Received 16 November 2020
Revised 24 December 2020
Accepted 8 January 2021

A causal model of functional status among persons with liver cirrhosis from four public hospitals in Thailand

Surachai Maninet, Yupin Aungsuroch and Chanokporn Jitpanya
Faculty of Nursing, Chulalongkorn University, Bangkok, Thailand

Abstract

Purpose – The purpose of this study is to develop and test the causal relationships between alcohol consumption, social support, illness perception, fatigue and functional status among persons with liver cirrhosis. The hypothesized model was developed based on the theory of unpleasant symptoms.

Design/methodology/approach – A cross-sectional study was conducted among 400 persons with liver cirrhosis by stratified random sampling. Data were collected at outpatient departments from four public hospitals across three regions in Thailand. Six self-report questionnaires were utilized to collect data from March to August 2020. The developed model was verified via a structural equation modeling analysis.

Findings – The proposed model fit with the empirical data considering from χ^2/df = 2.397 (p = 0.061), root mean square error of approximation (RMSEA) = 0.056, comparative fit index (CFI) = 0.985, Tucker–Lewis index (TLI) = 0.981, and standardized root mean square residual (SRMR) = 0.048. The model explained 71.30% of the total variance in functional status. Social support was the most influential factor affecting functional status both directly and indirectly through illness perception. Illness perception had a negative direct effect on functional status and a positive indirect effect on functional status through fatigue. Fatigue had a negative direct effect on functional status. Alcohol consumption was found as the lowest influential factor affecting functional status.

Originality/value – This is the first study that explores the characteristics of functional status among persons with liver cirrhosis comprehensively. A causal relationship among various variables found in this study would shed light as important fundamental data for developing interventions to enhance functional status among this population.

Keywords Functional status, Social support, Alcohol consumption, Illness perception, Fatigue, Liver cirrhosis, Thailand

Paper type Research paper

Introduction

Liver cirrhosis is the end-stage of chronic liver disease. It causes a significant global health burden with high incidence, prevalence, morbidity and mortality [1]. Globally, it is the 11th leading cause of death and approximately one million persons with liver cirrhosis die each year [2]. Thailand reported that the standardized prevalence rate of liver cirrhosis was 75.3 per 100,000 with an occurrence of higher rates in males than females [3]. Cirrhosis

This study was supported by the scholarship from "The 100th Anniversary Chulalongkorn University Fund for Doctoral Scholarship" and also "The 90th Anniversary Chulalongkorn University Fund (Ratchadaphiseksomphot Endowment Fund)". The authors would like to extend special thanks to all participants who willingly participated in this study.

Journal of Health Research
Vol. 36 No. 6, 2022
pp. 1028-1039
Emerald Publishing Limited
e-ISSN: 2586-940X
p-ISSN: 0857-4421
DOI 10.1108/JHR-11-2020-0558

complications such as esophageal varices bleeding and hepatic encephalopathy are associated with poor health outcomes and mortality [2, 3]. Hence, liver cirrhosis has become a serious health problem worldwide, especially in Thailand.

Functional status is defined as the ability of the individual to particularly perform defined tasks to fulfill and maintain their wellbeing [4]. It consists of four dimensions including physical, psychological, social and role functioning [4]. Prior studies reported that approximately 80% of persons with liver cirrhosis experienced functional status decline [5]. Considering the functional status in each stage of liver cirrhosis, 35% of persons with early stages of liver cirrhosis suffered from mild to moderate levels of functional status decline [5], while over 50% of persons with advanced stages of liver cirrhosis reported a severe decline in functional status in terms of physical limitation, negative perceptions about illness and less social interaction [5]. Consequently, some of them do not perform or spend less time performing an activity of daily living and getting back to work, and they experience psychological distress [5]. Therefore, searching for the potential factors related to functional status among this population is important and necessary.

Empirically, several studies have reported factors related to functional status among persons with liver cirrhosis. The theory of unpleasant symptoms (TOUS) [6], together with an extensive systematic review of existing evidence from different disciplines and diverse perspectives, such as nursing, the medical profession and psychological profession, was used to explain the interaction of various factors that interfere with levels of functional status among persons with liver cirrhosis. Based on a review of previous studies, fatigue was reported as the most serious unpleasant symptom caused by difficulty in maintaining physical functioning [7]. For the physical factor, alcohol consumption was found as the cause of the functional status decline in terms of having limitations in maintaining physical, psychological and social functioning [8]. Approximately 48.8% of patients with liver cirrhosis were continuous heavy drinkers and over 50.3% were moderate continuous drinkers [9]. For the psychological factor, illness perception was found as a predictor of functional status decline [10], while perceiving good social support (as a situational factor) encouraged cirrhotic persons to increase levels of physical, psychological, social and role functioning [11]. Thus, these factors need to be accounted for when considering the functional status among persons with liver cirrhosis.

According to the literature mentioned above, previous studies have explored specific dimensions of functional status or only reported bidirectional associations between those factors and functional status in their single studies. To our knowledge, no study has captured causal relationships among these factors simultaneously. Thus, the development of a causal model of functional status which addresses these specific variables in liver cirrhosis is important and necessary. This study selected the factors that can be modified by nursing intervention including alcohol consumption, illness perception, social support and fatigue as the influencing factors of functional status. Therefore, the objective of this study was to develop and test a hypothesized causal model of functional status among persons with liver cirrhosis in Thailand. Considering the theoretical and empirical literature, the hypothesized model of this study was developed (Figure 1).

Methodology

Study design and setting

A cross-sectional design was conducted. A stratified three-stage random sampling approach was utilized to identify the settings. First, three regions including Northern, Central, and Northeastern were randomly selected from the six-region system. Second, one province was randomly selected from each of these regions. One public general hospital was then randomly

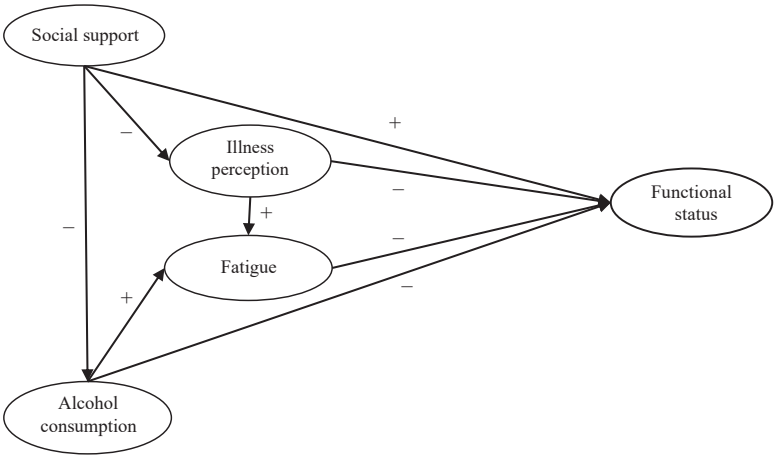

Figure 1.
Hypothesized model of functional status

selected from each of these three provinces. In addition, one general hospital from these three provinces was randomly selected due to the number of participants likely being below the required sample size. As a result, the major settings in this study were Lampang Hospital, Nakorn Nayok Hospital, Sanpasithiprasong Hospital and Nakorn Phanom Hospital.

Population of study
The target population was adults or older persons with liver cirrhosis in Thailand who had been receiving medical monitoring at outpatient departments in four public tertiary hospitals.

Sample and sample size
Participants who met the inclusion criteria were recruited in the study including those who were aged 40 years and older, diagnosed with liver cirrhosis by a physician, had perceived their diagnosis of liver cirrhosis, were literate in the Thai language and had signed the consent form. A common rule of thumb was used to calculate the sample size. This study used the ratio of 10:1 as recommended by Bentler and Chou [12]. There were 40 free parameters in the hypothesized model. Thus, the sample size was 400. Proportionate sampling was employed to recruit participants at each site.

Ethical considerations
Approval was obtained from the Committee for Human Research of the four selected settings including Nakorn Nayok Hospital (REC No 02/2563), Lampang Hospital (No. 22/63), Sanpasithiprasong Hospital (No. 003/63 C) and Nakorn Phanom Hospital (NP-EC11-No. 3/2563).

Instruments
Six measures were used to collect data.

Demographic data form. This form was developed by the researchers to collect the general characteristics of the participants including gender, age, marital status, education level, occupation, income, the duration of illness, stage of disease, comorbidity and treatment options.

Alcohol use disorders identification test-consumption. This measure was developed by Bush *et al.* [13]. It comprised three items with three subscales including one item of frequency, one item of quantity and one item of heavy alcohol drinking. Each item had five answer

choices and values from 0 to 4 points. The total score ranged from 0 to 12. A higher score indicated increasing associated-health risks from drinking alcohol. Psychometric properties of this measure were tested and recommended as valid and reliable [13]. In this study, Cronbach's alpha reliability was 0.84.

Brief illness perception questionnaire. This instrument was developed by Broadbent *et al.* [14]. It consisted of eight items. Each item assessed one dimension of illness perception: consequences, timeline, personal control, treatment control, identity, concerns, illness comprehension and emotions. The response was on a Likert scale ranging from 0 to 10. A higher score represented a more threatening view of his/her illness. Psychometric properties were tested and found as valid and reliable [14]. This study found that Cronbach's alpha reliability was 0.93.

Multidimensional scale of perceived social support. This instrument was developed by Zimet *et al.* [15]. It consisted of 12 items divided into three dimensions including family members, friends and significant others. It was a seven-point scale. The summing score was calculated from all 12 items. The possible scores ranged from 12 to 84. Higher scores represented a higher level of perceived social support. Construct validity of this instrument was tested using a confirmatory factor analysis which confirmed that three factors that remained in this instrument fit with the empirical data [15]. Zimet *et al.* [15] have concluded that this instrument was valid and reliable. This study found that Cronbach's alpha reliability was 0.89.

Fatigue Severity Scale. This measure was developed by Krupp *et al.* [16] to assess the severity of fatigue. It consists of nine items which are rated on a seven-point Likert scale. The sum score ranged from 9 to 63. Higher scores demonstrated higher levels of fatigue. Psychometric properties were tested and found as valid and reliable [17]. The current study reported Cronbach's alpha reliability as 0.86.

Functional status questionnaire. This instrument was originally developed [18] to assess six aspects of functional status including the basic activity of daily living, the intermediate activity of daily living, mental health, work performance, social activity and quality of interactions. It is a twenty-eight-item scale. In addition, six open-ended questions were asked. This measure was translated into the Thai language by the researchers using the forward and backward translation method with permission from Jette *et al.* [18]. Due to each dimension of functional status varying in the number of items and score, to compare the mean score of each dimension, a single algorithm was used to calculate the summing score of each dimension which ranged from 0 to 100. The interpretation of the range of scores was divided into two groups including warning and good zones. The warning zone refers to a person who had a problem with functional status and required clinical attention. The warning zone scores for the basic activity of daily living were 0–87, for the intermediate activity of daily living 0–77, for mental health 0–70, for work performance and social activities 0–78, and quality of interactions 0–69 [18]. In this study, Cronbach's alpha reliability was 0.92.

Data collection

After obtaining the required permission, the researcher collected the data based on the research protocol at outpatient departments from four hospitals in Thailand. Data were collected between March and August 2020. The total and complete data were 400 for analysis (100%).

Data analysis

Statistical Package for the Social Sciences (SPSS) version 25.0 for Windows and Mplus software version 7.1 were utilized to analyze the data. Descriptive statistics were analyzed for the participants' characteristics and illness-related characteristics. The reliability of the measured variables was tested. In all tests, $p < 0.05$ was accepted as statistically significant.

All relevant assumptions were tested prior to the analysis process. There were five statistical criteria used to assess the model fit with the data. First, the Chi-square (χ^2) test for model fit was nonsignificant ($p > 0.05$). Second, normed Chi-squared (χ^2/df) was <3. Third, the value of the root mean square error of approximation (RMSEA) was ≤0.05. Fourth, the value of the comparative fit index (CFI) and Tucker–Lewis index (TLI) was >0.95. Finally, the value of the standardized root mean square residual (SRMR) was <0.08 [19].

Results

Characteristics of the participants

The findings revealed that the mean age of the participants was 60.39 (Standard deviation (SD) = 7.6) ranging from 40 to 83 years old. The predominant participants in this study were male (77.8%), married (64.5%), lived with their spouse (65.3%), were Buddhist (96.8%), had completed primary education (77.7%) and worked in agriculture (45%). The average duration of the illness was 9.2 (SD = 8.0) months and ranged from 1 to 50 months. Most of the participants visited a doctor due to a follow-up appointment (84%). About one-third (35.5%) had been diagnosed with liver cirrhosis in stage 2, while 30.2% were diagnosed at stage 3. The most common etiologies of liver cirrhosis were alcoholism (61.7%) and hepatitis B virus (20.8%). Most of the participants (79%) had routine treatment as part of their medical monitoring. Over half of them (53%) reported no comorbidity disease. Over three-fourths of the participants (85.2%) used universal health coverage services. Details about the demographic characteristics of the participants are presented in Table 1.

Characteristics of the studied variables

The current study found that persons with liver cirrhosis had functional status in the warning zone, particularly the dimensions of basic activity of daily life ($\bar{X} = 80.43$, SD = 6.47), intermediate activities of daily living ($\bar{X} = 74.10$, SD = 6.58), social activity ($\bar{X} = 66.51$, SD = 14.34) and work performance ($\bar{X} = 59.73$, SD = 15.77) (Table 2).

The characteristics of the independent variables are summarized in Table 3. The results showed that all variables assessed in the model were at a moderate level. The mean score of alcohol consumption was 4.72 (SD = 3.17), indicating that the participants had moderate levels of associated – health risk from drinking alcohol. The mean score of illness perception was found as 46.57 (SD = 16.34), indicating that the participants had moderate levels of a perceived threat of illness. For social support, the mean score was found as 58.40 (SD = 13.73), showing that the participants had moderate levels of perceived social support. In addition, the mean score of fatigue was 41.34 (SD = 15.24), interpreting that the participants had moderate levels of fatigue.

Model testing

In the hypothesized model, the endogenous variables were alcohol consumption, illness perception, fatigue and functional status. The exogenous variable was social support. As presented in Figure 2, the results from conducting structural equation modeling (SEM) revealed that the model fit with the empirical data. The model fit indices were acceptable: $\chi^2 = 386.458$, df = 172, $p = 0.061$, χ^2/df = 2.397, RMSEA = 0.056, CFI = 0.985, TLI = 0.981, SRMR = 0.048. The model explained 71.30% of the total variance in functional status.

In the casual model of functional status, all parameter estimates were statistically significant and supported the hypothesized model. The findings revealed that the standardized total effect from social support to functional status was 0.744 ($p < 0.01$). Social support had a positive direct effect on functional status ($\beta = 0.542$, $p < 0.01$) as well as a positive indirect effect on functional status through alcohol consumption ($\beta = 0.202$, $p < 0.01$). Regarding illness perception, it also had both a negative direct effect on functional status

Characteristics	*N*	%
Age (Years)		
40–59	203	50.8
60 and older	197	49.2
Gender		
Male	311	77.8
Female	89	22.2
Reason for visiting doctor		
Follow-up	336	84.0
Gastrointestinal bleeding	26	6.5
Ascites	15	3.8
Pain	10	2.5
Other symptoms	7	1.7
Fatigue	4	1.0
Jaundice	2	0.5
Stage of disease		
Stage 1	93	23.3
Stage 2	142	35.5
Stage 3	121	30.2
Stage 4	44	11.0
Etiology of cirrhosis		
Alcoholic	247	61.7
Hepatitis B virus	83	20.8
Chronic liver disease	51	12.8
Unspecified cause	14	3.4
Hepatitis C virus	5	1.3
Treatment		
Medication	316	79.0
Non-medication	84	21.0
Comorbidity		
No comorbidity	212	53.0
Having comorbidities	188	47.0

Table 1. Demographic characteristics of the participants ($N = 400$)

Variable	Possible range	Actual range	$\bar{X}$	SD	Interpretation
Functional status					
Mental health	1–100	36.0–100	72.69	15.90	Good zone
Quality of interaction	1–100	33.3–100	69.79	14.39	Good zone
Basic activity of daily living	1–100	33.3–100	80.43	16.47	Warning zone
Intermediate activity of daily living	1–100	33.3–100	74.10	16.58	Warning zone
Social activity	1–100	33.3–100	66.51	14.34	Warning zone
Work performance	1–100	16.7–100	59.73	15.77	Warning zone

Table 2. Mean score and standard deviation of functional status ($N = 400$)

($\beta = -0.263$, $p < 0.01$) and a negative indirect effect on functional status through fatigue ($\beta = -0.028$, $p < 0.05$). Alcohol consumption had both a negative direct effect ($\beta = -0.176$, $p < 0.01$) on functional status and a negative indirect effect on functional status through fatigue ($\beta = -0.055$, $p < 0.01$). In addition, fatigue had a negative direct effect on functional status ($\beta = -0.218$, $p < 0.01$). The summary of model testing is shown in Table 4.

Variable	Possible range	Actual range	$\bar{X}$	SD
Alcohol consumption	*0–12*	*0–12*	*4.72*	*3.17*
Frequency	0–4	0–4	1.84	1.23
Quantity	0–4	0–4	1.30	1.13
Heavy drinking	0–4	0–4	1.60	1.17
Illness perception	*0–80*	*10–80*	*46.57*	*16.34*
Consequences of illness	0–10	0–10	6.27	2.20
Emotions	0–10	1–10	6.21	2.15
Concern of illness	0–10	1–10	6.01	2.21
Timeline	0–10	1–10	5.99	2.25
Identity	0–10	0–10	5.96	2.17
Treatment control	0–10	0–10	4.99	2.14
Illness comprehensibility	0–10	1–10	4.91	2.07
Personal control	0–10	0–10	4.87	2.14
Social support	*12–84*	*31–84*	*58.40*	*13.73*
Family	4–28	10–28	21.62	4.50
Significant others	4–28	8–28	19.29	4.87
Friends	4–28	8–28	17.50	5.02
Fatigue	*9–63*	*9–63*	*41.34*	*15.24*

Table 3.
Mean score and standard deviation of independent variables ($N = 400$)

Discussion

The objective of this study was to develop and test a hypothesized causal model of functional status among persons with liver cirrhosis in Thailand. Regarding the results of this study, it is worth highlighting that the functional status of persons with liver cirrhosis had been affected by several factors including alcohol consumption, illness perception, social support and fatigue. This indicates that attention to enhancing functional status should be given to persons with liver cirrhosis compared to other chronic diseases. Focusing on the dimensions of functional status, persons with liver cirrhosis in this study had the highest score in mental health followed by quality of interaction. This can be because most of the participants had their spouse looking after them and had good support from family members, health care providers and friends. As a result, they had a high feeling of mental well-being and still interacted with other people around them.

This study found that social support was the most influential factor affecting functional status both directly and indirectly. This finding may be related to the fact that most of the participants were married and lived with their spouses. Similarly, one study found that persons with chronic liver disease had the highest support from family members [20]. In contrast with other studies, more than half the persons with liver cirrhosis (52.6%) felt that their family members did not try to support them in particular activities such as preparing food, giving mental support or helping with housework [11]. The same researcher also found that friends were least likely to help the participants when things went wrong and more than half of them (56.4%) had difficulty discussing their health conditions with friends [11]. One study also found that most persons with chronic liver disease (98.26%) perceived having a moderate to high level of social support from people around them [21].

The findings showed that the participants had moderate-health risk from consuming alcohol ($\bar{X} = 4.72$, SD = 3.17). Furthermore, alcohol consumption directly and indirectly affected functional status. Compared to other studies, Owens *et al.* [22] also found that persons with chronic liver disease had moderate-health risk from drinking alcohol ($\bar{X} = 6.5$, SD = 3.3). In addition, one study reported that frequency of drinking was associated with functional limitation [8]. It is possible that most of the participants in this study had been diagnosed and underwent medical monitoring for a long time. Thus, they would reduce the frequency and quantity of alcohol consumed per drink as recommended by health care

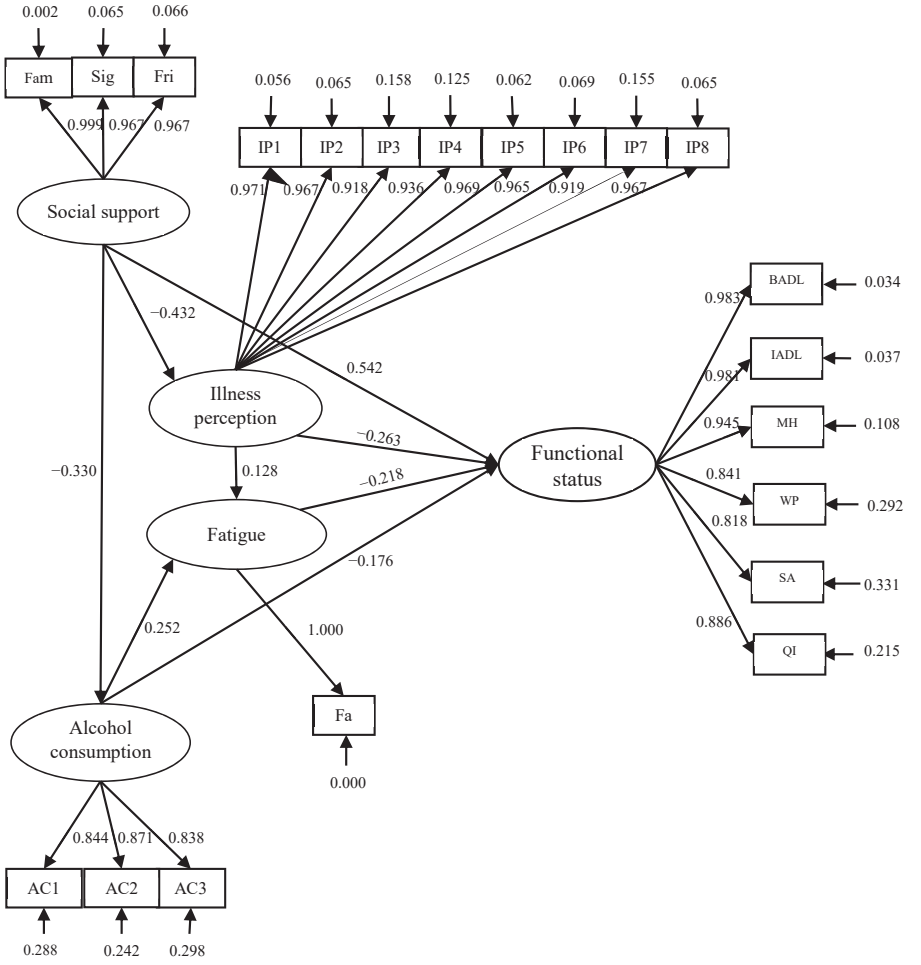

Figure 2.
A causal model of functional status among persons with liver cirrhosis

providers. Nevertheless, this population should be advised about the disadvantages of consuming alcohol that would impact on their functional status.

Fatigue had a negative direct effect on functional status. Most of the participants perceived that the severity of fatigue impacted their motivation as well as work, family and social life. A previous study that used the Fatigue Severity Scale also found moderate severity of fatigue in patients with chronic liver disease. A study of 106 persons with liver cirrhosis in Brazil found that the mean score of fatigue was at a moderate level ($\bar{X} = 4.7$) [17]. These findings strongly highlight the need to manage fatigue in persons with chronic liver disease such as liver cirrhosis worldwide. In addition, almost half of the participants were aged over 60 years old (49%); thus, they may feel easily fatigued compared to younger participants. This study found that almost half of the sample (49.6%) had a long duration of illness. This may be related to the fact that long-term inflammation either caused or resulted from chronic liver disease, and because liver cirrhosis contributes to fatigue, this, in turn, increased the level of functional status.

Table 4.
The direct, indirect and total effects between variables of the study ($N = 400$)

Caused variables	Affected variables											
	Functional status			Alcohol consumption			Illness perception			Fatigue		
	TE	IE	DE	TE	IE	DE	TE	IE	DE	TE	IE	DE
Social support	0.744**	0.202**	0.542**	−0.330**	–	−0.330**	−0.432**	–	−0.432**			
Alcohol consumption	−0.231**	−0.055**	−0.176**	–	–	–	–	–	–	0.252**	–	0.252**
Illness perception	−0.291**	−0.028*	−0.263**	–	–	–	–	–	–	0.128*	–	0.128*
Fatigue	−0.218**	–	−0.218**	–	0.109**	–	–	0.186**	–	–	0.089**	–
R–square	0.713**											

Note(s): *$p < 0.05$, **$p < 0.01$, TE = total effect, IE = indirect effect, DE = direct effect

Limitations

First, the participants were limited to persons with liver cirrhosis in the outpatient department using purposive sampling. The results, thus, could not be generalized to persons with liver cirrhosis living with other health conditions or in other clinical settings. Second, the nature of a cross-sectional study made it difficult to identify causation at different points in time.

Practical implications

The findings of this study have several important implications. Health-care providers should assess levels of functional status and associated factors when persons with liver cirrhosis visit outpatient departments regularly. To improve functional status among this population, nurses and other health-care providers should provide suggestions about abstinence from alcohol when this population visits doctors at outpatient departments. In addition, psychosocial therapy and family members should be incorporated in managing alcohol consumption behavior which could enhance and maintain their functional status. For minimizing unpleasant symptoms, nurses and physicians should assess and evaluate the description of the symptoms such as fatigue and its related factors by observing physiological reactions, interviews and questionnaires. The data gained from this practice would help to manage the symptoms, which in turn will increase their ability to maintain functional status.

To advance the quality of care, nurses and health-care professionals should consider innovative strategies to improve functional status among persons with liver cirrhosis such as working with a multidisciplinary team to develop mobile applications that family members and health-care providers can access for current developments such as levels of functional status, practical tips for enhancing functional status, strategies for reducing alcohol consumption through virtual support groups and methods for minimizing their perception of illness.

Recommendations for further research

For the target population, future studies should be conducted to validate the functional status among persons with liver cirrhosis in other settings such as in different socioeconomic groups, stages of the disease and critical units. Considering research designs, exploring the longitudinal causal relationships among these variables is needed. Innovative interventions to enhance functional status among persons with liver cirrhosis should be developed. These interventions should incorporate enhancing social support and positive illness perception, and the selection of appropriate strategies to reduce or stop alcohol consumption to decrease the risk of harm from alcohol that might increase the level of functional status among persons with liver cirrhosis. Furthermore, fatigue management should also be promoted in the program.

Conclusion

The causal model of functional status among persons with liver cirrhosis obtained a good fit with the empirical data. The findings of this study highlighted that functional status among persons with liver cirrhosis was affected by social support, illness perception, fatigue and alcohol consumption. In clinical practice, nurses and other health-care providers should assess levels of functional status and its related factors when they visit doctors at outpatient departments. Emphasis should be placed on the involvement of family members and other significant persons that aimed to support and encourage their perceived threat of illness, manage symptoms of fatigue and stop alcohol consumption. Importantly, nurses and

health-care teams could use a causal relationship among variables found in this study to further develop comprehensive interventions to enhance functional status among persons with liver cirrhosis.

Conflict of Interest: None

References

1. Sepanlou SG, Safiri S, Bisignano C, Ikuta KS, Merat S, Saberifiroozi M, *et al.* The global, regional, and national burden of cirrhosis by cause in 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet Gastroenterol Hepatol. 2020; 5(3): 245-66. doi: 10.1016/s2468-1253(19)30349-8.
2. Asrani SK, Devarbhavi H, Eaton J, Kamath PS. Burden of liver diseases in the world. J Hepatol. 2019; 70(1): 151-71. doi: 10.1016/j.jhep.2018.09.014.
3. Rattanamongkolgul S, Wongjitrat C, Puapankitcharoen P. Prevalence of cirrhosis registered in nakhon Nayok, Thailand. J Med Assoc Thai. 2010; 93(Suppl 2): S87-91.
4. Wang TJ. Concept analysis of functional status. Int J Nurs Stud. 2004; 41(4): 457-62. doi: 10.1016/j.ijnurstu.2003.09.004.
5. Lai JC, Dodge JL, Sen S, Covinsky K, Feng S. Functional decline in patients with cirrhosis awaiting liver transplantation: results from the functional assessment in liver transplantation (FrAILT) study. Hepatology. 2016; 63(2): 574-80. doi: 10.1002/hep.28316.
6. Lenz ER, Pugh LC. The theory of unpleasant symptoms. In: Smith MR, Liehr PR, (Eds), The middle range theory for nursing. New York, NY: Springer; 2014. p. 165-95.
7. Wu LJ, Wu MS, Lien GS, Chen FC, Tsai JC. Fatigue and physical activity levels in patients with liver cirrhosis. J Clin Nurs. 2012; 21(1–2): 129-38. doi: 10.1111/j.1365-2702.2011.03900.x.
8. Rattawitoon T, Perngparn U. Alcohol consumption and health consequences among villagers in Thum Tong sub-district, Muang Nan district, Nan province, Thailand. J Health Res. 2012; 26(1): 25-9.
9. Bell S, Mehta G, Moore K, Britton A. Ten-year alcohol consumption typologies and trajectories of C-reactive protein, interleukin-6 and interleukin-1 receptor antagonist over the following 12 years: a prospective cohort study. J Intern Med. 2017; 281(1): 75-85. doi: 10.1111/joim.12544.
10. Langston S, Edwards MS, Lyvers M. Illness perceptions, coping, benefit finding, and adjustment in individuals with hepatitis C. Aust Psychol. 2018; 53(1): 87-96. doi: 10.1111/ap.12255.
11. Youssef NF, Shepherd A, Evans JM. Factors associated with health-related quality of life among patients with liver cirrhosis in Egypt. J Egypt Public Health Assoc. 2015; 90(1): 14-9. doi: 10.1097/01.EPX.0000461923.98204.f5.
12. Bentler PM, Chou CP. Practical issues in structural modeling. Sociol Methods Res. 1987; 16(1): 78-117. doi: 10.1177/0049124187016001004.
13. Bush K, Kivlahan DR, McDonell MB, Fihn SD, Bradley KA. The AUDIT alcohol consumption questions (AUDIT-C): an effective brief screening test for problem drinking. Arch Intern Med. 1998; 158(16): 1789-95. doi: 10.1001/archinte.158.16.1789.
14. Broadbent E, Petrie KJ, Main J, Weinman J. The brief illness perception questionnaire. J Psychosom Res. 2006; 60(6): 631-7. doi: 10.1016/j.jpsychores.2005.10.020.
15. Zimet GD, Powell SS, Farley GK, Werkman S, Berkoff KA. Psychometric characteristics of the multidimensional scale of perceived social support. J Pers Assess. 1990; 55(3–4): 610-7. doi: 10.1080/00223891.1990.9674095.
16. Krupp LB, LaRocca NG, Muir-Nash J, Steinberg AD. The fatigue severity scale. Application to patients with multiple sclerosis and systemic lupus erythematosus. Arch Neurol. 1989; 46(10): 1121-3. doi: 10.1001/archneur.1989.00520460115022.
17. Rossi D, Galant LH, Marroni CA. Psychometric property of fatigue severity scale and correlation with depression and quality of life in cirrhotics. Arq Gastroenterol. 2017; 54(4): 344-8. doi: 10.1590/s0004-2803.201700000-85.

18. Jette AM, Davies AR, Cleary PD, Calkins DR, Rubenstein LV, Fink A, *et al.* The Functional Status Questionnaire: reliability and validity when used in primary care. J Gen Intern Med. 1986; 1(3): 143-9. doi: 10.1007/bf02602324.

19. Byrne BM. Structural equation modeling with Mplus : basic concepts, applications, and programming. New York, NY: Routledge Academic; 2012.

20. Poorkaveh A, Modabbernia A, Ashrafi M, Taslimi S, Karami M, Dalir M, *et al.* Validity, reliability and factor structure of Hepatitis B Quality of Life Questionnaire version 1.0: findings in a large sample of 320 patients. Arch Iran Med. 2012; 15(5): 290-7.

21. Ben DT, Puwarawuttipanit W, Thosingha O. Factors related to quality of life among patients with chronic hepatitis B infection in Vietnam. J Nurs Sci. 2017; 35(Suppl.1): 39-46.

22. Owens MD, Ioannou GN, Tsui JL, Edelman EJ, Greene PA, Williams EC. Receipt of alcohol-related care among patients with HCV and unhealthy alcohol use. Drug Alcohol Depend. 2018; 188: 79-85. doi: 10.1016/j.drugalcdep.2018.03.047.

Corresponding author
Yupin Aungsuroch can be contacted at: yaungsuroch@gmail.com