

The Effects of Kidney-Disease-Related Loss on Long-Term Dialysis Patients' Depression and Quality of Life: Positive Affect as a Mediator

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Background and objectives: In kidney disease, the concept of loss is widely discussed but minimally researched. It appears that dialysis patients who grieve a range of losses suffer increased depression and reduced quality of life (QoL). Limited research is partly due to the lack of a relevant loss measure. The study presented here developed a measure and tested the criterion validity of loss in relation to depression and QoL.

Design, setting, participants, & measurements: In a cross-sectional observational study, 151 long-term dialysis patients were interviewed using standardized psychometric measures and the Kidney Disease Loss Scale (KDLS), developed for the study. Factor, path and multigroup analyses were conducted.

Results: The factor structure and reliability of KDLS were supported. The path analyses supported the criterion validity of loss. It was a stronger contributor to depression than other clinical variables. Its effect on QoL was fully mediated by depression and positive affect (coping). The magnitude of the paths from loss to QoL through depression and positive affect was larger in home-based dialysis patients than in hospital-based patients.

Conclusions: KDLS is a promising measure of loss. Patient-defined losses may contribute to the high level of depression and in turn a reduction in patients' coping and QoL. These findings suggest several points of intervention to improve long-term dialysis patients' QoL.

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The concept of Kidney-Disease-Related Loss (KDRL) in ESRD has been clinically and theoretically significant for decades (1–4). ESRD patients experience multiple losses, both tangible and symbolic; for example, loss of physical strengths, freedom, employment, and social life, resulting in grief throughout the course of ESRD and dialysis (1,2,4). Resolving loss successfully is identified as one of the adaptational factors in ESRD (3). Although widely discussed, there exists no clear definition or measure of KDRL.

Loss, traditionally discussed in the context of death, has recently been broadened to comprise loss of significant elements in a person's life due to chronic illness (5,6). In chronic-illness-caused losses, individual grief responses, rather than actual losses, are of conceptual importance (6). These grief responses, which can persist for many years and cause significant dysfunctions, are shown to be empirically and conceptually different from depression and anxiety in several studies (7–10). The grief symptomatology is characterized by cognitive preoccupation or rumination, yearning, disbelief, stunned responses, and nonacceptance of losses (7,9,11), which could be

summarized as cognitive and affective grief responses (6). Thus, the study presented here defines KDRL as the cognitive and affective grief responses after tangible and symbolic losses due to kidney disease and its treatments. This definition will guide the development of a measure for KDRL.

KDRL has traditionally been seen as one of the causes of depression in ESRD patients. In the psychodynamic perspective, depression may be an extension of patients' grief responses (1) or KDRL may increase patients' vulnerability to developing depression (4). In the cognitive-behavioral perspective, patients' cognitive rumination over their losses may lead to depression, as negative rumination has been found to be associated with depression (12,13).

There exists a strong inverse relationship between depression and quality of life (QoL) in ESRD patients (14,15). If KDRL is a significant cause of depression, it may have a mediated effect on QoL through depression or KDRL may also independently affect both depression and QoL. Although the literature suggests a direct relationship between depression and QoL, positive affect as a way of coping (16,17) may mediate the effect of depression and loss (18). Positive affect may have adaptive values in dealing with chronic stress (16,17) and thus moderate the effect of depression and KDRL on QoL.

The clinical validity of KDRL can be understood not only by measuring it, but also by examining its relations to clinical variables, including medical comorbidity, length of time on dialysis, and level of hemoglobin and its effects on hospital-

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and home-based dialysis patients. It is hypothesized that patients' KDRL will covary with these clinical variables influencing QoL through depression and positive affect (15,19–23). Moreover, the clinical observation suggests that hospital-based patients may experience more losses and become accustomed to their effects, whereas home-based patients may regain or minimize some losses through the advantages of home treatments. Thus, it is assumed that each additional loss for home-based patients will have a greater effect on their well being and QoL, and thus the clinical validity of the KDRL can be demonstrated.

The aim of this research is to show the criterion-related validity of the KDRL construct by developing a measure for KDRL, to examine its relationship with relevant psychologic and clinical variables, and its effect on home-based dialysis patients. It is hypothesized that (1) the proposed scale of KDRL will consist of cognitive and affective grief responses and that (2a) loss will lead to depression, (2b) covary with other clinical variables to influence QoL through depression and positive affect, and (2c) influence the home-based patients more.

Materials and Methods

Participants

Participants were recruited from two major university teaching hospitals in Sydney South West Area Health Service (SSWAHS) and South Eastern Sydney & Illawarra Area Health Service (SESAHS) Sydney, Australia. The inclusion criteria were a diagnosis of ESRD, receiving dialysis treatment for approximately 2 yr or more and aged 18 or above. The main exclusion criterion was incapacity to complete questionnaires and/or the semistructured interview with reasonable assistance. Of 209 eligible patients, 31 (14.8%) refused, 7 (3.4%) withdrew during the interview as being too sick to continue, 16 (7.7%) did not return the questionnaires, and 4 (1.9%) did not complete the data collection because of death, transplant, acute medical problems, or cognitive impairment. Thus, 151 (72.2%) patients participated in the interview and returned the questionnaires. The sample consisted of 90 (60%) men and 61 women (40%) with the mean age 58 ± 14.28 (SD) yr, the mean duration of dialysis was 67.97 ± 42.84 (SD) mo (range 22 to 248 mo). Approximately half ($n = 68$, 45%) of the participants were doing home-based dialysis, including home hemodialysis ($n = 26$, 17%) and peritoneal dialysis ($n = 42$, 28%), and the others ($n = 83$, 55%) were on hospital-based dialysis including satellite ($n = 56$, 37%) and in-center hemodialysis ($n = 27$, 18%).

Procedures

This study was approved by the SSWAHS and SESAHS Ethics Committees. After being informed of the study details and having signed a consent form, participants completed the semistructured interview and returned completed questionnaires by mail. One reminder letter and spare questionnaire were sent to those who did not return the questionnaires. Two interviewers were trained in the application of measures before the initiation of the study to ensure the quality of the data collection.

Measures

Seven variables were examined in the study: QoL, depression, KDRL, positive affect (a key component of coping), medical comorbidity, length of time on dialysis, and hemoglobin. In addition to developing a scale to measure KDRL, standardized measures were used in the study—the Schedule for Evaluation of Individual Quality of Life—

Direct Weighting (SEIQoL-DW) (24), the Depression Scale of Depression Anxiety Stress Scale 21 (DASS21) (25), the Positive Affect Scale (PAS) (18), and the Comorbidity Index (CMI) (26,27). Additional questions were included to collect participants' demographic and dialysis related information including length of time on dialysis (the total number of months). Hemoglobin level was an average over 3 mo, including the month of the research interview.

The Kidney Disease Loss Scale

The measurement context in which an individual considers their losses will in part determine the validity of the measurement. The context can be determined from individual-defined losses or from a standard set of losses. The type and importance of losses varies widely between patients and thus a predefined set of losses may only be partially relevant to any individual's experience (6,24). The Kidney Disease Loss Scale (KDLS) was constructed to first elicit the five most important individual KDRL and second to obtain cognitive and affective grief responses. A second-order factor structure of KDLS was hypothesized with four statements measuring cognitive rumination and four measuring the affective response to loss.

The SEIQoL-DW

The SEIQoL-DW is a patient-centered semistructured interview to measure individual QoL (24). It was chosen because of known limitations in multidimensional measures of QoL (28) and its ability to produce both qualitative and quantitative data. Of particular importance for renal patients are that preselected life domains may not be relevant, and equal weighting of life domains is inconsistent with patients' own values (29,30).

In the SEIQoL-DW, the five most important areas of a respondent's life are elicited, then the level of satisfaction and relative importance of each area is determined. Its global index score, ranging from 0 to 100, is the sum of a product of the ratings and weightings of each nominated area. Its reliability, validity, and utility in the medical and ESRD populations are excellent (24,30–33).

The DASS21

The DASS21 is a 21-item scale, comprising of three subscales: depression, anxiety, and stress (seven items each), a total score for each subscale ranging from 0 to 21. Only scores on the depression subscale were used in the analyses. The DASS21 focuses on the cognitive and affective aspects of depression, limiting the methods bias of using a measure that contains somatic elements common to depression and kidney disease (2,34,35). Additionally, it was developed in the Australian population (the site of this study); it has strong psychometric properties in both general and clinical populations (25,36,37); it is relatively short, reducing administrative burden on patients; and differentiates depression, anxiety, and stress.

PAS

The PAS is a four-item scale on a Likert scale ranging from 0 (not at all) to 10 (very much), with a total score ranging from 0 to 40 to measure individual positive feelings. Its reliability and discriminant and convergent validities have been well established (18).

CMI

The CMI was compiled on the basis of Friedman's Index (26) and Charlson's Index (27). It is in a checklist format, with scores ranging from 0 to 15, higher scores indicating more comorbid conditions.

Data Analyses

Analyses were performed with SPSS 15 (38) and LISREL 8.72 (39). Missing data were rare and nonsystematic and thus replaced using EM (expectation-maximization) method (38,40). The first set of analyses examined and validated the factor structure of the KDLS using confirmatory factor analysis (CFA) and exploratory factor analysis (EFA). Standard techniques of correlation, ANOVA, and *t* test were used with a critical value of alpha set to 0.05. The final set of analyses used structural equation modeling (SEM) to test, develop, and examine alternative models. Multigroup analyses were used to compare hospital and home dialysis.

The two-step approach was used with SEM (41). Composite scores of the observed variables, using the unit-weighted addition method, were calculated and error variances fixed in the measurement model (42,43) before the structural model was tested. Because the distributions of the observed variables were skewed, SEM was undertaken using “asymptomatic distribution free covariance” matrices using the robust maximum likelihood and the Satorra-Bentler statistic for parameter estimation (44–46). Several goodness-of-fit (GFI) indices were chosen to evaluate the overall model fit (40): Satorra-Bentler χ^2 test ($P > 0.05$, in SEM nonsignificant χ^2 indicates a good model fit), the GFI (≥ 0.90), adjusted GFI (AGFI) (> 0.90), the root mean square residual (RMR; close to 0), the root mean square error of approximation (RMSEA; ≤ 0.05 , 90% confidence interval < 0.08), and the comparative fit index (CFI; ≥ 0.90).

Results

Development of KDLS

The hypothesized factor structure of KDLS was not supported using CFA [$\chi^2 = 73.44$, degrees of freedom (*df*) = 19, $P = 0.00$, RMSEA = 0.09, GFI = 0.89, AGFI = 0.80, CFI = 0.99, RMR = 0.05; LISREL 8.72 39]. Re-examining the data, EFA using SPSS (38) indicated two factors with 72.24% of the total variance explained. There were two items loading onto both factors and therefore excluded (42). The first factor consisted of four items and resembled cognitive responses and the second factor consisted of two items reflecting affective responses. The second factor was retained for its theoretical importance and the items' correlation was greater than 0.7 (47). The two factors were strongly correlated ($r = 0.71$, $P < 0.01$), suggesting the previously hypothesized second-order factor. The new factor structure and possible second-order factor model were examined using CFA ($\chi^2 = 12.63$, $df = 8$, $P = 0.128$, RMSEA = 0.00, GFI 0.97, AGFI 0.93, CFI 1.00, RMR 0.03) (LISREL 8.72 39). The first-order factors measure cognitive and affective responses and a second-order factor reflects an overall sense of loss regarding self-defined KDRLs. Therefore, the KDLS comprises an overall loss scale by summing the six items (48) and two subscales (see Table 1). High scores are indicative of greater sense of loss, with more rumination and stronger affect. The internal consistence of KDLS was good ($\alpha = 0.88$ for both the cognitive and affective subscales).

The convergent and discriminant validity of KDLS were supported by its significant positive correlation with depression ($r = 0.60$, $P < 0.01$), and negative correlation with QoL ($r = -0.20$, $P < 0.05$) and positive affect ($r = -0.36$, $P < 0.01$). It was unrelated to clinical variables (hemoglobin $r = 0.07$, comorbidity $r = 0.04$, length of time since dialysis $r = -0.15$). Construct

validity was examined by conducting a two-factor EFA of the six KDLS and the seven DASS21 depression items. The depression items loaded onto one factor and KDRL items loaded onto another without cross-loading items.

Patients' nominated losses on KDLS were codified by two independent coders by iteratively examining the data. The intercoder agreement was 95% and the differences in the remaining 5% were resolved by consensus. In total, 109 of 151 respondents nominated 431 losses. Of the 23 types of losses identified, the seven most common were travel (18.56% of the total nominated losses), leisure activities (12.06%), physical functioning (10.90%), employment/work (9.74%), family/personal relationships (6.50%), freedom (perception of being free from constraints; 4.87%) and social life (4.87%). The mean score difference on KDLS between those who did not nominate losses (\bar{x} 5.41) and those who did (\bar{x} 5.84) was nonsignificant ($t = 0.49$, $df = 149$, $P > 0.05$).

Univariate Analyses

There was no gender differences in the variables used in the study. An examination of differences between the two hospitals identified a significant difference in hemoglobin levels (SS-WSAH $\bar{x} = 123.84$ (13.88), SESIAHS $\bar{x} = 117.13$ (14.05), $P < 0.01$); there were no differences on other variables. There were no treatment modality (in-center hemodialysis, home hemodialysis, peritoneal dialysis, satellite hemodialysis) differences on any variable.

Path Analyses

Model Testing and Modification. The structural relationships between length of time on dialysis, hemoglobin, comorbidity, loss, depression, positive affect, and individual QoL were examined using SEM. The hypothesized path model was not supported ($\chi^2 = 16.57$, $df = 8$, $P = 0.04$, RMSEA = 0.09; for all fit statistics see Table 2). Therefore, the model modification process was conducted to improve the model fit by examining the *t*-values of path coefficients, standardized residual values, and modification indexes. The path from hemoglobin to depression was insignificant and thus deleted, and an additional path from comorbidity to positive affect added ($\chi^2 = 7.91$, $df = 13$, $P = 0.85$, RMSEA = 0.00; see Table 2 and Figure 1), indicating a plausible model for the observed data.

As shown in Table 3, each variable explained a small proportion of variance in QoL with positive affect (9.6%) and hemoglobin (4.8%) having the highest direct effect. The effects on positive affect from comorbidity and length of time since dialysis were moderate whereas depression explained the largest proportion (29.2%) of variance in positive affect. Loss explained 38.4% of variances in depression, larger than comorbidity (2.3%) and length of time since dialysis (5.3%), and only had a small effect on QoL fully mediated by depression and positive affect.

Alternative Models

In covariance structure modeling, several equivalent models may exist (40). Two theoretically based alternative mod-

Table 1. The final version of the Kidney Disease Loss Scale (KDLS)^a

When you consider life as it is now with kidney disease and dialysis treatments, it is clearly different from what your life used to be or would have been. You might find yourself having lost many things. Please consider LOSSES: things that you used to do before kidney disease/dialysis and now you cannot do anymore or things that you would have been doing if you did not have kidney disease/dialysis. Please list below the five most important things you have lost because of the kidney disease/dialysis.

- 1:
- 2:
- 3:
- 4:
- 5:

In regard to the five losses described above, please read each of the following statements carefully and circle a number 0, 1, 2 or 3 that indicates how much the statement applied to you

The rating scale is as follows:

- 0 = Did not apply to me at all
- 1 = Applied to me to some degree, or some of the time
- 2 = Applied to me to a considerable degree, or a good part of time
- 3 = Applied to me very much, or most of the time

1. I think about these losses so much that it is hard for me to do the everyday things I normally do	0	1	2	3
2. Memories of the losses upset me	0	1	2	3
3. I am preoccupied with thoughts of the losses	0	1	2	3
4. I feel myself longing for regaining what I have lost	0	1	2	3
5. I feel disbelief over what happened	0	1	2	3
6. I feel stunned or dazed over what happened	0	1	2	3

^aThe first part of the KDLS that requires respondents to nominate the five most important losses must be retained when the KDLS is used, because it sets the context for rating the six items.

els were also tested. Alternative model 1 was to examine if depression has a direct effect on QoL, and alternative model 2 was to investigate the ordinal relations between KDRL and depression. The χ^2 difference statistics showed that alterna-

tive model 1 was not a better model ($\chi^2_D = 1.85, df_D = 1$, nonsignificant, $P < 0.05$; also see Table 2). Alternative model 2 was rejected by the fit statistics (Table 2); depression does not precede KDRL.

Table 2. The goodness-of-fit statistics of the hypothesized, modified, and alternative models^a

Path Models		Goodness-of-Fit Statistics							
Hypothesized path model	χ^2	<i>df</i>	<i>P</i>	GFI	AGFI	RMR	RMSEA	90%CI	CFI
	16.57	8	0.04	0.97	0.89	16.25	0.09	0.02 to 0.14	0.95
Modified path model	χ^2	<i>df</i>	<i>P</i>	GFI	AGFI	RMR	RMSEA	90%CI	CFI
	7.91	13	0.85	0.99	0.97	15.81	0.00	0.00 to 0.05	1.00
Alternative model 1 ^b	χ^2	<i>df</i>	<i>P</i>	GFI	AGFI	RMR	RMSEA	90%CI	CFI
	6.06	12	0.91	0.99	0.98	17.42	0.00	0.00 to 0.03	1.00
Alternative model 2 ^c	χ^2	<i>df</i>	<i>P</i>	GFI	AGFI	RMR	RMSEA	90%CI	CFI
	41.20	13	0.00	0.93	0.84	13.33	0.12	0.08 to 0.16	0.84

^a χ^2 , Satorra-Bentler scaled chi-square; *df*, degrees of freedom; GFI, goodness-of-fit index; AGFI, adjusted GFI; RMR, root mean square residual; RMSEA, root mean square error of approximation; NNFI, non-normed fit index; CFI, comparative fit index.

^bAdditional path from depression to quality of life was added in the model.

^cKidney-disease-related loss precedes depression, given all other parameters being constant.

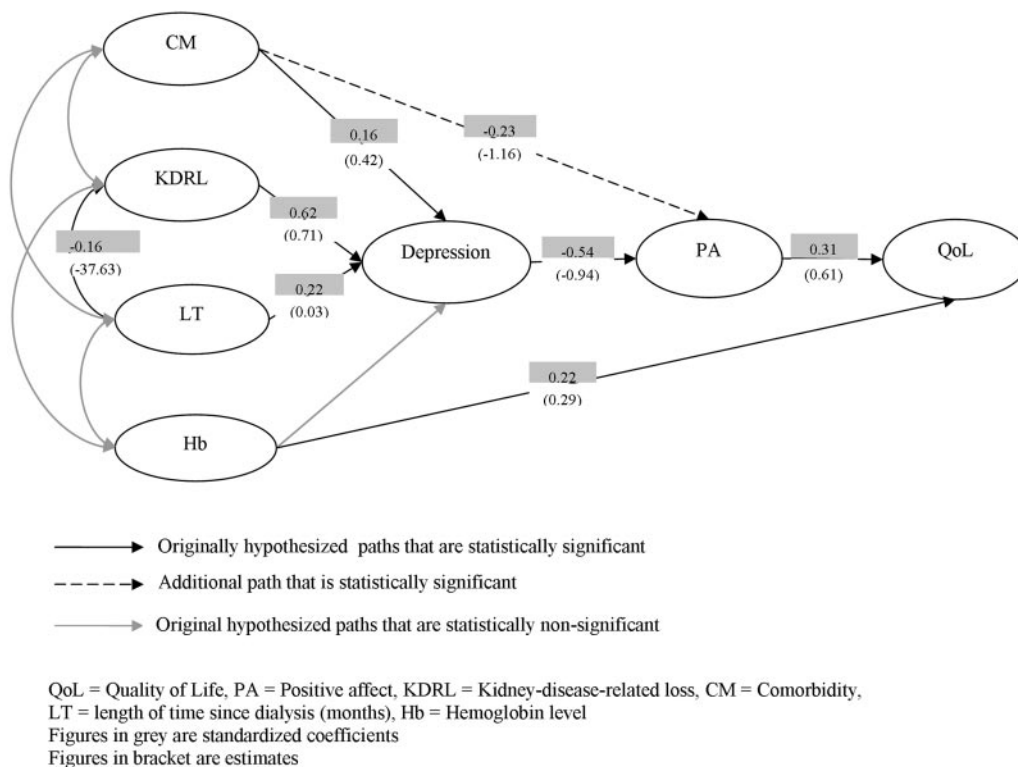


Figure 1. Path diagram of the final modified model of KDRL. QoL, quality of life; PA, positive affect; KDRL, kidney-disease-related loss; CM, comorbidity; LT, length of time since dialysis (months); Hb, hemoglobin level. Figures in grey are standardized coefficients. Figures in brackets are estimates.

KDRL in Relation to the Treatment Location Effect

To further demonstrate the criterion validity of KDRL, a multigroup analysis on the hospital- and home-based dialysis patients was conducted. The poor global fit statistics ($\chi^2 = 135.66$, $df = 38$, $P = 0.00$, RMSEA = 0.19) suggested

differences between the two groups. A reasonable fit ($\chi^2 = 43.87$, $df = 34$, $P = 0.12$, RMSEA = 0.06) of the re-specified model suggested that the main difference was a greater strength of the relations between KDRL, depression, positive affect, and QoL in home-based dialysis patients, although

Table 3. Standardized direct, indirect, total effects of the variables^a

	CMI	Loss	Hemoglobin	Length of Time Since Dialysis	Positive Affect	Depression
Direct effects						
QoL ^b	-	-	0.22	-	0.31	-
Positive affect	-0.23	-	-	-	-	-0.54
Depression	0.16	0.62	-	0.23	-	-
Indirect effects						
QoL	-0.10	-0.11	-	-0.04	-	-0.17
Positive affect	-0.08	-0.34	-	-0.12	-	-
Depression	-	-	-	-	-	-
Total effects						
QoL	-0.10	-0.11	0.22	-0.04	0.31	-0.17
Positive affect	-0.31	-0.34	-	-0.12	-	-0.54
Depression	0.16	0.62	-	0.23	-	-

^aStandardized total effect is the sum of direct and indirect effects of one variable on another variable. Its value ranges from 0 to 1 with either negative or positive direction. The larger the value is, the stronger the effect is.
^bQoL, quality of life.

mean score differences on these variables between the groups were nonsignificant.

Discussion

The study presented here provides empirical support for KDLS and the hypotheses that loss leads to depression, covaries with length of time since dialysis to influence QoL through depression and positive affect, and has greater effect on home-based patients. Moreover, the moderate direct effect that hemoglobin has on QoL is consistent with previous clinical trials showing erythropoietin treatment enhances ESRD patients' QoL (49).

The concept of KDRL is operationalized by KDLS, which has encouraging psychometric properties. Consistent with previous research, depressive and loss symptoms loaded onto separate factors, and the path analyses demonstrated that KDRL precedes depression (7–10). Thus the KDRL is empirically distinct from depression. The cognitive rumination, yearning, disbelief, and stunned responses remain the key symptomatology that contributes to depression.

KDRL as a strong contributor to depression is consistent with the previous theories that loss is a significant cause of depression. Although the findings presented here may not support depression as being an extension of KDRL, whether depression is due to increased vulnerability or cognitive rumination over negative contents of loss remains equivocal. Perhaps, more cognitive rumination items contributing to the total score of KDLS may suggest that cognitive rumination is the underlying mechanism between KDRL and depression. Nevertheless, the findings that travel, leisure activities, and physical functioning are the most nominated types of losses may not be surprising clinically, because many dialysis patients commonly describe their dialysis experiences as being restrictive. Therefore, these results may suggest that to improve patients' depression and QoL, psychosocial interventions could target loss; for example, helping patients to regain losses by helping them to travel or perform activities more, or to process their related thoughts and feelings by reducing their cognitive ruminations. Encouragingly, these findings have already changed the educational practice of one of the renal units where the study was conducted.

Another interesting finding of the study is that the effect of both KDRL and clinical variables on QoL is mediated by depression and positive affect. This shows that disease-specific variables may influence QoL indirectly through psychological states (50). However, the type of psychological states has not been explicitly specified, but rather implicitly assumed to be depression in the ESRD literature. The findings presented here suggest that both positive and negative psychological states could act as mediators. Positive affect may be a distinct factor and has adaptive values buffering the effect of loss and depression on QoL (17,18).

The criterion validity of the KDRL construct is also illustrated by the multigroup analyses showing that a stronger magnitude of the relations between KDRL and other psychological variables exists for home-dialysis patients. For a small increase in their sense of loss, home-based patients experience more depression

and greater decline in positive affect and QoL than do the hospital-based. This may mean that psychosocial interventions for home-based dialysis patients, especially on the KDLS and depression, could result in greater improvement in their QoL and potentially delay the need for hospital-based treatment.

The study presented here has several limitations. The KDLS is a newly developed scale and awaits further research to crossvalidate its validity and reliability. Future research may also focus on item generation for the affective subscale of KDLS to improve its construct validity. Because the main purpose of the path analyses results was to examine the construct validity of the KDLS, the substantive meaning of the model requires replication in different samples. The sample size for the multigroup analyses is considered small in SEM, and although consistent with preliminary expectations, the interpretation of these results should be cautious.

Overall, the study presented here demonstrated the construct and criterion validity of KDRL and the promising psychometric properties of KDLS. KDRL may lead to depression and through it reduces QoL. The effect of depression is mediated by the coping mechanism of positive affect. The development of any new scale requires multiple studies to fully understand its properties. Studies in different populations (*e.g.*, pre- and early-dialysis patients) will also add to the construct validity.

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None.

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