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Factors associated with resilience among patients with end-stage kidney disease receiving hemodialysis in a teaching hospital: a cross-sectional study

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Abstract

Backgrounds Patients with End-Stage Kidney Disease (ESKD) receiving Hemodialysis (HD) face significant psychosocial and physical challenges. Improving their resilience by integrating protective factors is important for effectively managing the difficulties associated with the disease and its treatment. This study intended to identify factors associated with resilience among patients with ESKD receiving HD.

Methods A cross-sectional analytical study was done among 143 patients with ESKD receiving HD in a Tertiary Hospital "A" in Nepal. A non-probability convenience sampling technique was used to select samples. Data were collected following ethical approval through face-to-face interviews. A Nepali version of socio-demographic and clinical characteristics-related questions and five standardized and structured instruments were used to measure resilience, family support, illness cognition, self-efficacy, and self-esteem. Data were analyzed with descriptive and inferential statistics (i.e., correlation and multiple linear regression) using the Statistical Package for Social Science Software version 16.

Results The respondents had intermediate (49.0%), low (27.3%), and high (23.7%) levels of resilience. Illness cognition, self-efficacy, and self-esteem had statistically significant positive associations with resilience. However, age was negatively associated with resilience. These associated variables account for 64.0% of the variance in resilience (Adjusted $R^2 = 0.64$).

Conclusions The highest proportion of patients with ESKD receiving HD had an intermediate level of resilience. Factors such as illness cognition, self-efficacy, and self-esteem play an important role in enhancing resilience while advancing age appears to diminish it. Therefore, focusing on enhancing illness cognition, self-efficacy, and self-esteem with special care on older patients may be an effective strategy for improving resilience in patients with ESKD receiving HD.

Trial registration Not applicable.

Keywords Associated factors, Hemodialysis, Patients with ESKD, Resilience

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Background

Chronic Kidney Disease (CKD) is a clinical and public health problem with an increasing prevalence and mortality worldwide [1]. The prevalence of CKD is 697.5 million (9.1%) globally and 143.17 million in South Asia [1]. There are about 2.6 million cases in Nepal [1], and 7449 patients are receiving hemodialysis (HD) [2]. Patients with End-Stage Kidney Disease [ESKD] typically require multiple medications, dietary and lifestyle modification, fluid restriction, regular medical evaluation, and renal replacement therapy until successful kidney transplantation [3]. Although HD is a lifesaving treatment for ESKD [3], patients receiving HD suffer from psychosocial and physical problems such as fatigue, depression, anxiety, and stress [4, 5]; chronic pain, and poor sleep [6]. Despite the availability of free lifetime HD services in Nepal, patients may still experience increased physical and psychological stress [4, 5] due to medical and non-medical expenses, opportunity costs, and the need for long-distance travel to access these services [7, 8]. Moreover, Nepalese patients with ESKD receiving HD often face economic challenges as a result of employment disruptions and frequent hospitalizations [9]. In addition, they frequently experience feelings of isolation because of the necessity of staying in rented accommodations away from their families to access treatment [9].

Patients with ESKD receiving HD often face challenges with treatment adherence [10], emphasizing the need to build resilience as part of patient care [11]. Resilience, defined as the ability to adapt and adjust to challenging life experiences [12], is a dynamic trait influenced by personal characteristics, cultural background, contextual factors, and the level of stress exposure [13]. Consequently, patients' resilience can significantly affect their ability to manage and adapt to the challenges of ESKD and its treatment [11]. In line with this, previous cross-sectional studies showed varying levels of resilience among patients with ESKD receiving HD, with moderate levels of resilience reported in Thailand [14] and low levels of resilience in Taiwan [15]. Although evidence on resilience in Nepalese patients with ESKD is limited, similar patterns of low [16] and intermediate levels [17] of resilience have been documented among spinal cord injury survivors [16] and disaster survivors [17]. Therefore, building resilience is essential, as it has been shown to reduce stress, anxiety, and depression [18]; improve treatment adherence [19, 20], foster physical and psychological well-being [19, 21], and enhance the overall quality of life [18] in patients with chronic diseases. The Metatheory of Resilience and Resiliency, previous studies, and systematic reviews highlighted key protective factors such as family support [14, 22–24], hope [14, 25], illness cognition [22, 26], optimism [14, 22, 27], self-efficacy [14, 16, 22, 28, 29], self-esteem [22, 28, 30], social support [22, 23, 26, 27] and spiritual well-being [30–32]. Moreover, factors like subjective well-being, happiness, self-determination, self-control, faith, and wisdom enable individuals to adapt and thrive while facing difficulties [22]. Similarly, the Aging-related Resilience Theory highlights that older people can adapt to and overcome adversities throughout life [33]. Moreover, a systematic review emphasized the importance of mental health, adaptive coping, self-compassion, social functioning, access to information, and skills in nutrition and stress management in promoting resilience in patients with chronic diseases [28]. Furthermore, socio-demographic factors, such as higher education [34] and socioeconomic status [27], were positively associated with resilience, highlighting the influence of social determinants in enhancing an individual's resilience.

While protective factors are essential for promoting resilience, many studies on patients with ESKD in Nepal have focused on negative psychological constructs like depression and anxiety, rather than positive concepts such as resilience. Similarly, global studies have often examined individual protective factors of resilience rather than integrating multiple factors into a single study. Building on this gap, the metatheory of resilience and resiliency [22], systematic reviews, and prior empirical studies on resilience among patients with ESKD and other population groups were used to select relevant factors associated with resilience in this study (See Fig. 1). The study specifically aimed to (1) identify the level of resilience and other associated variables, and (2) analyze the factors such as [socio-demographic variables (i.e., age and educational status) and clinical variables (duration of disease), family support, illness cognition, self-efficacy, and self-esteem associated with resilience among patients with ESKD receiving HD.

Methods

Study design and place of study

A quantitative cross-sectional analytical study was conducted among 143 patients with ESKD receiving HD at the HD Unit of Tertiary Hospital "A", Nepal (See Fig. 2). Since 2016, this hospital has been offering free HD services to patients with ESKD with support from the Government of Nepal, serving approximately 40 to 50 patients daily across various shifts. With a consistently high bed occupancy rate and 155 patients receiving maintenance HD, this center was selected for the study. The study report was prepared based on the STROBE cross-sectional reporting guidelines [35].

Sample size and sampling technique

The calculated sample size was 154 using the formula [36]: n = $\frac{Z^2\sigma^2}{e^2}$, finite population correction formula:

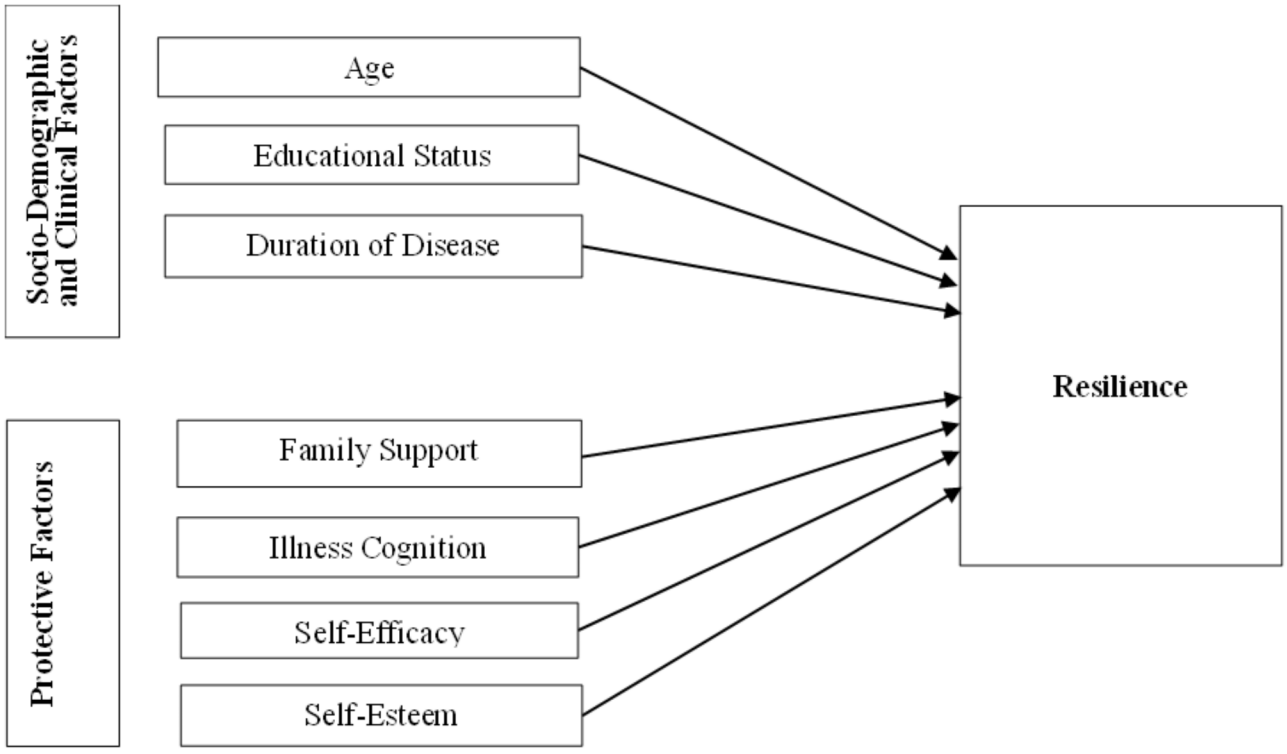

Fig. 1 Proposed conceptual framework of factors associated with resilience among patients with end-stage kidney disease receiving hemodialysis

$n = \frac{n_0}{1+\frac{(n_0-1)}{N}}$, and an 8.0% attrition rate according to prior evidence [27], where, n = required sample size, Z = 1.96 for 95% of the confidence interval, σ = standard deviation of the previous study [27]: 15.2, and n = 143.

However, the final sample size was 143 patients with ESKD receiving HD who were selected employing a non-probability convenience sampling technique. The inclusion criteria of selecting samples were: patients (1) who were aged 18 years and older diagnosed with ESKD who were receiving maintenance HD in the HD unit of a tertiary hospital; (2) who were willing to participate in the study; and (3) free from cognitive decline. Likewise, patients aged 60 years and older were assessed for cognitive ability through information from family members, HD unit staff, and direct communication with the patients. Exclusion criteria included patients (1) who were unable to speak Nepali, (2) who could not comprehend the instructions, and (3) who were receiving HD on an emergency basis.

Instruments

Six structured instruments were used to collect data. The first instrument included sociodemographic and clinical variables. Five other structured, valid, reliable, and standard instruments were used. The detailed description of instruments is described in Table 1.

Sociodemographic and clinical variables The authors included these variables based on the literature which included six questions. There were three open-ended questions, i.e., age, duration of disease, and duration of HD, and three additional questions on sex, educational level, and frequency of HD in a week.

The family apgar scale (five items) The scale was developed by Smilkstein in 1978 [37]. It was used to assess the patient's satisfaction with family support in a difficult situation, problem-solving, adapting to changing lifestyles and negative psychological effects (e.g., anger, sorrow, and love), and the time the patient is receiving from family [37]. The validity and reliability of the scale were established during the developmental stage [38]. The family support was categorized as scores 0–3 as 'high dysfunctional', 4–6 as 'moderate dysfunctional', and 7–10 as 'high functional' family [37].

Illness cognition questionnaire (ICQ-18 items) Evers and Kraaimaat developed this scale in 2001 [39]. It was used to assess the patient's perception or understanding of the disease, such as accepting illness, overcoming disease-related limitations, recognizing positive changes related to disease, realizing life priorities, and enjoying every moment of joy despite the disease's impact [39]. The validity and reliability of this scale were established among adult patients with rheumatoid arthritis and mul-

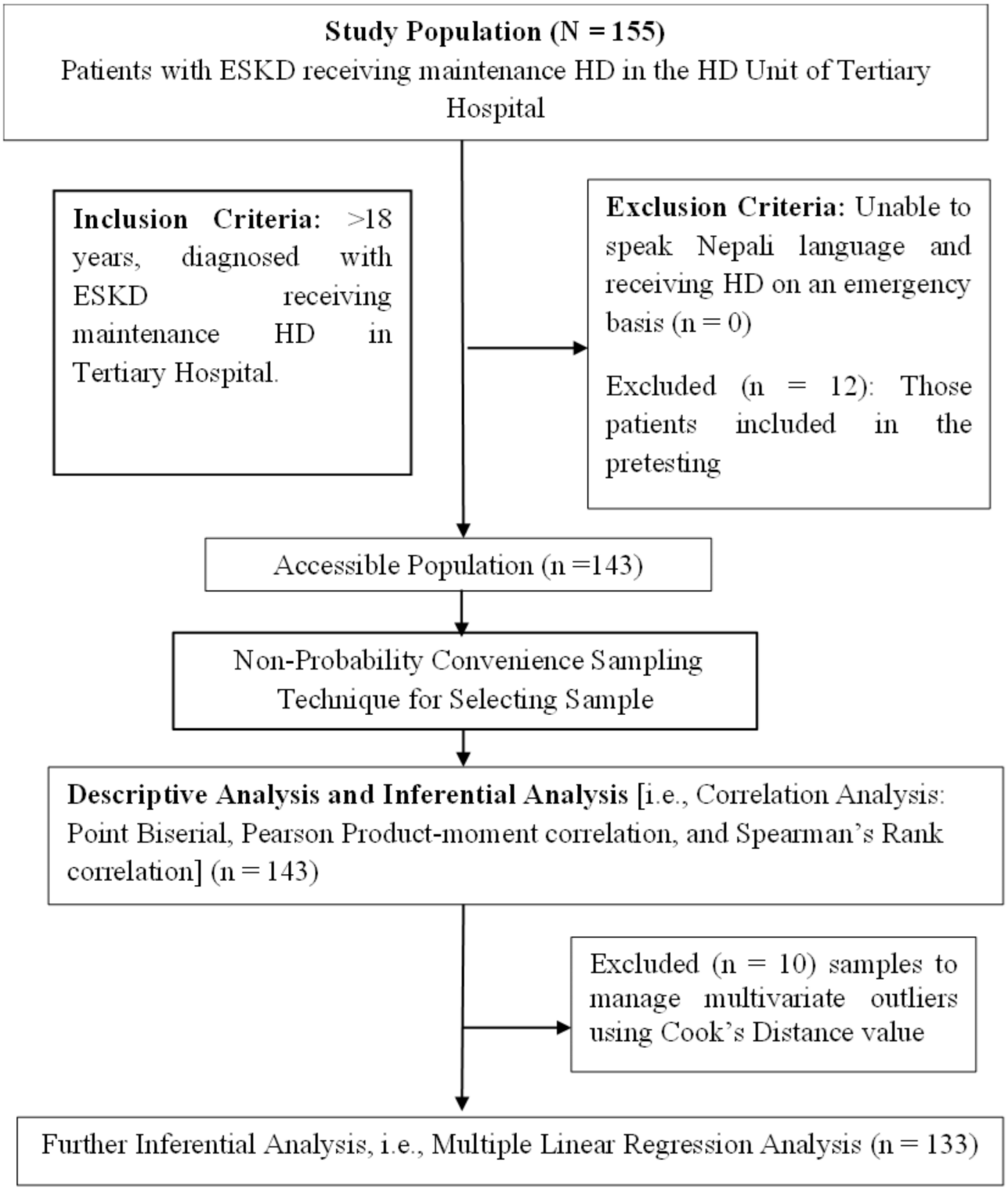

Fig. 2 Study population, sample recruitment, and final sample size with analytical techniques for cross-sectional study. Note. ESKD = end-stage kidney disease, HD = Hemodialysis

Table 1 Description of instruments used in this study

Name of Instruments with Examples of Items	Number of Items	Response Format	Range of Total Score	Cronbach's (α) of this Study	
				Pretesting (*n* = 12)	Current Study (*n* = 143)
1. Socio-demographic and Clinical Characteristics: Age, sex (male and female) educational status [four option items, i.e., (a) No education = No formal education, (b) basic level = ≤ 8 class, (c) secondary level = 9 ≤ 12 class, and (d) More than secondary level = > 12 class education]. Duration of disease, duration of HD, frequency of HD in a week (three option items)	6	Yes/No of the given options	-	-	-
2. Connor and Davison Resilience Scale (CD-RISC-10) [47, 48]. *"I tend to bounce back after illness, injury, or other hardships."*	10	5-Point Rating Responses: Not True at All (0) to True Nearly at All the Time (4)	0–40	*α* = 0.94	*α* = 0.85
3. Family APGAR Scale [37]. *"I am satisfied with the help that I receive from my family when something is troubling me."*	5	3-Point Rating Responses: Hardly Ever (0) to Almost Always (2)	0–10	*α* = 0.89	*α* = 0.83
4. Illness Cognition Questionnaire [39] (Subdivided into 3 subdomains [6 items in each domain i.e., helplessness, acceptance, and perceived benefits]) [39]. *"Dealing with my illness has made me a stronger person."*	18	4-Point Rating Responses: Not at All (1) to Completely (4)	18–72	*α* = 0.81	*α* = 0.78
5. General Self-Efficacy Scale (GSE-10) [41]. *"If someone opposes me, I can find the means and ways to get what I want".*	10	4-Point Rating Responses: Not at All True (1) to Exactly True (4)	10–40	*α* = 0.93	*α* = 0.90
6. Rosenberg Self-esteem Scale (RSES) [43]. *"I feel that I have a number of good qualities".*	9 (Positively and Negatively Worded) [44]	4-Point Likert Scale: Strongly Disagree (0) to Strongly Agree (3)	0–27	*α* = 0.78	*α* = 0.71

Note. HD = Hemodialysis

tiple sclerosis in the Netherlands [39]. The level of illness cognition was categorized based on the mean scores of each item from the current study sample: scores ≤ 2 were classified as 'somewhat,' scores > 2 to 3 as 'to a large extent,' and scores > 3 as 'completely' [40].

General self-efficacy scale (GSE-10) The scale was developed by Jerusalem and Schwarzer in 1981 [41]. It was used to assess the patient's belief in the capability or confidence to manage and cope with the challenges and stressors the patient faces daily. The level of self-efficacy was categorized using the median cut-off point of the current study sample: scores ≤ 23 were classified as 'low,' and scores > 23 were classified as 'high' [42]. This tool's validity and reliability were established during the developmental stage [41]. Permission to use the Nepali translation of the GSES scale was obtained from the author who had used it in their research among older disaster survivors [30].

Rosenberg self-esteem scale (RSES) The scale was developed by Dr. Morris Rosenberg in 1965 [43]. It was used to assess a patient's feelings about one's worth or values as a person or favorable or unfavorable attitude towards self. A valid and reliable Nepali version of RSES comprising nine items [44] was used in the study. The level of self-esteem was categorized as follows: scores of 0–15 were classified as 'low,' 16–25 as 'intermediate (normal),' and 26–27 as 'high' [45].

Connor and davison resilience scale (CD-RISC-10) It was used to assess resilience, originally developed by Connor and Davidson [46], later reanalyzed the item and finalized it into 10 items [47]. The valid and reliable Nepali version of CD-RISC-10-NP [48] was used in the study. The level of resilience was categorized based on the quartile range of the current study sample: scores ≤ 13 were classified as 'low' (1st quartile), scores 14–25 as 'intermediate' (2nd and 3rd quartiles), and scores > 25 as 'high' (4th quartile) [49]. The authors obtained permission to use the scale from the original tool developer, Professor Davidson through email.

The Family APGAR Scale, GSES, ICQ, and RSES are available in the public domain. Family APGAR scale and ICQ were translated into Nepali following the guidelines

proposed by Borsa et al. [50] (See Supplementary Figure S1). Pretesting was done among 12 patients with ESKD receiving HD in Tertiary Hospital "A" who were excluded from the final samples of this study. The tools' reliability was assessed using Cronbach's alpha, with scores ranging from 0.78 to 0.94 which was deemed acceptable according to criteria established by Polit and Beck [51] (See Table 1).

The CD-RISC-10-NP, Family APGAR Scale, ICQ, GSES, and RSES are well-established, validated, and reliable instruments frequently used in previous research. In the context of psychometric analysis, factor loadings in Exploratory Factor Analysis (EFA) are a critical component, as they evaluate the relationships between observed variables and latent constructs [52]. Moreover, EFA plays a vital role in assessing the construct validity of a measurement tool. In this study, EFA with 143 samples indicated that all items demonstrated factor loadings above 0.2, which is acceptable based on the guidelines cited in Kellar and Kelvin [52] (See Supplementary Tables S1-S3). However, the authors chose not to proceed with further analysis or remove items with low factor loadings, as they attributed the issue to insufficient sample size for conducting the EFA and confirmatory factor analysis [CFA]. Additionally, the reliability coefficients of these scales, based on the sample data, are presented in Table 1.

Data collection method

The primary author collected data through face-to-face interviews with patients with ESKD at their bedside in the HD unit. The interviews were conducted during dialysis sessions, using a curtain for privacy, and employed Nepali versions of structured instruments. The authors collected data from 13 August to 23 September 2023 by adopting all the ethical principles and procedures. The interview with each respondent lasted approximately 40 min. Field editing was conducted after each interview. Three respondents were re-approached to address missing information with their consent before they left the HD unit. The interview process was immediately stopped for two respondents who experienced discomfort during data collection. However, complete data were collected from them during a subsequent HD session with their consent. Thus, the authors successfully collected the required sample size ($n = 143$) within the allotted time.

Ethics approval and consent to participate

All procedures were performed in alignment with the ethical principles outlined in the Declaration of Helsinki and in accordance with relevant national regulations. Ethical approval (Approval Number [Ref. No.]: PNA2308011785) from the Institutional Review Committee of Patan Academy of Health Sciences, Tertiary Hospital 'A', Nepal was obtained. Before inclusion in the study, informed written consent was obtained from all the respondents (signature or thumbprint) using an informed written consent form. For those respondents who could not sign or provide a thumbprint but were able to comprehend and communicate effectively, verbal informed consent was obtained from the respondents and written informed consent was obtained from their guardians. Other ethical procedures such as confidentiality and privacy were maintained.

Statistical analysis

Descriptive statistics were used to assess socio-demographic and clinical characteristics, level of resilience, illness cognition, family support, self-efficacy, and self-esteem. Inferential statistics, namely the Correlation test was used to examine the relationship and multi-collinearity, using the Statistical Package Social Science Software-16 version [53]. Point Biserial Correlation was used for educational status (uneducated = 0, educated = 1); Pearson Product Moment Correlation for age, illness cognition, self-efficacy, and self-esteem; and Spearman Rank Correlation for duration of disease and family support with resilience after meeting the assumption test (See Table 4).

Assumptions of multiple linear regression were assessed by applying the cut-off points of different statistics. There were no missing data. All the variables were assessed in an interval/ratio scale, however, educational status was included as a dummy-coded variable, where '0' represented uneducated respondents ($n = 56$) with no formal education and '1' represented educated respondents ($n = 87$) with formal education. The cut-off value of multicollinearity was determined by a correlation value (r) ≥ 0.80, a tolerance value < 0.2, and a variance inflation factor (*VIF*) of more than 10 based on prior reference [54]. The diagnostic indicators of autocorrelation consider a value lower than 1.5 of the residual models [54]. Ten cases with influential outliers were removed based on Cook's Distance and standardized residual [55]. Then, the results of the assumption tests indicated no multivariate outliers based on Cook's Distance and standardized residual value (i.e., -1.99 to 2.91); correlation ($r = -.01$ to 0.70), *VIF* (1.10 to 2.71), and tolerance (0.37 to 0.91). There was no evidence of autocorrelation, as shown by the Durbin-Watson statistic (i.e., 1.82).

Additionally, homoscedasticity and linearity were confirmed through scatter plots and normal P-P plots. Multivariate normality of residuals was supported by skewness (0.25), kurtosis (-0.25), and the Shapiro-Wilk test ($p = .340$). The duration of the disease was not included in this model as it was not significantly correlated with resilience. Finally, multiple linear regression analyses were conducted on data from 133 samples, focusing on variables correlated (i.e., age, educational

Table 2 Socio-demographic and clinical characteristics of Respondents $N = 143$

Socio-Demographic Characteristics	Frequency (*n*)	Percentage (%)
Age Group in completed Years [a]		
Young Adult (18 ≤ 40)	50	35.0
Middle Adult (40 ≤ 65)	69	48.3
Older Adult (> 65)	24	16.8
Minimum to Maximum Age in Years (19–83)		
Mean ± SD (49.32 ± 16.24)		
Sex		
Male	88	61.5
Female	55	38.5
Educational Status [b]		
No education (No Formal Education)	56	39.2
Basic Level (≤ Class 8)	50	35.0
Secondary Level (9 to ≤ Class 12)	27	18.8
More than Secondary Level (> Class 12)	10	7.0
Duration of Disease		
≤ 5 Years	100	71.3
> 5 Years	43	28.7
Median, IQR (3.26, 5.50)		
Minimum to Maximum Years of Having Disease (0.08-28.0)		
Duration of HD		
≤ 5 Years	127	88.8
> 5 Years	16	11.2
Median, IQR (1.58, 3.25)		
Minimum to Maximum Years of Doing Hemodialysis (0.08-12.0)		
HD in a Week		
1 Time	5	3.5
2 Times	111	77.6
3 Times	27	18.9

Note.[a] = age categorization based on Erik Erikson's psychosocial development [56]. [b] = Educational Status categorization based on Nepal Demographic and Health Survey, 2022 [57]. *SD* = Standard deviation, *IQR* = Inter Quartile Range, *HD* = Hemodialysis

status, family support, illness cognition, self-efficacy, and self-esteem) with resilience to assess the impact of the independent variables on the dependent variable (i.e., resilience) [54] (See Table 5). The significance *p*-value for the inferential analysis of the study was $p < .05$.

Results

Sociodemographic and clinical related characteristics

The highest percentage of respondents belonged to an age group of 40–65 years (48.3%) and were male (61.5%). A nearly equal proportion of the respondents did not have any formal education (39.2%) and had basic education up to Class Eight (35.0%). For the majority of respondents, the duration of ESKD was five years or less (71.3%) and the duration of HD was five years or less (88.8%). Additionally, 77.6% of the respondents underwent HD twice weekly (See Table 2).

Descriptive analysis of study variables

The highest proportion of the respondents had intermediate [neither low nor high] (49.0%) followed by low (27.3%), and high (23.7%) levels of resilience. Likewise, the highest proportion of the respondents had high functionality family (74.8%), to a large extent [neither low nor high] of illness cognition (67.8%), low self-efficacy (53.1%), and intermediate [normal] level of self-esteem (64.3%) (See Table 3).

Correlation between independent variables with resilience

The correlation between independent variables and dependent variable i.e., resilience is shown in Table 4. Education ($r_{pb} = 0.23$, $p < .01$), family support ($r_s = 0.24$, $p < .01$), illness cognition ($r = .59$, $p < .01$), self-efficacy ($r = .70$, $p < .01$) and self-esteem ($r = .59$, $p < .01$) were statistically significantly positively correlated with resilience. However, there was an inverse relationship between age

Table 3 Descriptive analysis of the respondents' resilience, family support, illness cognition, self-efficacy and self-esteem. $N = 143$

Variables	Possible Range Score	Observed Range Score	Mean	SD	Skewness with Standard Error & Kurtosis with Standard Error	Z-score of Skewness and Kurtosis	Level (%)	Collinearity Test: Tolerance & VIF
Resilience	0–40	3–36	18.85	7.55	0.19 (0.20); −0.77 (0.40)	0.95, -1.93	Low = 27.3% Intermediate = 49.0%, High = 23.7%	-
Family Support	0–10	0–10	*Md* = 9.00,	*IQR* = 4.00	-1.36 (0.20); 1.20 (0.40)	-6.80, 3.00	High Dysfunctional = 7.7% Moderate Dysfunctionality = 17.5% High Functionality Family = 74.8%	0.91, 1.10
Illness Cognition	18–72	24–62	41.53	7.31	0.21 (0.20); −0.05 (0.40)	1.05, −0.125	Some What = 28.0%, To a large extent = 67.8%, and Completely = 4.2%	0.45, 2.23
Self-Efficacy	10–40	12–38	23.37	5.75	0.19 (0.20); −0.27 (0.40)	0.95, −0.65	Low = 53.1%, High = 46.9%	0.37, 2.71
Self-Esteem	0–27	9–27	15.85	3.07	0.29 (0.20); −0.28 (0.40)	1.45, −0.70	Low = 35.7%, Intermediate Level = 64.3%	0.53, 1.90

Note. All the variables (except family support) lie within the range of normality of medium samples ($N = 50–300$) based on prior reference [58]. Tolerance and variance of the regression model for age and educational status were 0.775, 1.290, and 0.795, 1.258, respectively. *SD* = Standard deviation, *Md* = Median, *IQR* = Inter Quartile Range, *VIF* = Variance Inflation Factor

Table 4 Correlation of respondents' age, educational status duration of disease, family support, illness cognition, self-efficacy and self-esteem with resilience. *N* = 143

Dimension	1	2	3	4	5	6	7	8
1. Age [a]	-							
2. Educational Status (0 = Uneducated, 1 = Educated) [b]	−0.26**	-						
3. Disease Duration [c]	−0.01	−0.04	-					
4. Family Support [c]	0.01	0.07	0.09	-				
5. Illness Cognition [a]	0.27**	0.33**	0.14	0.27**	-			
6. Self-Efficacy [a]	−0.40**	0.34**	0.05	0.30**	0.66**	-		
7. Self-Esteem [a]	−0.03	−0.09	−0.02	0.22**	0.55**	0.56**	-	
8. Resilience	−0.35**	0.23**	0.16	0.24**	0.59**	0.70**	0.59**	-

Note.[a] = Pearson- product-moment correlation. [b] = Point Biserial correlation. [c] = Spearman's Rank Correlation test. ** = Correlation significant at the $p < .01$ level (2-tailed). **Normality of data** by using graphical presentation [histogram and Probability (P-P) plot] and statistics (skewness, kurtosis, z-score of skewness and kurtosis) (See Table 3). **Absence of outliers and linear relationships** between two variables by using box plot and scatter plot, respectively. **Homogeneity of variance** by using Leven's test, i.e., based on the *p*-value of educational status ($p = .980$) with resilience, achieved assumption based on prior reference [54]. **Educational Status**: Uneducated: Respondents who did not have formal education ($n = 56$) and educated: Respondents who had formal education ($n = 87$)

Table 5 Multiple regression analysis of factors associated with resilience *N* = 133

Variables	B	Standard Error	β	*p*-value	95% CI [LL, UL]
Age	−0.08	0.03	−0.17	0.004**	[-0.13, −0.02]
Education (0 = Uneducated, 1 = Educated)	−0.79	0.86	−0.05	0.358	[-2.49, 0.91]
Family Support	−0.01	0.16	0.01	0.959	[-0.31, 0.32]
Illness Cognition	0.17	0.08	0.17	0.031*	[0.02, 0.32]
Self-Efficacy	0.58	0.11	0.44	0.000***	[0.35, 0.80]
Self-Esteem	0.58	0.17	0.25	0.001**	[0.25, 0.92]

Note. Dependent Variable: Resilience. * = *p* value significant at < 0.05 level (2-tailed). ** = *p* value significance at < 0.01 level (2-tailed). *** = *p* value significance at < 0.001 level (2-tailed). *B* = Unstandardized Beta, *β* = Standardized Beta, **Adjusted** $R^2 = 0.64$

($r = -.35$, $p < .01$) and resilience. No significant correlation was found between the duration of disease and resilience.

Factors associated with resilience

Results showed that the illness cognition ($\beta = 0.17$, $p \leq .05$), self-efficacy ($\beta = 0.44$, $p \leq .001$), and self-esteem ($\beta = 0.25$, $p \leq .01$) were statistically significantly positively associated with resilience. These were protective factors of resilience. However, age (β = -0.17, $p \leq = 0.01$) was statistically significantly negatively associated with resilience indicating that the higher the age of the respondent, the lower the resilience score. Education and family support, although statistically significantly positively correlated with resilience, had no significant association with resilience in multiple linear regression analysis while adjusting with other variables. The protective factors, i.e., illness cognition, self-efficacy, and self-esteem, and negative factors, i.e., age explained 64.0% of the total variance in resilience (See Table 5 and Fig. 3).

Discussions

This cross-sectional study among 143 patients with ESKD receiving HD in a tertiary hospital was designed to identify resilience, family support, illness cognition, self-efficacy, self-esteem, and the factors associated with resilience. The majority of patients with ESKD receiving HD in the present study exhibited an intermediate (neither low nor high) level of resilience, similar to studies in Brazil [59], Iran [32], and Thailand [14], while lower resilience levels were reported in Taiwan [15] and India [60]. In contrast, the current study indicates that the majority of patients had high-functioning families, aligning with previous research in Korea [61], China [62], and Indonesia [63]. This similarity may be attributed to the role of family members, who serve as primary caregivers and provide both emotional and practical support [13]. A possible reason for the high-functioning families in the current study could be confounding bias, where patients with strong family support had better health outcomes and longer survival, allowing them to continue dialysis. Conversely, patients with weaker family support may have faced worse health outcomes, leading to earlier mortality and their absence from the study sample.

Additionally, the study reveals that the majority of the patients had to a large extent [neither low nor high] illness cognition, consistent with findings in Indonesia [64], likely due to disease awareness from health professionals, family, and other resources [13]. Furthermore, the present study shows that the highest proportion of patients had a low level of self-efficacy, similar to findings from Taiwan [65], while contrasting with studies from Saudi Arabia [66] and Nepal [67], where self-efficacy was moderate. In addition, the majority of patients had an intermediate level of self-esteem, which aligns with studies in Brazil [68] and Nepal [30]. However, a higher level of self-esteem was reported in Egypt [69] and lower self-acceptance (i.e., a component of self-esteem) in Indonesia [63]. The variation in resilience levels [15, 60], self-efficacy [63,

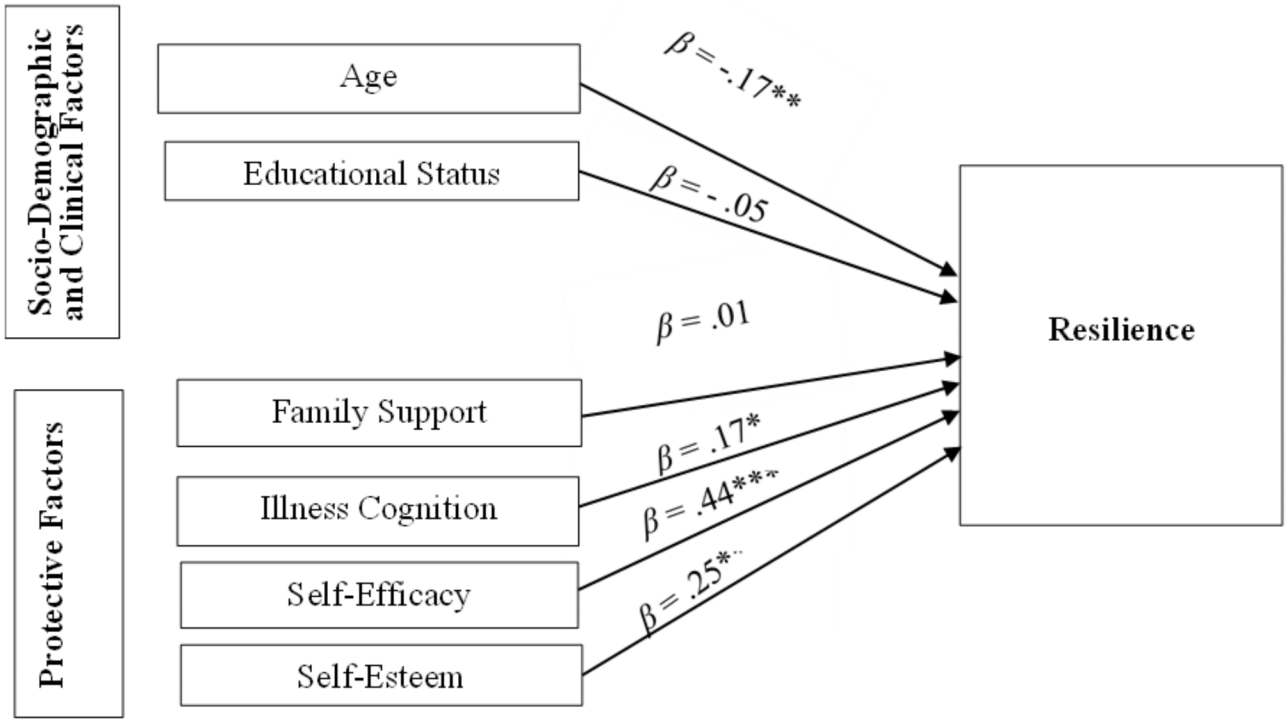

Fig. 3 Factors Associated with Resilience Among Patients with End-Stage Kidney Disease Receiving Hemodialysis After Excluding Disease Duration. *N* = 133

69], and family support [14, 23–25] can be explained by differences in measurement tools, scoring criteria, and analytical methods, as well as cultural factors influencing patients' perception of family support [14, 23–25]. Moreover, resilience levels might also be influenced by demographic characteristics (e.g., age) [15]; exposure to stressors (e.g., disease status and treatment), and contextual factors [13].

This study emphasizes that advancing age is associated with reduced resilience, which is consistent with studies in Brazil [34], Turkey [23], and Nepal [17]. However, it contrasts with other studies from Brazil [59], Turkey [31], and India [60], where no significant association was found. As individuals age, they become increasingly vulnerable to physical and psychological health challenges, including comorbidities [13]. On the other hand, the present study reveals a statistically non-significant association between educational status and resilience, which is consistent with studies in Iran [32], Korea [29], and Nepal [16]. However, this finding contrasts with studies from Brazil [34], Turkey [31], and China [27], where a significant positive association between education and resilience was found. Similarly, the current study reveals a statistically non-significant association between the duration of disease and resilience, consistent with previous studies in Turkey [23], Korea [70], and China [27]. However, the finding contrasts with a study in Turkey [31] which reported lower resilience in patients with a disease duration of five years or more. Notably, the current study shows a statistically non-significant association of family support with resilience, contrasting with studies in Turkey [23], Japan [24], and Thailand [14], which reported a statistically significant positive association. The non-significant association between family support and resilience in the study may be attributed to a potential ceiling effect [71] as the majority of patients reported a high level of family support, with a median score of 9 on a 0–10 scale. Likewise, this lack of non-significant association in the current study may be attributed to factors like social isolation [9, 72]; disrupted family relationships from relocation for treatment, and limited social engagement caused by treatment schedules [9]. Additionally, the severe burden of illness, financial strain, and psychological distress likely overwhelmed patients [9], diminishing the effectiveness of family support in fostering resilience.

In contrast, the current study reveals a statistically significant positive association between illness cognition and resilience, a finding consistent with a previous study conducted in Iran [26], and the meta-theory of resilience and resiliency [22]. Religious beliefs and an optimistic worldview foster cognitive appraisal [73] and enhance emotional well-being [74], which aligns with the positive role of religious practices in Nepalese culture. In Nepal, where Hinduism is predominant, religious practices such

as prayer, meditation, rituals, reading sacred texts, and reflecting on concepts like karma and the afterlife play a vital role in promoting peace, hope, and positive thinking [75, 76], thus contributing to mental well-being [76]. Moreover, the current study shows a statistically significant positive association of self-efficacy and self-esteem with resilience, consistent with previous studies in Nepal [30], and the metatheory of resilience and resiliency [22]. This finding is supported by Safi et al. [77] who highlighted that people with self-confidence tend to engage in better self-care, improving disease management. In line with this, Nepalese patients with ESKD viewed HD as a lifesaving intervention [9, 72]; accepted their new reality, and adapted by employing problem-focused strategies, positive coping mechanisms, and spiritual-religious practices [9]. Consequently, these approaches likely strengthened their self-esteem and self-efficacy, thereby enabling them to maintain emotional stability and resilience despite the substantial burdens of their illness [9]. In addition, individuals with higher self-esteem are better equipped to cope with stress and adversity, as self-esteem plays an important role in shaping expectations, emotional health, relationships, decision-making, and motivation to face new challenges [78]. Moreover, personal, social environmental, and disease-specific factors collectively influence resilience [79]. These factors can shape an individual's ability to adapt and cope with challenges, potentially explaining both significant and non-significant findings in resilience studies.

Although economic status and family support significantly influence resilience, this study did not specifically examine their impact on patients with ESKD undergoing HD. However, factors such as satisfaction with care and services, the positive attitude of nurses, government support for free HD, and access to medication through health insurance boost self-confidence and resilience by alleviating stress and financial burdens [72]. Thus, these factors may have confounding effects on resilience. Furthermore, consistent findings suggest that belief in one's abilities is vital for adapting to daily challenges and stressors. Incorporating counseling and peer support groups into patient care could further enhance resilience by fostering self-confidence, as patients observe others successfully navigating similar challenges [13]. Building on this perspective, this study aimed to bridge existing gaps in the literature while offering valuable insights into protective elements that enhance resilience. Consequently, these findings can guide the development of interventions to enhance self-efficacy, self-esteem, and illness cognition, foster family support, and ultimately improve resilience and psychological well-being among patients.

Limitations

The findings may be broadly relevant to patients with ESKD receiving HD. However, this study was limited by the convenience sampling approach. Additionally, this study was conducted among patients from a single tertiary hospital. Response and social desirability bias may have occurred due to face-to-face interviews conducted at the bedside during HD, where distractions and discomfort could have influenced the patients' responses. Additionally, as a cross-sectional study, it only provides data from a single point in time, which limits the ability to establish cause-and-effect relationships due to potential threats related to temporal ambiguity. Additionally, this study did not capture other potentially influential factors such as spirituality and religiosity, economic status, social support beyond family support alone, optimism, social functioning, activities of daily living, and self-compassion, all of which have been highlighted in previous studies. Furthermore, the study's sample size was insufficient for conducting a robust Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA), limiting the ability to evaluate the construct validity of the measurement tools fully.

Implications and recommendations

The findings may be helpful for nurses and healthcare professionals to conduct health education programs emphasizing resilience and its protective factors while developing targeted strategies such as self-efficacy training, cognitive behavioral therapy, and formulating support groups to enhance resilience among patients with ESKD receiving HD. Future research should focus on culturally sensitive qualitative studies, and multicentric studies with larger sample sizes using probability sampling to generalize findings and explore the factors contributing to resilience. Experimental studies are recommended to establish causal relationships. Future studies should focus on conducting CFA of the Nepalese versions of resilience, family support, illness cognition, self-efficacy, and self-esteem scales with a sufficiently large sample to evaluate their psychometric properties.

Conclusions

The majority of patients with ESKD receiving HD in this study had an intermediate level of resilience and self-esteem, high-functioning families, to a large extent illness cognition, and a low level of self-efficacy. Age, illness cognition, self-efficacy, and self-esteem were statistically significant factors associated with resilience. The study findings suggest that healthcare professionals should assess and consider these factors when providing care to patients with ESKD receiving HD with special consideration for older patients. Addressing these factors may help patients with ESKD receiving HD adapt more

effectively to their disease and, in turn, enhance their overall well-being.

Abbreviations

CD-RISC	Connor & davidson resilience scale
CKD	Chronic kidney disease
CFA	Confirmatory factor analysis
CI	Confidence interval
EFA	Exploratory factor analysis
ESKD	End-stage kidney disease
GSES	General self-efficacy scale
HD	Hemodialysis
ICQ	Illness cognition questionnaire
IQR	Inter quartile range
RSES	Rosenberg self-esteem scale
SD	Standard deviation
VIF	Variance inflation factor

Supplementary Information

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Supplementary Material 1

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Author contributions
Both authors met the criteria of authorship and were involved in: Conception of the original research idea and study design: BP & RT: Data collection: BP collected data under the supervision of RT. Data analysis and synthesis: BP & RT. Drafting, revising, and finalizing the manuscript: BP & RT. Acknowledge shared responsibility for all aspects of the work and the final manuscript: BP & RT. Both authors reviewed the manuscript.

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Data availability
The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request. In addition, some additional information has provided in additional document.

Declarations

Ethics approval and consent to participate
All procedures were performed in alignment with the ethical principles outlined in the Declaration of Helsinki and in accordance with relevant national regulations. Ethical approval (Approval Number [Ref. No.]: PNA2308011785) from the Institutional Review Committee of Patan Academy of Health Sciences, Tertiary Hospital 'A', Nepal was obtained. Before inclusion in the study, informed written consent was obtained from all the respondents (signature or thumbprint) using an informed written consent form. For those respondents who could not sign or provide a thumbprint but were able to comprehend and communicate effectively, verbal informed consent was obtained from the respondents and written informed consent was obtained from their guardians. Other ethical procedures such as confidentiality and privacy were maintained.

Consent for publication
Not Applicable.

Competing interests
The authors declare no competing interests.

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