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ORIGINAL RESEARCH

Path Analysis Modeling of Impaired Well-being in Advanced Cancer Patients Undergoing Chemotherapy

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Abstract

Background: Well-being is an overall indicator of an individual's health status. Psychological and somatic symptoms may negatively impact patients undergoing chemotherapy for advanced cancer. Previous studies have identified cancer-related symptoms and psychosocial factors associated with impaired well-being but have not fully explored the factor structure of the whole spectrum of impaired well-being or assessed the causal effects of those factors on impaired well-being.
Purpose: This study aimed to develop and test a path model of the relationships between unpleasant symptoms and impaired well-being among patients undergoing chemotherapy for advanced cancer.
Methods: A cross-sectional secondary analysis was conducted among 500 patients with advanced cancer who received treatment at a tertiary care hospital in the lower northern region of Thailand. Data included personal and clinical information and the Edmonton Symptom Assessment System (ESAS), which assessed the severity of cancer-related symptoms, including pain, anxiety, nausea, shortness of breath, drowsiness, tiredness, depression, and loss of appetite. Impaired well-being was measured using the ESAS well-being item, ranging from 0 (best well-being) to 10 (worst possible well-being). Path analysis was used to examine the relationships between symptoms and impaired well-being.
Results: The final path model demonstrated a good fit to the data and explained 22.1% of the variance in impaired well-being ($R^2 = .221$). Loss of appetite had the strongest total effect on impaired well-being ($\beta = 0.72$, $p < .001$). Loss of appetite ($\beta = 0.71$, $p < .001$), depression ($\beta = 0.31$, $p < .001$), and shortness of breath ($\beta = 0.21$, $p < .001$) had significant direct effects on impaired well-being. Anxiety, nausea, shortness of breath, pain, tiredness, and loss of appetite had indirect effects on impaired well-being.
Conclusion: The study provides an explanatory model of the relationships between symptoms and impaired well-being in patients undergoing chemotherapy for advanced cancer. The findings highlight the importance of comprehensive symptom assessment and management and may help nurses design interventions that address both direct and indirect symptom pathways.

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1. Introduction

Cancer is a major global health concern, accounting for 20 million new cases and nearly 10 million deaths annually (1 in 6 deaths) (International Agency for Research on Cancer [IARC], 2022a; Sung et al., 2021). In Thailand, GLOBOCAN 2022 reported 183,541 newly diagnosed cancer cases and 118,829 cancer-related deaths. In addition, data from the Hospital-Based Cancer Registry of the National Cancer Institute of Thailand indicate that a large proportion of cancer patients are diagnosed at late or advanced stages (stage III–IV), reflecting delayed presentation in clinical practice (IARC, 2022b; National Cancer Institute of Thailand, 2022).

Patients with advanced-stage cancer, typically defined as stage III or IV disease according to TNM classification or equivalent clinical staging (National Cancer Institute, 2022), who receive chemotherapy commonly experience multiple physical and psychological symptoms. These include pain, anxiety, nausea, shortness of breath, drowsiness, loss of appetite, tiredness,

depression, and impaired well-being (Döner et al., 2025; Lertpanit et al., 2021). In Thailand, although no study has directly reported impaired well-being, evidence indicates that patients with advanced cancer experience substantial impacts on physical, emotional, and functional well-being. Symptoms such as tiredness, pain, anxiety, and depression reflect challenges in patients' overall well-being (Savisit, 2023; Woradet et al., 2025), consistent with the symptoms assessed using the ESAS. These unpleasant symptoms substantially compromise patients' functional status, psychological well-being, and overall quality of life (Khamboon & Pakanta, 2021; Yang et al., 2021).

Previous studies have documented associations between cancer-related symptoms and impaired well-being, while the causal interactions among these symptoms remain insufficiently understood (Battat et al., 2023; Lewandowska et al., 2020). Recent studies conducted in Asian populations have reported a high burden of multiple concurrent symptoms among cancer patients (Khamboon & Pakanta, 2021; Woradet et al., 2025; Yang et al., 2021), highlighting the importance of comprehensive symptom assessment in cancer care. Olson et al. (2014) developed a causal model for nine common symptoms using the ESAS in palliative care patients and demonstrated both direct and indirect effects on impaired well-being. However, that study was limited by a small sample size and a specific palliative care setting, which may restrict its generalizability.

In a previous study conducted by the present authors, impaired well-being was found to be strongly associated with functional status among patients with advanced cancer receiving chemotherapy; however, the specific symptoms contributing to impaired well-being and their causal interrelationships were not examined (Khamboon et al., 2023). Other evidence also indicates that impaired well-being is commonly observed in patients with advanced-stage cancer, with symptom burden increasing as the disease progresses (Döner et al., 2025; Torres et al., 2022). These findings further support the need to investigate the causal pathways among multiple symptoms affecting impaired well-being.

Despite these findings, important gaps remain. Most existing studies have focused on associations between individual symptoms and well-being rather than examining the complex pathways linking multiple concurrent symptoms to impaired well-being. Limited studies have applied path analysis to examine both direct and indirect relationships among multiple cancer-related symptoms, particularly in Asian populations. Furthermore, no study has examined these causal relationships among Thai patients with advanced cancer undergoing chemotherapy, whose characteristics and care contexts may differ from those reported in previous studies. Addressing these gaps is essential to improve understanding of symptom interactions and to support the development of targeted symptom management strategies.

This study was guided by the Theory of Unpleasant Symptoms (TOUS), which provides a comprehensive framework for examining multiple symptoms concurrently, their interrelationships, and their effects on outcomes such as impaired well-being (Lenz & Pugh, 2018). Using the Edmonton Symptom Assessment System (ESAS), impaired well-being was conceptualized as an outcome reflecting the cumulative impact of multiple symptoms. A hypothesized model based on the TOUS and relevant literature was developed to examine both direct and indirect relationships among symptoms, thereby capturing the complexity of impaired well-being in patients with advanced cancer. These specific symptoms were selected because they are the most prevalent and burdensome among Thai patients receiving chemotherapy, as shown in prior studies (Khamboon & Pakanta, 2021; Woradet et al., 2025), and they significantly impact patients' overall well-being and functional status in the Thai healthcare context.

Therefore, this study aimed to develop and test the causal relationships between pain, anxiety, nausea, shortness of breath, drowsiness, loss of appetite, tiredness, depression, and impaired well-being among patients undergoing chemotherapy for advanced cancer.

2. Methods

2.1 Research design

This study is a secondary data analysis of data from a previous study conducted by the same authors (Khamboon et al., 2023). The use of secondary data analysis allowed for efficient utilization of an existing dataset with an adequate sample size to further explore relationships that were not examined in the original study. The original study employed a cross-sectional descriptive design to examine the influence of unpleasant symptoms on the functional status of patients with advanced cancer. In the present study, data from the ESAS were reanalyzed to examine the causal

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relationships among common cancer-related symptoms, with impaired well-being specified as the outcome variable. Eight symptoms, including pain, tiredness, drowsiness, nausea, lack of appetite, shortness of breath, depression, and anxiety, were modeled as predictors of impaired well-being using path analysis. The study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

2.2 Setting and samples

This study utilized an existing dataset from a previously published study (Khamboon et al., 2023). In the original study, data collection was conducted at the chemotherapy unit of a tertiary care hospital in the lower northern region of Thailand between March 2020 and October 2021. The required sample size for the primary data collection was calculated using G*Power software version 3.1.9.2 for multiple regression analysis (Kang, 2021), with a statistical power of 0.80, a significance level of 0.05, and a small effect size ($R^2 = 0.044$) based on a previous study (Suedee et al., 2015). This calculation yielded a minimum requirement of 426 participants. To account for potential refusal or incomplete data, an additional 20% was added, targeting 511 participants. Participants for the original study were recruited using a consecutive sampling technique. Eligible participants were adults with clinically confirmed advanced-stage cancer (stage III or IV according to the TNM classification or equivalent clinical staging) who had received at least one cycle of chemotherapy and were able to communicate effectively. Patients were excluded if they were receiving concurrent treatments (e.g., radiotherapy or surgery) or had severe comorbidities, complications, or diagnosed cognitive or psychological disorders. During the original data collection period, 511 eligible patients were approached, and 11 were excluded due to refusal to participate or incomplete data, resulting in a final dataset of 500 participants.

2.3 Measurement and data collection

All data analyzed in the present study were secondary data extracted from the aforementioned dataset (Khamboon et al., 2023). Two research instruments were used in this study. First, a structured questionnaire developed by the principal investigator was applied to collect demographic information (gender, age, religion, marital status, level of education, occupation, and monthly income) and clinical characteristics (type of cancer, stage, number of chemotherapy cycles received, and total duration since diagnosis). Second, the ESAS, originally developed by Bruera and colleagues, was employed to measure symptom burden in patients with advanced cancer (Hui & Bruera, 2017). The ESAS comprises nine symptoms assessed using a 0–10 numerical rating scale (NRS): pain, tiredness, drowsiness, nausea, lack of appetite, shortness of breath, depression, anxiety, and well-being. Scores are interpreted as 0 = no symptom, 1–3 = mild, 4–6 = moderate, and 7–10 = severe (Lertpanit et al., 2021).

The ESAS has been translated into more than 20 languages, including Thai, and has been validated in Thai patients with various types of cancer. The Thai version of the ESAS showed strong internal consistency, with a Cronbach's alpha of 0.89 reported in a previous study (Chinda et al., 2011). As the ESAS is a standardized instrument with established reliability, no additional reliability testing was conducted in the present study. For the present analysis, we used secondary data from our previous study (Khamboon et al., 2023). The dataset included demographic characteristics and symptom data measured using the ESAS. No additional data collection was conducted in the present study; all analyses were based solely on the existing dataset.

2.4 Data analysis

Data analysis was conducted using IBM SPSS Statistics version 22 (IBM Corp., Armonk, NY) and Mplus version 7.11. Descriptive statistics were applied to summarize demographic characteristics and key study variables. Pearson's correlation coefficients were computed to examine relationships among the study variables. Path analysis was performed in Mplus to assess the causal relationships. Statistical assumptions for path analysis, including linearity, homoscedasticity, and multicollinearity, were tested and satisfied. Model fit was evaluated using the following indices (Wang & Wang, 2019): Chi-square (χ^2) > 0.05, Chi-square to degrees of freedom ratio (χ^2/df) ≤ 2, Root Mean Square Error of Approximation (RMSEA) < 0.05, Comparative Fit Index (CFI) ≥ 0.95, Tucker–Lewis Index (TLI) ≥ 0.95, and Standardized Root Mean Square Residual (SRMR) < 0.08. A p-value < .05 was considered statistically significant.

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2.5 Ethical considerations

This study adhered to recognized ethical standards for research involving human participants. Ethical approval was granted by two institutional review boards: the Naresuan University Institutional Review Board (COA No. 527/2019, IRB No. 0418/62) and the Ethics Committee of Buddhachinaraj Hospital Phitsanulok (IRB No. 020/63). All participants were approached in the chemotherapy unit, where the study objectives, procedures, potential benefits, and the voluntary nature of participation were clearly explained. Written informed consent was obtained from each participant prior to data collection. Participants were assured that confidentiality and anonymity would be maintained, and they retained the right to withdraw from the study at any point without affecting their ongoing treatment.

3. Results

3.1 Demographic and clinical characteristics of participants

A total of 500 patients completed the study measures, with a mean age of 53.08 years (SD = 12.70). Most were female (64.60%), Buddhist (96.20%), married (77.40%), and had completed primary education (65.60%). Participants included farmers (28.20%) and unemployed individuals (21.80%), while 51.40% had a monthly income below 10,000 Baht. Gastrointestinal cancer was the most common diagnosis (35.60%), followed by breast cancer (27.40%), other cancers (23.60%), and hematologic cancer (13.40%). More than half of the participants had stage III cancer (56.00%), and most had received at least two cycles of chemotherapy (90.00%). Approximately 45.80% had been diagnosed 1–2 years prior to the current treatment. Detailed characteristics are presented in Table 1.

Table 1. Demographic and clinical characteristics of participants (n = 500)

Characteristics	Frequency (f)	Percentage (%)
Age (years), Mean±SD = 53.08 ± 12.70		
Gender		
Female	323	64.60
Male	177	35.40
Religion		
Buddhist	481	96.20
Other	19	3.80
Marital status		
Married	387	77.40
Other	113	22.60
Level of education		
Primary	328	65.60
Secondary/Higher education	172	34.40
Occupation		
Farmer	141	28.20
Unemployed	109	21.80
Other	250	50.00
Monthly income		
<10,000 Baht	257	51.40
≥10,000 Baht	243	48.60
Type of cancer		
Gastrointestinal	178	35.60
Breast	137	27.40
Hematologic	67	13.40
Other	118	23.60
Cancer stage		
Stage III	280	56.00
Stage IV	220	44.00
Time since diagnosis		
1–2 years	229	45.80
> 2 years	271	54.20
Number of chemotherapy cycles		
≥2 cycles	450	90.00
1 cycle	50	10.00

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3.2 Symptom severity and correlations among study variables

Participants reported mild levels of pain, anxiety, nausea, shortness of breath, drowsiness, tiredness, depression, and impaired well-being, whereas loss of appetite was rated as moderate. Table 2 shows the average rated scores for each symptom on the ESAS.

Table 2. The summary of average rated scores for each symptom on the ESAS (n = 500)

Variables	Possible Range	Actual Range	Mean	SD	Level of score
1. Pain	0-10	0-9	2.72	2.52	Mild
2. Anxiety	0-10	0-8	1.84	2.37	Mild
3. Nausea	0-10	0-9	1.08	1.94	Mild
4. Shortness of breath	0-10	0-8	0.75	1.82	Mild
5. Drowsiness	0-10	0-7	1.20	2.04	Mild
6. Loss of appetite	0-10	0-9	3.26	2.69	Moderate
7. Tiredness	0-10	0-8	2.88	2.19	Mild
8. Depression	0-10	0-6	1.14	1.92	Mild
9. Impaired well-being	0-10	0-10	1.71	2.44	Mild

The correlation matrix of the key variables included in the final analysis is presented in Table 3. The bivariate correlations among the study variables ranged from -0.10 to 0.76, indicating no severe multicollinearity (Shrestha, 2020).

Table 3. Correlation matrix of study variables (n = 500)

Variables	1	2	3	4	5	6	7	8
1. Impaired well-being	1.00							
2. Pain	.26**	1.00						
3. Anxiety	.32**	-.02	1.00					
4. Nausea	.16**	-.11*	-.03	1.00				
5. Shortness of breath	.34**	.07	.04	-.09	1.00			
6. Drowsiness	.32**	.26**	.22**	.01	.25**	1.00		
7. Loss of appetite	.24**	.11*	.10*	.29**	.14**	.13**	1.00	
8. Tiredness	.26**	-.02	.17**	.11*	.38**	.22**	.28**	1.00
9. Depression	.22**	-.16**	.76**	-.10*	.05	.31**	.07	.25**

Note: * $p < .05$, ** $p < .01$

3.3 Model fit and direct, indirect, and total effects on impaired well-being

The initial hypothesized model (Figure 1) demonstrated an inadequate fit to the data ($\chi 2$ = 234.475, df = 13, $\chi 2$ / df = 18.04, RMSEA = 0.185 [0.164–0.206], CFI = 0.783, TLI = 0.499, SRMR = 0.066). Therefore, the model was modified based on both theoretical rationale and modification indices. Specifically, the non-significant paths from drowsiness to impaired well-being and drowsiness to loss of appetite were removed, while all other paths that were statistically significant and consistent with theory were retained. After trimming the initial model, the final model demonstrated a good fit based on goodness-of-fit indices (Wang & Wang, 2019) ($\chi 2$ = 8.688, df = 9, the ratio of $\chi 2$ / df = 0.97, RMSEA = 0.000, CFI = 1.000, TLI = 1.001, SRMR = 0.018).

The model (Figure 1), based on the Theory of Unpleasant Symptoms (TOUS), illustrates the proposed direct and indirect pathways between eight concurrent symptoms (pain, anxiety, nausea, shortness of breath, drowsiness, loss of appetite, tiredness, and depression) and the outcome variable (impaired well-being). Single-headed arrows represent the hypothesized causal directions prior to statistical testing.

Figure 2 presents the final causal model with standardized path estimates. In Figure 2, single-headed arrows indicate significant direct pathways between variables, with standardized path coefficients (β) presented on each arrow. Non-significant paths (from drowsiness to impaired well-being and to loss of appetite) have been removed. Model fit indices: χ^2 = 8.688, df = 9, χ^2/df = 0.97, RMSEA = 0.000, CFI = 1.000, TLI = 1.001, SRMR = 0.018.

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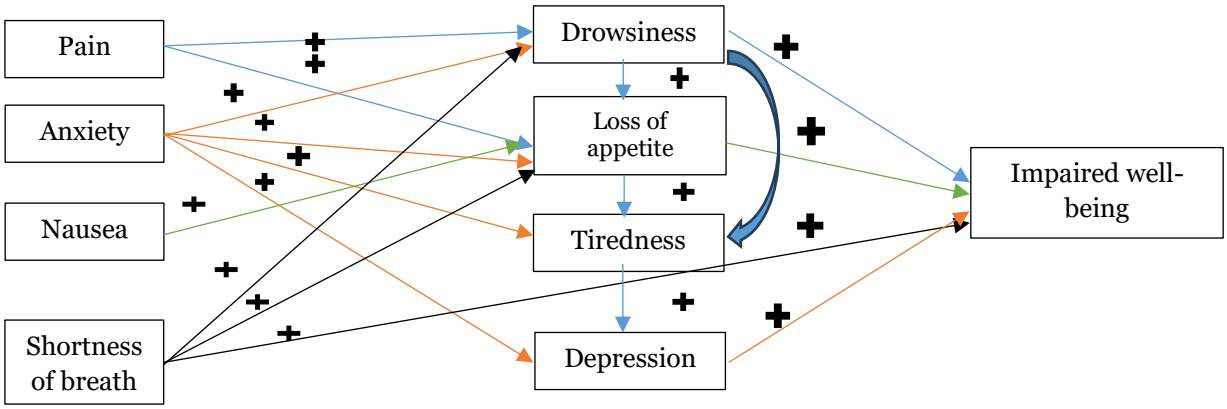


Figure 1. The initial hypothesized causal relationships of impaired well-being in advanced cancer patients undergoing chemotherapy

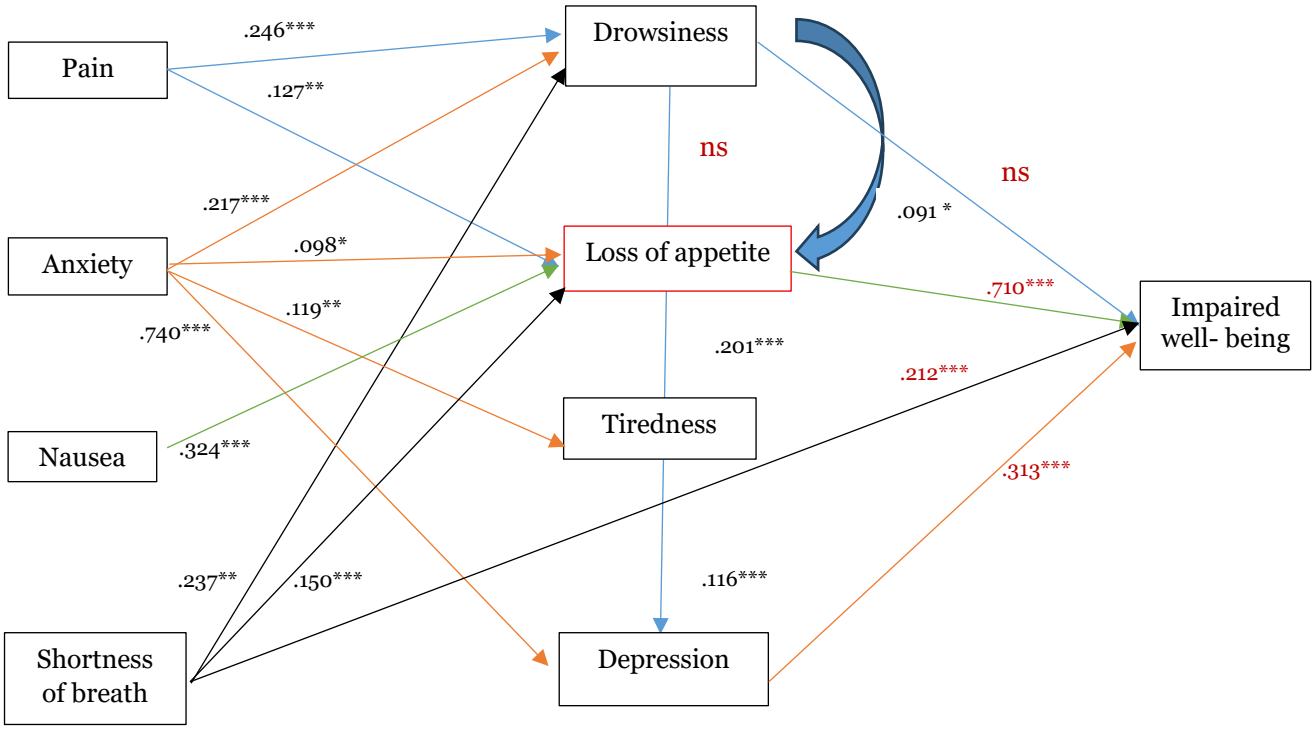


Figure 2. The final causal model of impaired well-being in advanced cancer undergoing chemotherapy (*p < .05, **p < .01, ***p < .001, ns = non-significant)

The model of impaired well-being in patients with advanced cancer undergoing chemotherapy explained 22.1 % of the total variance in impaired well-being. Loss of appetite had the strongest total effect on impaired well-being (β = 0.72, p < .001). Loss of appetite (β = 0.71, p < .001), depression (β = 0.31, p < .001), and shortness of breath (β = 0.21, p < .001) directly affected impaired well-being. The final model indicated that anxiety, nausea, shortness of breath, pain, tiredness, and loss of appetite had indirect effects on impaired well-being. The effects of each symptom on impaired well-being are presented in Table 4.

4. Discussion

The findings of this study demonstrated that the TOUS-based model of impaired well-being was supported, indicating that multiple cancer-related symptoms exert both direct and indirect effects on impaired well-being. Loss of appetite, depression, and shortness of breath had direct effects, whereas anxiety, nausea, pain, and tiredness showed indirect effects. Shortness of breath

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and loss of appetite also demonstrated both direct and indirect effects, reflecting the interconnected nature of symptom experiences. The hypothesized model, grounded in a literature review and the Theory of Unpleasant Symptoms (Lenz & Pugh, 2018), was used to examine these relationships. Path analysis showed that multiple symptoms occur concurrently and cumulatively influence impaired well-being. Overall, the findings support the applicability of the TOUS in explaining multidimensional symptom experiences in patients with advanced cancer and provide empirical support for the framework.

Table 4. Parameter estimates of direct, indirect, and total effects of study variables in the model (n = 500)

Variables	Impaired Well-being		
	DE	IE	TE
1. Pain		0.11**	0.11**
2. Anxiety		0.32***	0.32***
3. Nausea		0.23***	0.23***
4. Shortness of breath	0.21***	0.12**	0.33***
5. Drowsiness	0.03	0.03	0.06
6. Loss of appetite	0.71***	0.01**	0.72***
7. Tiredness		0.04**	0.04**
8. Depression	0.31***		0.31***

Note. ** $p < .01$, *** $p < .001$

The strongest effect was observed for loss of appetite, which influenced impaired well-being both directly and indirectly through tiredness and depression. Most patients with advanced cancer suffer from loss of appetite, which affects their ability to perform usual activities and leads to poor quality of life (Ehret & Jatoi, 2021). The regulation of loss of appetite involves many factors and cytokines that modulate receptors and neurons in the central nervous system (CNS). Elevated levels of interleukin 1 (IL-1), interleukin 6 (IL-6), tumor necrosis factor-α (TNF-α), and interferon γ (IFN-γ) have been reported in cancer patients. These cytokines affect neuroendocrine control of appetite, leading to anorexia and hypermetabolism, resulting in muscle wasting and tiredness (Hariyanto & Kurniawan, 2021; Li et al., 2021). Cancer treatments, including chemotherapy, may lower appetite or alter taste and smell; side effects such as mouth and throat problems, nausea, vomiting, or tiredness can further reduce appetite (Milliron et al., 2022). Loss of appetite is also linked to tiredness and depression, which are common contributors to impaired well-being. Consistent with previous studies, loss of appetite and tiredness often co-occur as symptom clusters (Khamboon & Pakanta, 2021). These findings support the TOUS assumption that a single symptom may function both as a primary symptom and as a mediator within a symptom network.

Path analysis results indicated that nausea, shortness of breath, pain, and anxiety directly affected loss of appetite, with nausea being the strongest contributor. These effects indirectly influenced impaired well-being through reduced appetite, demonstrating how multiple symptoms interact and accumulate to affect overall patient well-being, which is consistent with the TOUS principles of symptom interrelationships. This pattern highlights appetite as a key pathway through which physical and psychological symptoms jointly influence impaired well-being. Nausea is an unpleasant feeling in the back of the throat or stomach that may come and go in waves (Gupta et al., 2021). Vomiting is the expulsion of stomach contents, while retching refers to stomach and esophageal movements without vomiting. These symptoms can significantly reduce quality of life and may deter patients from continuing treatment. Chemotherapy-induced nausea and vomiting (CINV) involve coordination among gastrointestinal organs and the peripheral and central nervous systems, with serotonin, neurokinin-1, and dopamine receptors playing key roles. Despite new antiemetics, nausea and vomiting remain highly distressing, affecting up to 50% of patients undergoing chemotherapy (Gupta et al., 2021) and reducing appetite, leading to malnutrition and tiredness.

Depression was the second most influential symptom directly associated with impaired well-being. Cancer is widely recognized as a life-threatening diagnosis, often causing substantial psychological distress. Prolonged mental anguish may lead to anxiety, depression, or both. The prevalence of depression in cancer patients is up to three times higher than in the general

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population, with around two-thirds also experiencing clinically significant anxiety (Grassi et al., 2023). These findings highlight the critical role of emotional health in overall well-being. Depression and anxiety can negatively affect quality of life, treatment adherence, and potentially mortality (Götze et al., 2020). A cross-sectional cohort study of 1,002 cancer survivors showed moderate to severe depression and anxiety occurring simultaneously, affecting global quality of life (Götze et al., 2020). Our findings are consistent, indicating that depression mediates the effect of anxiety on impaired well-being, further supporting the TOUS assumptions regarding interrelated psychological symptoms. Appropriate prevention and treatment of depression and anxiety are essential to improve patients' well-being.

Shortness of breath was the last symptom directly influencing impaired well-being. Shortness of breath, also referred to as breathlessness or dyspnea, is a common symptom in patients with advanced cancer, influenced by cancer progression, therapies, acute complications, or comorbidities such as COPD or heart failure (Crombeen & Lilly, 2020; Hui et al., 2020). It can affect patients physically, emotionally, and socially, and is challenging to manage during daily activities such as eating. Our study found that loss of appetite mediated the relationship between shortness of breath and impaired well-being, illustrating an indirect pathway as conceptualized in the TOUS. This finding is consistent with recent evidence demonstrating a highly interactive relationship between shortness of breath and other concurrent cancer symptoms (McKenzie et al., 2020). In that study, the severity and presence of shortness of breath were found to be significantly correlated with an increased burden of other symptoms, particularly appetite loss, anxiety, depression, tiredness, and drowsiness, which collectively diminish patients' overall quality of life and well-being. Together, these findings suggest that shortness of breath impairs well-being both directly and indirectly through its interactions with other symptoms, reflecting the complex role of this symptom in patients with advanced cancer.

The paths from drowsiness to impaired well-being and loss of appetite were not statistically significant and were removed to improve model fit. Although prior research and the pathophysiology of advanced cancer suggest that drowsiness could potentially influence these outcomes, our results indicate that its direct or indirect effects remain unclear. This finding differs from Olson et al. (2014), who reported that drowsiness affected well-being in cancer patients. The lack of significance may be attributable to multiple factors. In patients with cancer, drowsiness can result from sleep disturbances or as a side effect of opioids used for pain management (American Cancer Society, 2024). However, this study did not collect data on participants' sleep problems or analgesic use, which may have obscured the relationship. These findings highlight the importance of carefully assessing drowsiness while considering other factors such as sleep quality and pain management. Moreover, they underscore the need for further research to clarify how drowsiness influences well-being and appetite when potential confounders are controlled.

Although this study primarily examined symptom relationships using path analysis, interpretation of the findings in the Thai context suggests that symptom perception and impaired well-being may also be shaped by cultural, social, and family-related factors. Thai patients often interpret illness through both biomedical understanding and cultural beliefs, including karma, mind–body balance, and religious or spiritual coping, which may influence symptom appraisal differently from Western contexts (Du, 2024; Phenwan et al., 2019). Family involvement is central to cancer care in Thailand, where daily caregiving, emotional support, and shared activities such as eating are commonly embedded within family relationships. Consequently, symptoms such as loss of appetite may affect not only physical and psychological well-being but also relational well-being, as patients may experience distress or guilt related to perceived family burden. Consistent with prior studies on well-being in Thailand, these findings suggest that strong family and social ties play a key role in shaping patients' well-being (Phenwan et al., 2019; Puicharoen, 2025; Suavansri et al., 2022). When considered alongside the path analysis results, these contextual factors indicate that certain symptoms, particularly loss of appetite, may have a greater impact on well-being in Thai patients, underscoring the importance of culturally sensitive and holistic symptom management.

Although loss of appetite was identified as the strongest mediator affecting impaired well-being, its implications for nursing practice in Thai oncology wards are particularly meaningful. Nurses can use this finding to prioritize early assessment and monitoring of appetite, considering not only physical symptoms but also emotional and relational aspects, such as distress related to family involvement and social support (Palang & Nunuan, 2020; Savisit et al., 2022). Family and

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social support are significantly associated with psychological well-being in patients receiving cancer treatment, suggesting that supportive relationships can influence overall health outcomes (Savisit et al., 2022). In this context, culturally sensitive interventions may include: (1) collaborating with family members to provide shared meals and encouragement, respecting family dynamics and caregiving roles, which are central to Thai cancer care practice (Palang & Nunuan, 2020); (2) incorporating traditional Thai foods or patient-preferred meals to enhance appetite and emotional comfort in the context of patients' cultural preferences (Khamboon & Pakanta, 2021; Phenwan et al., 2019); and (3) offering gentle education and counseling about nutrition, symptom management, and coping strategies that acknowledge spiritual and cultural interpretations of illness, as spiritual well-being and family bonds are key components of patients' lived experiences in Thailand (Phenwan et al., 2019). By integrating these approaches, nurses can address both physical and psychosocial dimensions of appetite loss, improving overall well-being while honoring Thai cultural values and family involvement.

5. Implications and limitations

Based on the identified symptom pathways, nursing care should move beyond single-symptom management toward a symptom cluster–oriented approach, particularly for clusters involving loss of appetite, depression, and shortness of breath. Early changes in appetite may serve as an early indicator of broader physical and psychological distress, underscoring the need for integrated assessment and intervention. Actionable nursing interventions may include: (1) routine and systematic screening for loss of appetite, depression, and shortness of breath during chemotherapy or follow-up visits; (2) collaboration with dietitians to provide individualized nutritional support, especially when appetite loss is identified early; (3) implementing non-pharmacological interventions for patients experiencing shortness of breath, such as breathing exercises, positioning techniques, and energy conservation strategies; (4) considering contextual factors such as family support, sleep quality, and pain control, and actively involving caregivers in symptom monitoring and supportive care; and (5) adopting a holistic, patient- and family-centered approach supported by multidisciplinary collaboration to enhance overall well-being among patients with advanced cancer.

This study has several limitations that must be acknowledged. The data were obtained from a single site, and laboratory data and detailed information on medications for pain and sleep management were not collected. In addition, the study relied primarily on patient self-reports, which may have influenced the results. These factors should be considered in future research.

6. Conclusion

This study successfully developed and tested a causal model examining the relationships between unpleasant symptoms and impaired well-being in patients undergoing chemotherapy for advanced cancer. The model demonstrated that loss of appetite, depression, and shortness of breath directly influence impaired well-being, while other symptoms, including anxiety, nausea, pain, and tiredness, as well as loss of appetite and shortness of breath, also have indirect effects. These findings highlight the importance of comprehensive symptom assessment and management, enabling nurses and multidisciplinary healthcare teams to design interventions that address both direct and indirect symptom pathways. Future research should aim to validate and extend these findings through multi-site studies and detailed clinical assessments.

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Author contribution

KT contributed to the study's conceptualization and design, supervised the study and data collection, performed data analysis and interpretation, and drafted the manuscript. PI contributed to the design of the initial path analysis model, interpreted the data, reviewed the manuscript, and served as the corresponding author. Both KT and PI contributed to the critical revision of the manuscript and read and approved the final version of the manuscript.

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Conflict of interest

The authors declare that they have no conflicts of interest.

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Declaration of Generative Artificial Intelligence (AI)

The authors declare that ChatGPT (OpenAI) was used solely to improve language clarity, grammar, and readability during manuscript preparation. All AI-assisted content was carefully reviewed, edited, and verified by the authors, who take full responsibility for the accuracy and integrity of the final manuscript.

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