability and validity. Patients' awareness about CKD and its related causes and attributes are crucial for successful primary prevention. This study provided beginning evidence that the CKD Screening Index is a reliable and a valid measure for population at high risk for developing CKD in Jordan. In general, all psychometric tests of the CKD Screening Index showed satisfactory results. Content validity assured the diversity and adequacy of items reflecting knowledge, attitudes and practices regarding prevention and early detection of CKD. Reliability of the questionnaire as measured by the Guttmann Split-Half Coefficient for the 24 items of the knowledge subscale was satisfactory and exceeded the recommended value of 0.70. However, the alpha coefficient of the attitudes and practices subscales was lower than desired (alpha = 0.69).

It can be argued that the heterogeneity of the subscales in terms of items included, the scale length, and the number of response choices presented in each subscale are responsible for the lower than desired internal consistency results, which was consistence with others.[11] For future studies, the new version of the CKD Screening Index without the excluded items will be used. It was found that almost half of the patients demonstrated high knowledge levels (>80% of correct answers) about CKD prevention and early detection in a recent published study using the same dataset.[16] The CKD Screening Index is valid and reliable for evaluating the awareness of patients at risk for CKD and it can be used easily in routine clinical practice.

Table 2. Factor loadings* for the attitudes and practices subscale using oblimin rotation.

Items within the attitude subscale	Factor I[a]	Factor II[b]	Factor I[c]	Factor II[d]
I believe that				
I will be shocked if I get kidney disease.		0.40		
I will talk with my friends about kidney disease.		0.72		
I will talk with my family about kidney disease.		0.79		
I will go to a health care provider if I have signs and symptoms of kidney disease.		0.48		
Kidney disease is an expensive to diagnose and treat				
Maintaining good health is extremely important.	0.73			
I should search for new information to improve my health.	0.80			
I feel it is important to carry out activities which will improve my health.	0.81			
I want to discover my health problems in the early stages.	0.72			
I want to discover my health problems in the early stages.				
I feel I will get kidney problem in the future.				
Doctors and nurses should have given me more information about kidney disease.	0.50			
Kidney disease is from Allah (God) and nothing I can do about it.				
One has an authority over his body and can prevent the occurrence of CKD.				
Preventing kidney disease needs money and efforts.				
Items within the practice subscale				
I eat well balanced meals.			0.69	
I exercise regularly such as walking and jogging.			0.65	
I have regular checkups even when I'm not sick.			0.62	
I keep my weight within normal range.			0.67	
I not smoke.				
I not drink alcohol.				
I take only the medication with prescription				0.80
I follow my medications regimen.				0.81
I follow my food restrictions, such as low salt diet and diabetic diet.			0.56	
I recognize abnormal changes related to CKD.			0.55	
I seek medical help if I notice signs of CKD.				0.44
I get family help and support if I get CKD.				

Note: *Factor loadings of 0.40 or more are presented.
[a]Factor I within the attitudes subscale is actions/applications.
[b]Factor II within the attitudes subscale is seeking help/assistance.
[c]Factor I within the practices subscale is lifestyle.
[d]Factor II within the practices subscale is compliance.
CKD, chronic kidney disease.

Table 3. Correlations between subscales within the chronic kidney disease (CKD) screening index.

CKD screening index	Knowledge	Attitudes factor I	Attitudes factor II	Practices factor I	Practices factor II
Knowledge	1.00*				
Attitudes					
Factor I	0.21*	1.00*			
Factor II	0.21*	0.38*	1.00*		
Practices					
Factor I	0.28*	0.22*	0.12*	1.00*	
Factor II	0.19*	0.28*	0.19*	0.33*	1.00*

Note: *All correlations are < 0.001.

Table 4. Convergent validity of the CKD screening index using ''depression'' and ''anxiety'' variables.

[a]CKD screening index	Depression			Anxiety		
	Mean (SD)	*t* Value	*p* Value	Mean (SD)	*t* Value	*p* Value
Knowledge		2.36	0.02		0.72	ns
Yes	38.22 (5.2)			38.4 (5.2)		
No	39.2 (5.1)			38.7 (5.1)		
Attitudes						
Factor I		2.99	0.003		2.8	0.006
Yes	21.95 (2.8)			22.0 (2.7)		
No	22.5 (2.3)			22.5 (2.5)		
Factor II		2.4	0.02		1.4	ns
Yes	12.3 (2.1)			12.4 (2.1)		
No	12.7 (2.1)			12.6 (2.1)		
Practice						
Factor I		4.06	<.0001		3.4	0.001
Yes	14.5 (3.9)			14.6 (3.9)		
No	15.8 (3.6)			15.6 (3.7)		
Factor II		3.3	0.001		2.3	0.02
yes	10.4 (1.7)			10.4 (1.7)		
no	10.8 (1.6)			10.7 (1.6)		

Note: [a]CKD screening index refers to chronic kidney disease screening index for knowledge, attitudes, and practices scale.

It is well established that the internal consistency as measured by the alpha coefficient echoes the extent to which every item on the scale measures the same concept.[20] In this case, the specific items of the attitudes and the practices are not homogenous. For example, within the 15-item attitudes scale, there were three subsets of items clustering in factor analysis. The attitudes items were grouped into two subscales (actions/applications) and (seeking help/assistance), rather than the three subscales suggested by factor analysis because the items 9, 15, and 16 were negatively correlated with the other items within the scale. The two-factor structure jointly accounted for 38.6% of the variance which yielded a relatively better value for the alpha coefficient. The factor analysis of the third subscale in the CKD Screening Index clearly indicated that the practices subscale includes two underlying factors namely lifestyle and compliance. Riegel et al. (2007) developed the ACS Response Index for patients with ischemic

Table 5. Discriminant validity of CKD screening index using the ''height'' variable.

[a]CKD screening index	Adjusted R^2	F value	Standardized coefficient (β)	p Value
Knowledge	0.001	0.95	−0.04	ns
Attitudes Factor I	0.001	0.53	0.03	ns
Attitudes Factor II	0.001	0.21	−0.02	ns
Practice Factor I	0.007	5.6	0.09	0.02
Practice Factor II	0.004	3.5	−0.07	ns

Note: [a]CKD screening index refers to chronic kidney disease screening index for knowledge, attitudes, and practices scale.

heart disease and found similarity in items dimensionality of the knowledge, attitudes and beliefs regarding ACS symptoms and response with the present study.[11]

The results showed that none of the items loadings were weak (<0.40); however, low to moderate amount of the item variance was captured by the factors in each subscale. For example, only 22.94% of the variance in response to the knowledge items was captured by presence of one component (factor) within the knowledge subscale, which emphasizes on the consistency in knowledge related to renal disease presented from international resources and mass media. There were two subsets of items clustering in factor testing within the 5-item attitudes scale and the 4-item practices scale. The significant correlations between the three subscales were highly related to their complementary effect to each other and that more testing of stability or test–retest reliability is needed.

Known groups' analysis also indicated that the CKD Screening Index have satisfactory convergent validity. The findings showed that patients who were depressed or anxious in this study scored significantly lower on the three subscales as compared to non-depressed/non-anxious respondents. The CKD Screening Index separated into conceptually valid groups on factor analysis and successfully correlated with patients' scores of self-reported depression and anxiety scores. Studies of knowledge and attitudes and its relationships with self-reported depression and anxiety scores also reported similar results in a range of medical conditions.[24,27] For instance, lower score on the control attitudes scale-revised (patients' perception of control related to cardiac disease) independently predicted higher levels of depressive symptoms and anxiety measured by the BSI depression subscale among patients with heart failure.[8] This suggests that in future studies using the CKD Screening Index in population of kidney diseases and the contribution of depression and anxiety to the findings should be considered. Further validity testing of the instrument should be assessed in sub-group analysis, including those from other Arabic speaking communities. Since this is a new measure, confirmatory factor analysis will be needed with the next set of data collection in order to see if the same factor structure fit the data from the current study.[20]

Limitations

This study is limited by its cross-sectional design and the convenience sample. The limitation of the convenience sample was reduced by the multicenter nature of the study which improved the ability to generalize. The present study does not provide evidence on test–retest reliability. Therefore, further research is needed to assess stability or test–retest reliability of the instrument.

Conclusion and implications for practice

In the absence of a validated tool, an index entitled CKD Screening Index assessing knowledge, attitudes and practices was developed based on the review of literature to enhance the reliability and validity as well as generalizability to other populations. There is a lack of empirical assessments of knowledge, attitudes, and practices towards prevention and early detection of CKD. Few studies have assessed knowledge worldwide, but never used a validated instrument. The results showed that the CKD Screening Index separated into conceptually valid groups on factor analysis, and its three subscales are correlated significantly with depression and anxiety scores. Thus, the CKD Screening Index seems to function as a reliable and valid instrument for measuring knowledge, attitudes, and practices of persons at high risk for developing CKD.

The CKD Screening Index could be used effectively among hospitalized patients and in outpatients' departments to provide the nurses and other health care providers with baseline data for effective management. Nurses play an effective role in communication, motivation and assessment of the patients' knowledge, attitudes and practices, which is essential to reduce the risk of CKD. An improved understanding of knowledge, attitudes and practices of patients at risk for CKD, as well as the interrelationship between these variables, is important to achieve successful public health program toward prevention and early detection of CKD. For further validity of the CKD Screening Index, the association between this index and health outcomes such as mortality and morbidity should be examined. Although the current study provides an initial evaluation of the CKD Screening Index in Jordanian sample, an additional research with different sample is needed to document the utility and validity of this index.[21]

Acknowledgements

We thank the out-patient clinics, patients, administrators, nurses, and medical directors for their assistance in conducting this study.

Declaration of interest

This work was funded by Deanship of Academic Research at the University of Jordan. The authors declare no conflict in interest. The authors declare that there is no conflict of interest and the results presented in this paper have not been published previously in whole or part.

References

1. U.S. Renal Data System, National Institutes of Health, National Institutes of Diabetes and Digestive and Kidney Diseases 2009. *Annual Data Report: Atlas of Chronic Kidney Disease and End-stage Renal Diseases in the United States*. Available at: http://www.usrds.org/2009/pdf/V2_05-09.PDF.

2. Barsoum RS. Chronic kidney disease in the developing world. *New Engl J Med.* 2006;354:997–999. Available at: www.nejm.org. Accessed March 9, 2012.
3. The Hashemite Kingdom of Jordan Ministry of Health, Non-communicable Disease Directorate 2009. *National Registry of End Stage Renal Disease Annual Report*. Available at: ww.moh.gov.jo.
4. McCullough P, Brown W, Gannon M, et al. Sustainable community – Based CKD screening methods employed by the National Kidney Foundation's Kidney Early Evaluation Program (KEEP). *Am J Kidney Dis*. 2010;57:S4–S8.
5. Go A, Chertow G, Fan D, McCulloch C, Hsu C. Chronic kidney disease and the risks of death, cardiovascular events, and hospitalization. *New Engl J Med.* 2004;351:1296–1305.
6. The Hashemite Kingdom of Jordan Department of Statistics. 2010. Available at: http://www.dos.gov.jo/dos_home_a/main/Analasis_Reports/Smoking_2010/Smoking_2010.pdf. Accessed 6 July 2013.
7. Khalil A, Darawad M. Objectively measured and self-reported nonadherence among Jordanian patients receiving hemodialysis. *Hemodial Int.* 2013;18:95–103.
8. Khalil A, Hall L, Moser D, Frazier K, Lennie T. The psychometric properties of the brief symptom inventory depression and anxiety subscales among patients with heart failure and renal dysfunction. *Arch Psychiatr Nurs.* 2011;5:419–429.
9. Khalil A, Lennie T, Frazier S. Understanding the negative effects of depressive symptoms in patients with ESRD receiving hemodialysis. *Nephrol Nurs J.* 2010;37:289–308.
10. Akl K, Said R. Need for Jordanian National Registry of chronic renal disease. *Jordan Med J.* 2010;44:437–431.
11. Riegel B, McKinley S, Moser D, Meischke H, Doering L, Dracup K. Psychometric evaluation of the acute coronary syndrome (acs) response index. *Res Nurs Health.* 2007;30:584–594.
12. Coresh J, Selvin E, Stevens LA, et al. Prevalence of chronic kidney disease in the United States. *J Am Med Assoc.* 2004;298:2038–2047.
13. Hassanien A, Al-Shaikh F, Vamos E, Yadegarfar G, Majeed A. Epidemiology of end-stage renal disease in the countries of the Gulf Cooperation Council: A systematic review. *J Royal Soc Med Short Rep*. 2012;3:38. doi: 10.1258/shorts.2012.011150.
14. Collins A, Gilbertson D, Snyder J, Chen S, Foley R. Chronic kidney disease awareness, screening and prevention: Rational for design of a public education program. *Nephrology.* 2010;15:37–42.
15. Alramly M, Darawad M, Khalil A. Slowing the progression of chronic kidney disease: Comparison between predialysis and dialysis Jordanian patients. *Renal Fail.* 2013;35:1348–1352.
16. Khalil A, Abdalrahim M. Knowledge, attitudes, and practices towards prevention and early detection of chronic kidney disease. *Int Nurs Rev.* 2014;61:237–245.
17. Darawad M, Khalil A. Jordanian dialysis patients' perceived exercise benefits and barriers: A correlation study. *Rehabil Nurs.* 2013;38:315–322.
18. Lewin K. Problems of research in social psychology. In: Cartwright D, ed. *Field Theory in Social Science: Selected Theoretical Papers by Kurt Lewin*. New York: Harper & Row; 1951.
19. Gronhaug K, Olson O. Action research and knowledge creation: Merits and challenges. *Qualit Market Res: Int J.* 1999;2:6–14.
20. Orlando L, Belasco E, Patel U, Matchar D. The chronic kidney disease model: A general purpose model of disease progression and treatment. *BMC Med Inform Decision Mak*. 2011;11:41.
21. Streiner D, Norman G. *Health Measurement Scales: A Practical Guide to their Development and Use*. 3rd ed. Oxford: Oxford University Press; 2003.
22. Derogatis LR, Melisaratos N. The Brief Symptom Inventory: An introductory report. *Psychol Med.* 1983;13:595–605.
23. Lang A, Norman S, Means-Christensen A, Stein M. Abbreviated Brief Symptom Inventory for use as an anxiety and depression screening instrument in primary care. *Depress Anxiety.* 2009;26:537–543.
24. Prelow H, Weaver S, Swenson R, Bowman M. A preliminary investigation of the validity and reliability of the Brief-Symptom Inventory-18 in economically disadvantaged Latina American mothers. *J Commun Psychol.* 2005;33:139–155.
25. Khalil A, Frazier K, Lennie T, Sawaya P. Depressive symptoms and dietary adherence in patients with end-stage renal disease. *J Renal Care.* 2011;37:30–39.
26. Nunnally JC, Bernstein IH. *Psychometric Theory.* 3rd ed. New York: McGraw-Hill; 1994.
27. McKinley S, Dracup K, Moser D, Riegel B, Doering L, et al. The effect of a short one-on-one nursing intervention on knowledge, attitude and beliefs related to response to acute coronary syndrome in people with coronary heart disease: A randomized controlled trial. *IJNS.* 2009;46:1037–1046.