A structural equation modeling approach to understanding physical function of terminal cancer patients

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Research Article

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Abstract

Purpose Understanding the activities of daily living (ADL) of cancer patients at the end-of-life stage may help healthcare providers develop interventions for preserving physical function and enhance patient's dignity in an everyday care context. This study aims to develop and test a causal effect model of physical function in terminal cancer patients.

Methods A total of 238 terminal cancer patients were recruited from two hospitals in South Korea. The data were collected using a structured questionnaire including demographics, visual analogue scale for pain, Functional Assessment of Chronic Illness Therapy-Fatigue, and Katz index of independence in ADL. The collected data were analyzed using SPSS WIN 25.0 and AMOS 23.0 programs for structural equation modeling procedures.

Results The model showed a good fit to the data (χ^2/df=2.08, GFI=0.932, NFI=0.966, TLI=0.971, CFI=0.982, AGFI=0.874, RMSEA=0.067). Physical function of patients with terminal cancer was positively influenced by regular exercise and negatively influenced by hospitalization, fatigue, and pain, explaining 35.1% of the variance. In this study, regular exercise improved participants' ADL level directly and indirectly either by reducing fatigue or decreasing fatigue through controlling pain. Pain did not affect ADL directly but decreased ADL level indirectly through fatigue as a mediator.

Conclusion Based on these results, in order to minimizing the problems of physical function in terminal cancer patients, interventions that reduce pain and fatigue and provide regular exercise are required. Particularly, hospitalized patients are susceptible to a decrease in physical function, so regular physical function evaluations may be considered.

Introduction

The five-year survival rate of cancer patients was about 45.1% in 2000 and reached 70.4% in 2017 due to consistent improvement in healthcare services for cancer patients [1]. The cancer patient experiences severe physical and psychological suffering as the illness progresses into terminal stage by worsening of the general condition. The most common symptoms in terminal cancer patients include pain, fatigue, anorexia, nausea, vomiting, constipation, delirium, and respiratory distress [2], and these symptoms alter their daily routine activities, ultimately impacting their quality of life in a negative way [3,4].

Recent meta-analysis research shows that more than one-third of cancer patients suffer from disturbance in ADL [5]. It is expected that terminal cancer patients with severe physical dysfunction may experience more severe alteration in daily activities. Activities of daily living (ADL) comprise six basic physical capacities essential for individuals to live independently: bathing, dressing, toileting, transferring, continence, and feeding [6], and act as a critical predictor of mortality and life expectancy of terminally-ill patients [7]. Losing the ability to perform ADL is one of the major stresses for terminally-ill patients [8] and may increase terminal patient's dependency on others and cause them to feel burdensome to their family, which may impose a sense of depression [9]. Such feelings of depression are the main cause of suicidal ideas in cancer patients [10]. Therefore, maintaining ADL abilities is essential for terminal cancer patients to preserve independence and autonomy, which leads to improved quality of life and dignity at the end-of-life stage.

ADL are correlated with diverse factors, including physiological factors, demographic factors, living arrangement, social support, exercise behavior, and participation in social activities [11–14]. Although ADL in cancer patients are a multi-dimensional outcome that is influenced by a variety of personal and inter-personal factors, they have been examined as a dependent variable with univariate relationships and individual factors in previous research without ample description of a cause-effect model. There is sparse research on structural equation modeling (SEM) of ADL in terminal cancer patients. Therefore, this study aims to develop a causal effect model of ADL in terminal cancer patients and to understand the causal relationships with predictors through SEM.

Conceptual Framework

This study used the International Classification of Functioning, Disability and Health (ICF), which was developed by World Health Organization, as a theoretical framework to explain ADL. The ICF framework classifies predictors into domains of personal factors, environmental factors, body functions and structure, activity and participation and emphasizes interactions among these factors to explain an individual's health status. [15]. The integrated model of ICF may be useful for understanding ADL and its influencing factors in terminal cancer patients from the standpoint of multi-dimensionality. In previous research, the ICF model has been used as a conceptual framework for explaining ADL in middle-aged adults [14] and community-dwelling elderly populations [13]. Based on the ICF model, this study built an ADL construct, and selected causal factors from previous studies and the perspectives of personal factors, environmental factors, body functions and structure, and activity. The participation domain in the ICF model was excluded from the ADL model in this study because it refers to social roles in a daily living context within the community, which may not be applicable to the mostly inpatients admitted in this study.

In the ICF model, personal factors are defined as individual characteristics influencing health status. In terms of personal factors, ADL have been reported to be significantly lower in patients with advanced age [13] and in women [16]. In previous studies, performance status and muscle volume, which can be indirect indicators of ADL in the elderly, are impacted by palliative chemotherapy [17]. Therefore, age, sex, and use of palliative chemotherapy were included as personal factors for predicting ADL in terminal cancer patients. In terms of the domain of environmental factors, older adults in long-term care facilities have been reported to have significantly lower ADL levels than community-dwelling older adults [18]. In accord with this finding, hospitalization was proposed as a causal independent variable for ADL in terminal cancer patients of this study. The activity factor in the ICF model includes engagement in specific activities or performance of tasks in a daily living context. Previous studies have reported that older adults both in long-term care facility and in the community show significant improvement in ADL when they engage in regular exercise [19]. Therefore, regular exercise was included as an independent variable, representing an activity factor in the ICF model, and predicts ADL in terminally-ill cancer patients in this study. Body functions and structure domain in the ICF model refer to physiological function and anatomical structure of the body. Previous studies have reported that pain [20] and fatigue [21] have negative impacts on ADL. Therefore, pain and fatigue were included as predictor variables for ADL, which were derived from the body functions and structure domain of the ICF model.

Based on review of the literature guided by the ICF model, 7 variables were included as predictors of ADL, and 20 pathways were proposed to explain the cause-effect model of ADL in terminally-ill patients. In the proposed structural equation model, age, gender, receipt of palliative chemotherapy, hospitalization, and regular exercise were proposed as causal variables. Pain and fatigue, which may be affected by personal and environmental factors [15], were included as mediating variables in the model.

Methods

Study design

This was a cross-sectional descriptive study. SEM was used to test the direct and indirect effects of physiological and psychological predictors on ADL in terminal cancer patients.

Participants

A total of 238 study participants were recruited from two hospitals located in Seoul metropolitan area, Korea. The sample size of this study was regarded as adequate for SEM, as the sample size of 200 or over is general accepted as recommended minimum size of sample for SEM research [22]. A convenience sampling method was used for recruiting study participants. Study participants were cancer patients who were aged 19 years or over, diagnosed as terminal cancer, and the recipient of palliative care at the time of data collection. Cancer patients of all stages of palliative care were recruited for participating in the study, including outpatients of oncology department, inpatients in a private clinic, and inpatients of hospice unit at a general hospital. Those who were able to communicate verbally, understand the purpose of the study and willing to participate in the research were included as the subjects.

Procedure

The data were collected from September 2013 to March 2016 using a structured questionnaire. After the IRB approval, eligible individuals were verbally invited to participate in the study, and those who signed informed consent completed a survey questionnaire. Researchers provided assistance with reading the questionnaire for participants who needed such help. It took about 20 minutes for a study participant to complete a survey questionnaire.

Measurements

All the measurements for this study were used upon the permit of original developers for the use of the scales.

Demographic And Clinical Characteristics

Demographic characteristics included age, gender, level of education, religion, main caregiver, and regular exercise behavior. Clinical characteristics included co-morbid disease, length of morbid period after cancer diagnosis, receiving of palliative chemotherapy, current hospitalization status.

Pain

Pain was measured using visual analogue scale (VAS). The intensity of pain was scored from 0 to 10, in which 0 represents 'no pain at all' and 10 represents 'unbearable pain'. A higher score indicated more severe pain. The severity of pain was categorized into none (0), mild (1–4), moderate (5–6), or severe (≥ 7) [23].

Fatigue

Fatigue was measured using the Korean version Functional Assessment of Chronic Illness Therapy-Fatigue [24]. The scale consists of thirteen items to measure the level of fatigue during the last seven days, and each item is scored from 0 (not at all) to 4 (very likely). A total score ranges from 0 to 52, and a lower score indicates more severe fatigue. For reduce confusion in interpretation of the results, a reverse coding was performed in the data analysis stage so that a higher score represents more severe level of fatigue. The Cronbach's alpha of the scale at the time of development was .95 [24]. The Cronbach's alpha for this study was .90. Because the fatigue scale was uni-dimensional and may possibly reduce the mode fit, the scale was re-structured into three item parcels based on the guides by Russel at all (1988) [25]. The items of the scale were classified into three item parcels: fatigue 1, fatigue 2, and fatigue 3.

Physical Function

Physical function was measured using the Katz index of independence in ADL [6]. The scale consists of six domains of basic physical function, including bathing, dressing, toileting, transferring, continence, and feeding. Each item is scored from 0 to 2, in which 0 indicating 'unable to do at all', 1 meaning 'able to do with some help', and 2 indicating 'able to do independently.' A maximum score is 12, and a higher score indicates a higher level of physical function. A score of 12 means no assistance is required, and a score of 11 or less means assistance is required. The Cronbach's alpha reliability of the scale was .98 in this study.

Data analysis

Demographic and clinical characteristics and study variables were analyzed using descriptive statistics. Internal consistency reliability of the measurements was examined using Cronbach's alpha. Normality of the data was assessed by skewness and kurtosis. Correlations and collinearity of measured variables were evaluated by Pearson's correlation coefficient. Structural equation model was analyzed using Maximum Likelihood estimation. Model fit and reliability and validity of the latent variable were examined by confirmatory factor analysis (CFA). Fit of the data to the hypothesized model was evaluated by fit indices, including Chi-square (χ^2), normal Chi-square (χ^2/df), Goodness of Fit Index (GFI), Standardized Root Mean Square Residual (SRMR), Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Normed Fit Index (NFI), and Tucker-Lewis Index. Bootstrapping method was used to examine statistical significance of direct effect, indirect effect, and total effect of the hypothesized model. Additional bootstrapping was performed after phantom variable, that does not affect model fit and population parameter, was identified in order to evaluate whether specific indirect effect among the variables was statistically significant. The data were analyzed using SPSS WIN 25.0 and AMOS 23.0 programs, and p values < 0.05 were considered statistically significant.

Results

Demographic and clinical characteristics

Of the study participants, 65.5% were aged 65 years or over, and 53.8% male. About one-third of the participants (35.3%) was middle school graduates, and 76.9% reported participation in religion. Most participants (84.0%) reported their main caregivers as family. Approximately 35% of the participants were engaged in exercise (20 minutes of walking or muscle strength training) at least three times a week. More than 40% of the participants (43.3%) had one or more co-morbid diseases, and 45.8% of them suffered from illness one to three years after cancer diagnosis. Approximately 19% of the participants were receiving palliative chemotherapy, and 74.4% of them were hospitalized patients (Table 1).

Table 1
Participants' demographic and clinical characteristics (*N* = 238)

Article title	**A structural equation modeling approach to understanding physical function of terminal cancer patients**
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Levels of fain, fatigue, and ADL

Descriptive results of the measured variables are presented in Table 2. Levels of pain, fatigue, and ADL were somewhat high among the participants. Of the participants, 60.5% reported moderate or severe pain, and 63.0% had limitation in ADL.

Table 2
Descriptive statistics of measured variables (*N* = 238)

Variables	Categories	n (%)
Age (yr)	< 65	82 (34.5)
	≥ 65	156 (65.5)
Gender	Male	128 (53.8)
	Female	110 (46.2)
Education level	Under middle school	84 (35.3)
	High school	80 (33.6)
	College or higher	74 (31.1)
Religion	Yes	183 (76.9)
	No	55 (23.1)
Caregiver	Family	200 (84.0)
	Others or none	38 (16.0)
Regular exercise	Yes	82 (34.5)
	No	156 (65.5)
Comorbidity	Yes	103 (43.3)
	No	135 (56.7)
Duration since diagnosis (month)	< 12	26 (10.9)
	12 ~ 35	109 (45.8)
	≥ 36	95 (39.9)
	Unknown	8 (3.4)
Palliative chemotherapy use	Yes	46 (19.3)
	No	192 (80.7)
Care setting	Outpatient setting	61 (25.6)
	Inpatient setting	177 (74.4)

Normality and multi-collinearity of measured variables

Analysis of skewness and kurtosis of the variables showed that skewness ranged from − 0.75 to -0.18 and kurtosis ranged from − 1.34 to -0.70, meeting the recommended normal distribution criteria of skewness less than 2 and kurtosis less than 7 in absolute value [26]. The largest correlation matrix between variables was 0.51, which did not exceed 0.8, the criterion for multi-collinearity [27], so there was no problem of multi-collinearity.

Model fit of the hypothesized model

Confirmatory Factor Analysis Of Measured Variables

To evaluate validity of constructs, confirmatory factor analysis was performed on the latent variables of fatigue and ADL. The analysis was conducted based on the fact that a variable is regarded as significant if standard factor loading (SFL) of the variable is over 0.4 in an absolute value [28]. In this study, SFL of fatigue (0.86 ~ 0.95) and ADL (0.83 ~ 0.99) met the recommended criteria. Construct reliability was 0.99 for fatigue and 0.91 for ADL, meeting the recommended criteria of 0.7 or over. There was no issue in convergent validity, as average variance extracted (AVE) was 0.92 for fatigue and 0.78 for ADL, meeting the recommended criteria of 0.5 or over [29]. Comparison of AVE with squared correlations in fatigue and ADL showed that AVE was larger than the squared correlation indices, demonstrating the discriminant validity of the variables [29].

Model Fit Of The Hypothesized Model

A model fit is considered as reasonable with Chi-square value of over 0.5, normed Chi-square values of less than, RMSEA of less than 0.08, AGFI of over 0.85, along with values over 0.90 in GFI, NFI, TLI, and CFI. The hypothetical model showed a good fit to the data (χ^2/df = 2.08, GFI = 0.932, NFI = 0.966, TLI = 0.971, CFI = 0.982, AGFI = 0.874, RMSEA = 0.067). Although Chi-square index was 134.98 (< 0.001), overall fit of the model was regarded as adequate in the consideration of the fact that Chi-square statistics are overly sensitive to sample size and is less commonly used [30].

Path Analysis For The Hypothesized Model

Direct effect, indirect effect, and total effect were tested on latent variables of the hypothesized model. Analysis of the pathways showed that 9 of 18 pathways were statistically significant (Table 3, Fig. 1). There were significant direct effects of receipt of palliative chemotherapy (ß=-0.28, p = 0.006), hospitalization (ß=0.35, p = 0.012), and regular exercise behavior (ß=-0.15, p = 0.011) on pain.

Table 3
Standardized direct, indirect, and total effects for the hypothesized model (N = 238)

	Possible Range	Min	Max	Mean ± SD or n (%)	Skewness	Kurtosis
Fatigue	0 ~ 52	0	51	29.28 ± 13.00	-0.58	-0.81
Pain	0 ~ 10	1	10	5.32 ± 3.03	-0.18	-1.34
none (0)				0 (0.0)		
mild (1–4)				94 (39.5)		
moderate (5–6)				37 (15.5)		
severe (≥ 7)				107 (45.0)		
ADL	0 ~ 12	0	12	8.07 ± 4.24	-0.75	-0.70
requiring assistance (0–11)				150 (63.0)		
requiring no assistance (12)				88 (37.0)		

In terms of fatigue, palliative chemotherapy had significant indirect effect (ß=-0.05, p = 0.007) on fatigue. Hospitalization had both direct effect (ß=0.22, p = 0.037) and indirect effect (ß=0.07, p = 0.010) on fatigue. Regular exercise behavior had significant direct effect (ß=-0.32, p = 0.001) and indirect effect (ß=-0.03, p = 0.012) on fatigue. Pain had significant direct effect (ß=0.19, p = 0.009) on fatigue.

Hospitalization had direct effect (ß=-0.29, p = 0.001) on ADL. Regular exercise behavior had direct effect (ß=0.23, p = 0.001) and indirect effect (ß=0.08, p = 0.003) on ADL. Pain had indirect effect (ß=-0.04, p = 0.008) on ADL. Fatigue had direct effect (ß=-0.24, p = 0.005) on ADL. The factors that had an influence on ADL were hospitalization (β=-0.35), regular exercise (β = 0.31), and fatigue (β=-0.24) explaining 35.1% of the variance.

Figure 1 Path diagram for the structural equation model on physical function in terminal cancer patients *p < 0.05; **p < 0.01; ***p < 0.001; y1, fatigue 1; y2, fatigue 2; y3, fatigue 3; y4, bathing; y5, dressing; y6, toileting; y7, transferring; y8, continence; y9, feeding

Mediating Effect In Hypothesized Model

The mediating effects of pain and fatigue in the relationships between independent variables (age, gender, palliative chemotherapy, hospitalization, and regular exercise) and ADL were examined. Five of fifteen pathways that include pain or fatigue as mediating variable were statistically significant. These pathways include: Palliative chemotherapy → Pain → Fatigue → ADL (B = 0.02, $p = 0.006$), Hospitalization → Fatigue → ADL (B=-0.08, $p = 0.025$), Hospitalization → Pain → Fatigue → ADL (B=-0.02, $p = 0.008$), Regular exercise → Fatigue → ADL (B = 0.10, $p = 0.003$), and Regular exercise → Pain→ Fatigue → ADL (B = 0.01, $p = 0.009$) (Table 4).

Table 4
Specific indirect effect for the hypothesized model

Path	**B**		**SE**		***p***		**95% CI**	
							Lower bounds	**Upper bounds**
Endogenous variables	Exogenous variables	Critical ratio (*p*)	SMC	Standardized direct effect	Standardized indirect effect	Standardized total effect		
				β (*p*)	β (*p*)	β (*p*)		
Pain	Age	0.31 (0.754)	0.430	0.016 (0.785)		0.016 (0.785)		
	Gender (female)	-1.07 (0.285)		-0.054 (0.309)		-0.054 (0.309)		
	Palliative chemotherapy	-3.08 (0.002)		-0.275 (0.006)		-0.275 (0.006)		
	Hospitalization	3.75 (< 0.001)		0.346 (0.012)		0.346 (0.012)		
	Regular exercise	-2.70 (0.007)		-0.146 (0.011)		-0.146 (0.011)		
Fatigue	Age	-0.50 (0.619)	0.477	-0.026 (0.744)	0.003 (0.732)	-0.022 (0.773)		
	Gender (female)	0.44 (0.663)		0.022 (0.629)	-0.010 (0.235)	0.012 (0.780)		
	Palliative chemotherapy	-1.34 (0.182)		-0.122 (0.230)	-0.052 (.007)	-0.174 (0.970)		
	Hospitalization	2.32 (0.021)		0.221 (0.037)	0.065 (0.010)	0.286 (0.007)		
	Regular exercise	-5.68 (< 0.001)		-0.322 (0.001)	-0.028 (0.012)	-0.349 (0.001)		
	Pain	2.90 (0.004)		0.189 (0.009)		0.189 (0.009)		
ADL	Age	0.69 (0.488)	0.351	0.038 (0.571)	0.006 (0.633)	0.044 (0.550)		
	Gender (female)	-0.61 (0.544)		-0.033 (0.594)	-0.004 (0.631)	-0.037 (0.506)		
	Palliative chemotherapy	-0.50 (0.615)		-0.049 (0.303)	0.034 (0.249)	-0.015 (0.627)		
	Hospitalization	-2.78 (0.006)		-0.289 (0.001)	-0.059 (0.094)	-0.348 (0.001)		
	Regular exercise	3.60 (< 0.001)		0.234 (0.001)	0.078 (0.003)	0.312 (0.001)		
	Pain	0.35 (0.729)		0.025 (0.759)	-0.044 (0.008)	-0.020 (0.808)		
	Fatigue	-3.04 (0.002)		-0.235 (0.005)		-0.235 (0.005)		
Age → Pain → ADL	0.000		0.000	0.608		0.000		0.001

Path	B	SE	*p*	95% CI	
				Lower bounds	Upper bounds
Age → Fatigue → ADL	0.000	0.001	0.629	-0.001	0.002
Age → Pain → Fatigue → ADL	0.000	0.000	0.657	0.000	0.000
Gender (female) → Pain → ADL	-0.002	0.008	0.450	-0.030	0.007
Gender (female) → Fatigue → ADL	-0.007	0.016	0.506	-0.045	0.021
Gender (female) → Pain → Fatigue → ADL	0.003	0.003	0.161	-0.001	0.014
Palliative chemotherapy → Pain → ADL	-0.011	0.039	0.639	-0.108	0.057
Palliative chemotherapy → Fatigue → ADL	0.046	0.046	0.137	-0.017	0.191
Palliative chemotherapy → Pain → Fatigue → ADL	0.020	0.013	0.006	0.004	0.061
Hospitalization → Pain → ADL	0.012	0.044	0.657	-0.071	0.110
Hospitalization → Fatigue → ADL	-0.075	0.048	0.025	-0.206	-0.008
Hospitalization → Pain → Fatigue → ADL	-0.022	0.014	0.008	-0.071	-0.005
Regular exercise → Pain → ADL	-0.005	0.017	0.659	-0.044	0.027
Regular exercise → Fatigue → ADL	0.100	0.037	0.003	0.040	0.191
Regular exercise → Pain → Fatigue → ADL	0.009	0.006	0.009	0.001	0.028

Discussion

This study proposed a hypothetical model of ADL in terminal cancer patients, and tested the model through SEM to identify factors influencing ADL. It was found that 63% of the study participants had limitation in ADL, which is higher than 37% of adult cancer patients [5] and 48% of patients with metastatic cancer [31], suggesting that ADL limitation in terminal cancer patients is more severe than in other groups.

The hypothetical model proposed in this study showed sound fit to the data, implying that the model is an adequate framework to explain ADL in terminal cancer patients. In the model, age and sex did not have any effect on ADL, which is inconsistent with the findings of previous studies suggesting that older age [32] and women [14] predicted ADL limitation. It is plausible that the disease severity of the terminal cancer patients in the present study was high, reducing the influence of personal factors on ADL. The ADL of terminal cancer patients was predicted by interactions among personal factors, environmental factors, body functions and structure and activity explaining 35.1% of the variance. ADL was positively influenced by regular exercise and negatively influenced by hospitalization, fatigue, and pain.

The most influential factor that predicts ADL in terminal cancer patients was hospitalization. This result suggests that admission itself can affect the daily routine and physical function of the cancer patient but may also imply that a decrease of ADL level due to worsened health status can be a triggering factor for hospitalization. It has been reported that 33% of older women with functional limitation experience reduced physical function after admission to a hospital. Further, extended length of admission increases the risk (1.69 times) of reduction in physical function [33], supporting the findings of this study. Hospitalization-associated disability, defined as worsening of ADL limitation at the time of hospital discharge compared to that at admission, occurs in one-third of inpatients older than 70 years [34]. An inpatient with terminal cancer tends to spend most of the time in bed during the admission period, which may result in reduced levels of physical activity [35] and muscle volume and function [36], leading to increased disability. Therefore, it is necessary for healthcare providers to regularly assess the patient's physical function and motivate the patient to engage in physical activity.

The second most significant predictor of ADL in terminal cancer patients was regular exercise. Regular exercise is known to improve mobility in terminal cancer patients [37]. Specifically for frail elderly patients, regular exercise enhances ADL levels [19]. In this study, regular exercise improved participants' ADL level directly and indirectly either by reducing fatigue or decreasing fatigue through controlling pain. This finding is in line with reports that regular exercise decreases cancer-related fatigue [38] and pain [39] and improves physical function [39]. Therefore, engagement in regular exercise is important for patients even in a terminal cancer stage to relieve pain and fatigue and to maintain maximal physical function. However, the intensity of exercise needs to be controlled based on the patient's physical condition, while considering that the physical and cognitive status of the terminal cancer patient may change rapidly [40].

In this study, fatigue was the third most influential factor on ADL of terminal cancer patients, followed by hospitalization and regular exercise. The significant impact of fatigue on physical function is consistent with the findings of previous research demonstrating that fatigue reduces the physical performance of cancer patients [21]. Fatigue is one of the most critical factors that affect quality of life in terminal cancer patients [4] and is an indicator of remaining life expectancy [41]. However, fatigue of cancer patients is less recognized by healthcare providers than are more urgent symptoms [42]. Cancer patients tend not to complain about fatigue to healthcare providers due to the impression that it is not an important symptom or fear that talking about fatigue may hinder healthcare providers solely focusing on treatment of cancer illness [43]. Therefore, healthcare providers should encourage cancer patients to describe their symptoms in detail, including fatigue. It is also important to identify and correct underlying conditions leading to fatigue.

In this study, pain did not affect ADL directly but decreased ADL level indirectly through fatigue as a mediator. This finding is consistent with that of a previous view that pain impacts functional performance of cancer patients through fatigue as a mediating factor [44]. 60.5% of the subjects in this study experienced moderate or severe level of pain, suggesting that pain is a major symptom in terminal cancer patients and may affect their quality of life [45]. Therefore, it is necessary for healthcare providers actively manage pain in order to improve ADL as well as quality of life in terminal cancer patients.

This study is significant in that it provides an integrated perspective on the factors affecting ADL in terminal cancer patients through a multidimensional approach. However, in this study, it is difficult to generalize the results by using the convenient sampling method when selecting subjects, so further studies need to be repeated for terminal cancer patients in various regions.

Also, since this study collected data based on a self-reported questionnaire, there was a limit to securing objectivity. Therefore, it is proposed to use objective clinical variables in future studies.

Conclusion

The SEM of this study showed significant pathways among factors influencing ADL of terminal cancer patients. ADL was positively influenced by regular exercise and was negatively influenced by hospitalization, fatigue, and pain. Based on these results, in order to minimizing the problems of physical function in terminal cancer patients, interventions that reduce pain and fatigue and provide regular exercise are required. Particularly, hospitalized patients are susceptible to a decrease in ADL, so regular physical function evaluations may be considered.

Declarations

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Figures

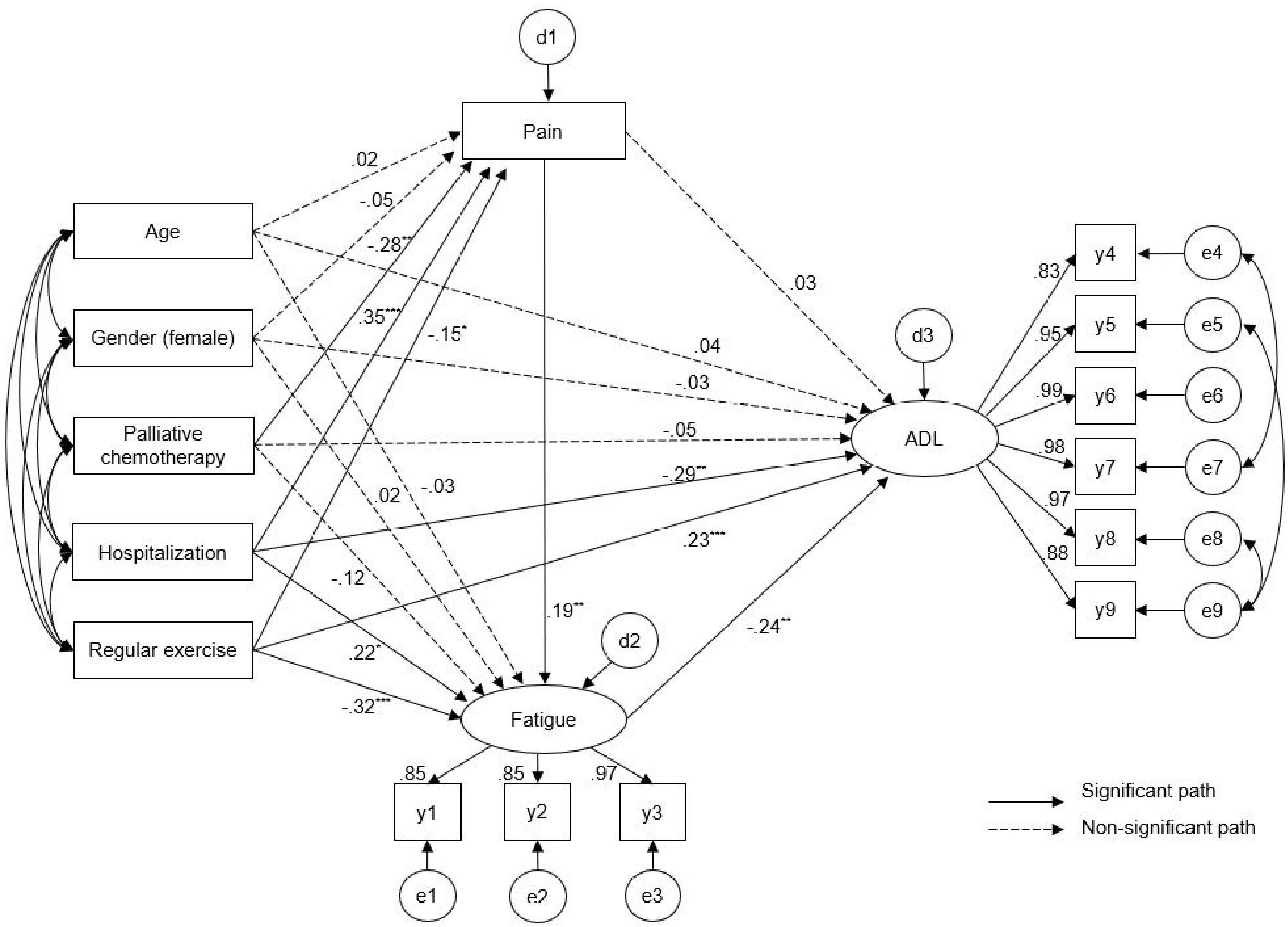

Figure 1

Path diagram for the structural equation model on physical function in terminal cancer patients *p < 0.05; **p < 0.01; ***p < 0.001; y1, fatigue 1; y2, fatigue 2; y3, fatigue 3; y4, bathing; y5, dressing; y6, toileting; y7, transferring; y8, continence; y9, feeding