Critical Health-literacy of Working-age Indonesians living with Early-stage Chronic Kidney Disease: A Cross-sectional Study

Ira Suarilah
* Faculty of Nursing, Universitas Airlangga, Indonesia.
(Corresponding Author)
ira.suarilah@fkp.unair.ac.id
Chiu-Chu Lin
College of Nursing, Kaohsiung Medical University, Taiwan.
Department of Renal Care, College of Medicine, Kaohsiung Medical University, Taiwan.
Department of Medical Research, Kaohsiung Medical University Hospital, Taiwan.
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ABSTRACT

Background and Objectives: Working-age living with chronic kidney disease requires a sufficient level of health-literacy to enable them to sustain their productivity and manage the progressivity of their disease. However, the paucity continues in terms of critical health-literacy. This study aims to examine health-literacy of working-age living with early-stage chronic kidney disease (CKD).

Materials and Methods: A total of 226 working-age living with early-stage CKD was recruited from 63 Public Health Centres in the second biggest city of Indonesia. The Mandarin Multidimensional Health Literacy Questionnaire (MMHLQ) was used to measure the level of health literacy. Descriptive and inferential statistics were performed to analyse data. This study adhered to the EQUATOR checklist, STROBE.

Results: An average age of the participants was 56.61 years (standard deviation [SD] = 7.48), whereas the estimated glomerular filtration rate was 63.45 mL/min/1.73 m2 (SD = 15.34). A cut point of high health-literacy is above 34.00. This study found out of 10 individuals, six (61.95%) reported low levels of health-literacy with an average level of 32.11 (SD = 4.46). Of five dimensions of health-literacy; obtaining, understanding, evaluating, and applying health information were below the adequate level while communication and interaction exhibited a sufficient level.

Conclusion: Factors that influence health-literacy were further characterized by low levels of education and low income. High rates of poor health-literacy among working-age patients with early-stage chronic kidney disease are deemed threatening. The lack of support toward elevating the levels of health-literacy may threaten the severity of the disease and shorten the period of productivity. A group which was characterised by low levels of education and income need to be supported by a simply accessible, understandable, and applicable of health-literacy program. Future studies examine novel factors, such as measuring health-literacy by specific health-literacy instruments and potential impact of multidisciplinary teams on the multifaceted aspects of health-literacy is warranty.

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Introduction

The World Health Organization (WHO) has predicted a global increase in mortality to 14% due to chronic kidney disease (CKD) by 2030 (WHO, 2018). In the United States of America (USA), 15% of adults are estimated to have (1). Likewise, a rapid increase in the prevalence of CKD has been reported annually by the Indonesia Renal Registry (IRR). In 2018, 132,142 Indonesians were diagnosed with end-stage renal disease (ESRD) (2). Of those with reduced kidney function who are not receiving dialysis are predicted to be unaware of the disease (3). Less awareness among this vulnerable population might relate to their ability to gain health-information and critically applied daily.

Poor health-literacy among adults living with CKD has been enormously examined to be connected to poor health outcomes (4). A study reported the health-literacy of patients in five different stages of CKD, that the level of health-literacy was not optimal (5) and that poor health-literacy is associated with a low level of EGFR (4, 6). A program to delay the progress of CKD through screening the level of health-literacy has been proposed as the first-line treatment on every new patient with early-stage CKD. Although previous studies reported low health-literacy as common among patients with CKD (7, 8) several limitations were identified: they did not focus on early-stage CKD (9), were not specific on working-age individuals (10), limited to functional health-literacy (11) and most those studies determining health-literacy in CKD population were conducted in developed countries that are given different demographic characteristics.

According to Nutbeam (2012), health-literacy skill refers to the individual's ability to seek, process, understand, and apply necessary information regarding their health. In this study, health-literacy is referred to the cognitive and social skills of individuals to access, understand, appraise, apply, communicate, and interact (12). Considering the above-mentioned health-literacy, theoretically, it is assumed that working-age individuals living with early-stage CKD with greater multifaceted health-literacy are able to perform well in many aspects of their daily life.

Measuring health-literacy is not merely focusing on health-related numeracy and reading skills. A functional health-literacy instrument was not able to evaluate individual's ability to understand the consequences of actions they made (13). To this point, an instrument assessment tool is required to comprehensively determine an individual's health-literacy. Therefore, this study aimed to investigate five dimensions of health-literacy among working-age individuals living with early-stage CKD and explore the associated factors.

Materials and Methods

Study design and participants

The present study applied a cross-sectional design and used a self-report questionnaire. Participants were recruited following criteria: working age of 18 to 65 years as stated on Balai Pusat Statistik (BPS), a national body for the Indonesia demographics data (14), primary diagnosis of early-stage CKD for a minimum of 6 months, ability to read and write in Bahasa Indonesia, willingness to participate, and signed informed consent. This study adhered to enhancing the quality

and transparency of health research (EQUATOR) check list through the strengthening the reporting of observational studies in epidemiology (STROBE) guidelines for cross-sectional study (15)(Supporting information 1).

Sampling

A simple convenience sampling was applied due the population of patients with early-stage CKD in Indonesia is unknown. A G*Power version 3.1.9.2 to estimate the sample size was applied. The statistical test to be conducted is linear multiple regression, were set power analysis with a standard alpha (α) level = 0.05, medium effect size = 0.15, and standard power = 0.85. ON the basis of these data, the researchers estimated the sample size using the F-test, where the effect size would target increases in R2 or R2 deviation from zero. According to the results of (8), an estimation sample size of 187 was appropriate for analysis. Finally, 226 patients with early-stage CKD were joined with this study, and it was given a statistical power of 0.90.

Data collection

Data were collected during the pandemic COVID-19 (June to September 2020). A formal written permission was sent to the 63 heads of the public health centers to enable the collection of data for using Google Forms. Patients who agreed to participate, signed the provided written informed consent and completed the questionnaire.

Instrument and measurement

This study used the Mandarin Multidimensional Health-Literacy Questionnaire (MMHLQ). With a total of 20 questions, the questionnaire consists of five dimensions, as follows: accessing (items 1–4), understanding (5–8), appraising (9–12), and applying (13–16) health information, and communication and interaction (17–20). The items are rated using a four-point Likert-type scale (1 = very difficult; 2 = difficult; 3 = easy; and 4 = very easy). High scores above 34.00 represent high levels of health-literacy (12).

The stage of CKD was diagnosed following the criteria of the IRR 2017 where kidney function was estimated using the CKD Epidemiology Collaboration and the creatinine equation was used to determine the estimated glomerular filtration rate. Early-stage CKD was categorized as estimated glomerular filtration rate ≥45 mL/min × 1.73 m2 for a minimum of 3 months. The most current levels of estimated glomerular filtration rate were retrieved from the medical records of the participants.

A self-report questionnaire was developed to obtain the demographic data of the participants, such as age, sex, level of education, level of family income, family history, and comorbidity. The number of comorbidities was presented according to the Davies Comorbidity Index, which was originally developed to predict the risk of hospitalization and mortality among individuals with CKD. The Davies Comorbidity Index was scored as follows: 0 = no comorbidity, 1 = one or two comorbidities, and 2 = three or more comorbidities (16).

Data analysis

Data analysis was performed in descriptive analyses and inferential analyses. The IBM Statistical Package version 25.0 for the Social Sciences was applied to conduct the statistical measures. Descriptive statistics, which include ranges, mean, SD, and frequencies, were appropriately used to

analyze all data before determining the correlations of the independent and dependent variables. Stepwise multiple linear regression analysis was performed to identify the association between health-literacy scales as dependent and independent variables. Significance level was set at p-value < 0.05.

Results

Demographic characteristics and kidney function of patients with early-stage chronic kidney disease

A total of 226 participants (mean age: 56.61 ± 7.48 years; female = 66.37%) completed the self-report questionnaire (Table 1). The majority attained an education of up to 12 years or less (84.96%). Among the participants who undertook an education of 9 years and higher, 62.13% presented low levels of health-literacy. The majority of participants (95.13%) reported a monthly family income of IDR 4,200,479.19 = US$ 289.694 or lower (~US$244.8). More than half (65.04%) reported a family history of comorbidity. Moreover, 94.7% reported living with one or two comorbidities and 140 (61.95%) reported low levels of health-literacy.

Table 1. Demographic Characteristics of the Participants and Level of Health-Literacy (N = 226)

Variables	N	%	Mean	SD	Level of Health Literacy	
					Low	High
GFR (mL/minute)			63.45	15.34		
Age			56.61	7.48		
31–39	10	4.42			6	4
40–49	24	10.62			12	12
50–59	91	40.27			58	33
60–65	101	44.69			64	37
Gender			1.66	0.473		
Male	76	33.63			47	29
Female	150	66.37			93	57
Level of Education			2.29	1.093		
6 years of education	77	34.07			55	22
9 years of education	40	17.7			26	14
12 years of education	75	33.19			39	36
College/University	34	15.04			20	14
Monthly family income*			1.05	0.216		
Less than the minimum regional wage	215	95.13			135	80
Equal to or more than the minimum regional wage	11	4.87			5	6
Family history of comorbidity			0.65	0.478		
No	79	34.96			55	24
Yes	147	65.04			85	62
Comorbidity (DCI** Score)			0.99	0.231		
No	9	3.98			5	4
One or two comorbidities	212	93.8			130	82
More than three comorbidities	5	2.2			4	1

*Minimum standard regional payment of Surabaya 2020 (IDR 4,200,479,19 = ~US$ 289.69)

**Davies Comorbidity Index (DCI); CKD, chronic kidney disease; SD, standard deviation; GFR, glomerular filtration rate.

Level of Health-Literacy and the Five Dimensions

The five dimensions for the measurement of health-literacy consist of four items per dimension. Each dimension was presented as mean and SD, whereas a total of 20 items was revealed by mean score (Table 2). Mean scores of <34.00 and >34.00 were categorized as inadequate and adequate levels of health-literacy, respectively. The scores for the 20 items ranged from 22.83 to 37.52.

In sequence, first of the five dimensions of health-literacy is access to health information (31.66, SD = 7.94). However, none of the four items reached the adequate level despite one item, which nearly reached the adequate level (33.99), that is, the ability to seek further information after receiving a health report.

The second dimension is understanding health information (33.85, SD = 6.23). Three of the four items exceeded the adequate level, whereas one item did not (the ability to understand the explanations of healthcare professionals [31.79]). Nevertheless, the mean scores for the three items were above the adequate level. Thus, the mean score for the second dimension remained inadequate.

In terms of evaluation health information (28.52, SD = 6.07), no item reached the adequate level. In other words, all four items displayed low scores, where the lowest was noted for the ability to determine health information on the Internet (22.83).

The fourth is applying health information at 31.58 (SD = 6.46). One item was found to be the above adequate level (the ability to use health information to select a treatment method: 34.14), whereas the rest was below the adequate level.

The last dimension is communication and interaction (34.86, SD = 7.42). All four items under this dimension exceeded the adequate level. Moreover, out of the 20 items, the highest score was noted for the ability to ask questions from health professionals (37.52).

Regarding the items, eight out of the 20 (40%) scored >34.00, namely, (1) following the instructions of healthcare professionals in terms of disease management, (2) understanding the explanation of healthcare professionals, (3) following the instructions on the medicine package, (4) using health information to select a treatment method, (5) communicating with physicians regarding preferred examination or treatment methods, (6) reassuring health professionals that one's understanding of a medical order is correct, (7) discussing treatment methods with physicians, and (8) asking questions from health professionals.

The mean scores for the first to fourth dimensions were similar. The inadequate level of these dimensions indicates that the participants were unable to perform the tasks associated with health-literacy abilities. The third dimension; evaluation of health information, displayed the lowest level of health-literacy. Nevertheless, the highest score for the item "the ability to communicate and interact" under the third dimension reached the adequate level.

Critical Health-literacy and Associated Factors

Stepwise linear regression was applied to determine the influencing factors of health-literacy (Table 3). Five sociodemographic variables (level of education, monthly family income, family history of comorbidity, comorbidity, and outcome variables) and

health-literacy and its four dimensions (obtaining, understanding, evaluating, and applying health information), and communication and interaction were added to the regression model.

A statistically significant influence of at least one or more of the dimensions of health-literacy on two factors, namely, level of education and family income. Nevertheless, the four factors did not exert a significant influence on understanding, evaluating, and applying health information. Factors with significant results ($p < .05$) were level of education and family income. In other words, level of education exerted an influence on the total health-literacy; obtaining health information; and communication and interaction. Moreover, monthly income was an influencing factor for obtaining health information.

Table 2. Level of Critical Health-Literacy

Dimensions (possible range)	Mean (SD)	Item	Mean
Obtaining health information (4–16)	31.66(7.94)	Finding knowledge about diseases is …	33.41
		Obtaining information about health care for daily living is …	33.11
		Searching for health-related information I need on the Internet is …	26.06
		After receiving my health report, further gathering information is …	33.99
Understanding health information (4–16)	33.85 (6.23)	Understanding the description on the medicine package is …	34.21
		Following healthcare professionals' instructions to take care of the disease is …	31.79
		Understanding healthcare professionals' explanation is …	35.10
		Following the instructions on the medicine package when taking medicine is …	35.46
Evaluating health information (4–16)	28.52 (6.07)	Determining whether the health information obtained is able to solve the health problem is …	32.97
		Determining whether the health information obtained is suitable for me is …	31.94
		Determining whether the health information obtained is consistent with other information is …	28.63
		Determining whether the health information on the Internet is reliable is …	22.83
Applying health information (4–16)	31.58 (6.46)	Using health information to understand changes in medical condition is …	31.79
		Using health information to prepare to face disease is …	30.84
		Using health information to understand the results of a health report is …	32.97
		Using health information to select a treatment method is …	34.14
Communication and interaction (4–16)	34.86 (7.42)	Telling the doctor, the examination or treatment method that I want is …	34.58
		Reassuring health professionals whether my own understanding of medical order is correct is …	35.54
		Discussing with the doctor about the treatment method is …	36.34
		Asking health professionals when I have a question is …	37.52

Table 3. Influencing factors of health-literacy among working-age individuals living with early-stage CKD

Outcomes	Influencing factors	β	S.E.	T	p	Adj R2	F
Total health literacy	Constant	27.78	1.64	16.90	.000	0.05	3.99
	Level of education	0.83	0.28	2.97	.003		
	Household income	1.76	1.39	1.26	.209		
	Family history of comorbidity	0.67	0.62	1.09	.276		
	Comorbidity	0.07	0.27	0.25	.805		
Obtaining health information	Constant	22.23	2.88	7.71	.000	0.08	5.76
	Level of education	1.38	0.49	2.83	.005		
	Household income	6.14	2.44	2.51	.013		
	Family history of comorbidity	1.13	1.08	1.05	.295		
	Comorbidity	−0.39	0.47	−0.85	.399		
Understanding health information	Constant	32.12	2.36	13.60	.000	−0.01	0.72
	Level of education	0.54	0.40	1.35	.178		
	Household income	−0.38	2.00	−0.19	.849		
	Family history of comorbidity	0.08	0.88	0.09	.927		
	Comorbidity	0.36	0.38	0.95	.342		
Evaluating health information	(Constant)	22.64	2.28	9.95	.000	0.02	2.06
	Level of education	0.36	0.39	0.94	.346		
	Household income	3.02	1.93	1.56	.119		
	Family history of comorbidity	1.08	0.85	1.27	.205		
	Comorbidity	0.51	0.37	1.40	.163		
Applying health information	(Constant)	31.44	2.45	12.82	.000	−0.01	0.60
	Level of education	0.52	0.42	1.26	.210		
	Household income	−1.56	2.08	−0.75	.455		
	Family history of comorbidity	−0.15	0.92	−0.16	.874		
	Comorbidity	0.29	0.40	0.74	.459		
Communication and interaction	(Constant)	30.30	2.74	11.05	.000	0.04	3.56
	Level of education	1.31	0.46	2.83	.005		
	Household income	1.65	2.32	0.71	.479		
	Family history of comorbidity	1.22	1.03	1.18	.238		
	Comorbidity	−0.42	0.44	−0.94	.347		

α = .05; Std β = standard beta coefficient; S.E. = standard error; *Adj*.R^2 = adjusted R^2

The five factors add Adj R2 = 0.05% (β = 27.78) on total health-literacy (Adj R2 = 0.08%; β = 22.23); on obtaining (Adj R2 = 0.01%; β = 32.12), understanding (Adj R2 = 0.02%), evaluating (Adj R2 = 0.01%; β = 22.64%), and applying (β = 31.44) health information; and on communication and interaction (Adj R2 = 0.04%; β = 30.30). The value for Adj R2 is considered 0. The effect sizes depict extremely small to small differences in health-literacy. Given the value or the independent variable, it is completely unable to explain the variance of the influencing factors.

Discussion

To the best of our knowledge, this study is the first that investigated the critical health-literacy of patients with early-stage CKD in a developing country, where the working-age population is dominant. The demographic

characteristics provided evidence that patients with early-stage CKD were dominantly aged from 31 to 59 years, were female, with a level of education of <12 years, living with a monthly family income that ranges under the minimum regional payment, with a family history of comorbidity, living with one and/or two chronic disease(s), and with low levels of health-literacy.

Current study found that participants aged 31–65 years with decreased kidney function were considered a vulnerable population. Given the criteria of the Indonesia Renal Registry and the National Kidney Foundation, the current mean estimated glomerular filtration rate of 63.45 mL/min/1.73 m2 (SD, 15.34) indicates CKD at stage 2. This threatening condition is relevant to the World Bank (2017) report on the mortality of Indonesian individuals with non-communicable diseases aged 30 to 70 years. The mortality rate of this population was 26.4%, whereas the global level was only 18.8% (17).

Level of Critical Health-Literacy

Two out of five working-age patients with early-stage CKD were living with low levels of health-literacy. This condition increases health risks and hinders the achievement of Sustainable Development Goals, that is, to ensure healthy lives and promote well-being for all at all ages. Among the participants with low levels of health-literacy, 14.29% attained college/university levels. This result underlined the formulation of a specific strategy for increasing health-literacy that may differ from groups with low levels of education.

Communication and interaction were the only dimension that reached an adequate level in the moderate point. Asking questions from health professionals scored the highest. The study infers that patients may have been mediocre in their relationship with healthcare providers due to previous disease(s), such as hypertension and diabetes. As such, confidence in communicating and interacting with healthcare professionals resulted in asking other disease-related questions. However, an increased ability in communicating and interacting with healthcare professionals contradicts the ability to obtain health information. The early-stage CKD patient's best ability on communication and interaction did not influence the other dimensions.

The greatest challenge faced by working-age patients with early-stage CKD was evaluating health information. This dimension reflected the ability to critically appraise health information retrieved online (i.e., the Internet) and offline. Evaluating health information denoted a transition phase that required a critical thinking ability to link the two previous dimensions, namely, obtaining and understanding health information to everyday application. Being unable to evaluate health information results in the decreased ability to apply health information received in everyday life.

Additionally, the two abilities with the lowest scores were searching for health-related information from the Internet (obtaining health information) and determining whether health information on the Internet is reliable (evaluating health information). This condition presents the most updated condition, where working-age

patients with early-stage CKD expressed difficulties in terms of the usability of health information on the Internet. Living in urban areas, where people are more reliant on Internet connection, represents neither the ability to search for the required health-related information nor the ability to appraise the health information retrieved.

Critical Health-literacy and Associated Factors

This study yielded the overall effect sizes depict extremely small to small differences in the dimensions of health-literacy across demographic characteristics. Moreover, none of the factors were able to examine the dimensions of understanding, evaluating, and applying health information. The absence of the influencing factors in the three dimensions of health-literacy may be related to the fact that health-literacy is a dynamic and sequence process, where learning theory and use; belief; attitudes; and attention are critical factors in the adoption of the health information system (18). However, these factors remained unexplored in this study.

Concerning the individual's side, this study found that the level of education was an existing influencing factor for total health-literacy and communication and interaction. Although family income was found as the sole influencing factor for obtaining health information, acquiring further education, especially at >12 years, does provide individuals with greater literacy abilities, which are beneficial to many aspects of daily life. Moreover, many of these abilities could be applied to the current health situation. Previous studies reported that an education of >12 years was a determining factor of the high levels of health-literacy (19). High levels of education remarkably improved employment opportunities and increased pay received. This aspect may be a likely encouragement that enables individuals to be actively involved in terms of exposure to health information and attainment of more abilities related to health-literacy.

Nevertheless, low levels of health-literacy among individuals who attained an education of nine years and above were relevant with evaluation of health information. The current study found that graduating from university does not guarantee high levels of health-literacy. This result indicates that graduates they were good in literacy skills, such as reading words and counting numbers, but weak in terms of critical thinking. Less ability on evaluating health information resulted in the inability to decide and transforming health information into behavior. In addition, less formal education and low levels of family income are the current situations of working-age patients living with early-stage CKD in Indonesia. Presently, the participants were a result of the government policy in Indonesia regarding the compulsory application of 12 years of education across the decades. Nevertheless, scholars had been argued

Health - literacy to be equated with educational attainment alone (20, 21). Low health-literacy might relate to living in urban area with a monthly family income of IDR 4,200,479.19 (approximately US$289.69) was relatively insufficient. Few families are living with single and/or double incomes above this level. As such, these conditions result in the difficulties of the participants in obtaining high levels of health-literacy. These matches of low education attained and low income

lead a barrier to higher level of health-literacy.

Low health-literacy among urban Indonesians living with early CKD depicts the role of public health centers in primary care, which are collocated, and, thus, enables increased communication and interaction. These abilities should be power-driven to improve another weak dimension. Formulating a strategy on communication and interaction between patients with early-stage CKD and healthcare professionals is necessary to consider varying inequalities in health-literacy abilities (22, 23). For an individual to understand how to care for themselves and their family, practitioners and healthcare agencies must give health information to the individual in such a way that it is understood by that individual. Therefore, professional allied health services in primary care should develop the cyclical process of teaching and learning sessions. A series of educational programs tailored according to a multidimensional assessment of health-literacy may enable health professionals to deliver health information within a given cultural context.

Study Limitations and Strengths: This study has several strengths, including the large sample of individuals living with early-stage chronic kidney in productive age, and recruited in the second biggest city of Indonesia. It was one of the first studies to examine critical health-literacy in developing country with a high prevalence of CKD. A critical health-literacy instrument was applied to measure five dimensions given a better description on targeted community programs aims to develop the level of knowledge of people living with CKD.

However, due to the restrictions of the COVID-19 pandemic, as data collection began in the early onset of the pandemic, regular health programs have ceased for months. Many participants experienced financial problems which may have influenced their personal and family income. Thus, questionnaires applied in this study were self-reported and might result in less objectivity. Finally, the analysis was based on cross-sectional data, meaning causality cannot be established. It is likely that some associations were bidirectional.

Conclusion

The level of multiple dimensions of health-literacy presents a clear indication of the vulnerability of working-age patients with early-stage CKD. Out of the five dimensions of health-literacy, communication and interaction are the only dimensions that reached adequate levels. The most challenging dimension of health-literacy was evaluating health information which reflects an inadequate critical thinking ability, and resulted in difficulties in deciding and transferring health information into behavior. A group which was characterized by low levels of education and income need to be supported by a simply accessible, understandable, and applicable health-literacy program. Therefore, health programs for increasing health should include an early comprehensive assessment of health-literacy before the delivery of intervention is alarming. Future studies should examine novel factors, such as measuring health-literacy by specific health-literacy instruments and potential impact of multidisciplinary teams on the multifaceted aspects of health-literacy.

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Availability of data and materials: The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Conflict of interest: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Consent for publication: Not applicable.

Ethical approval and consent to participate: This study was reviewed and approved by the Institutional Review Board of Universitas Airlangga, Indonesia (IRB Approval Number: 1863-KEPK) also this study was conducted in accordance with the Declaration of Helsinki, All participants provided written informed consent to participate in the study. Participants were informed about the study's purpose, procedures, potential risks, and benefits, and they were assured that their data would be kept confidential and handled ethically.

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Author's contributions: IS, CCL conceptualized and designed the study, IS collected the data and analyze, IS, CCL interpreted and drafted the manuscript. All the authors critically revised the manuscript for important intellectual content and approved the final version for submission.

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