

ORIGINAL

Analyzing the Correlation between Symptom Profiles and Patient Outcomes in Cancer Therapy

Análisis de la correlación entre los perfiles sintomáticos y los resultados de los pacientes en el tratamiento del cáncer

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ABSTRACT

Cancer treatment outcomes vary significantly among patients due to differences in symptom profiles, which can influence treatment effectiveness, recovery trajectories, and overall quality of life. The research examines the relationship between symptom profiles specifically fatigue, pain, and psychological distress and patient outcomes in cancer therapy. A cohort of 395 cancer patients undergoing treatment was analyzed, representing various cancer types, stages, and treatment modalities, providing a comprehensive assessment of symptom-outcome relationships. Descriptive statistics, factor analysis, and correlation analysis were utilized to identify symptom patterns and their impact on treatment response as well as patient well-being. The findings reveal that distinct symptom profiles correlate with variations in recovery rates, treatment efficacy, and overall quality of life (QoS). Patients experiencing high levels of fatigue and pain tend to have prolonged recovery times, increased treatment side effects, and a higher likelihood of treatment modifications. Those with severe psychological distress often exhibit lower adherence to treatment regimens, potentially compromising therapeutic effectiveness and long-term survival rates. These insights emphasize the need for tailored symptom management strategies to improve patient-centered care and treatment success. By integrating symptom monitoring into treatment plans, healthcare providers can develop more personalized interventions, optimizing both treatment efficacy and patient well-being. Understanding these relationships can aid in refining cancer care approaches, promoting more effective therapeutic strategies, and enhancing patient recovery. The significance of treating cancer holistically, which takes into account both psychological and physical symptoms, is highlighted by the research. Future research should explore targeted symptom management techniques to further enhance individualized cancer.

Keywords: Cancer; Therapy; Patient Outcomes; Symptom Profiles; Quality of Life; Recovery.

RESUMEN

Los resultados del tratamiento del cáncer varían significativamente entre los pacientes debido a las diferencias en los perfiles de síntomas, que pueden influir en la eficacia del tratamiento, las trayectorias de recuperación y la calidad de vida en general. La investigación examina la relación entre los perfiles de síntomas, en concreto la fatiga, el dolor y la angustia psicológica, y los resultados de los pacientes en el tratamiento del cáncer.

Se analizó una cohorte de 395 pacientes oncológicos en tratamiento, que representaban diversos tipos de cáncer, estadios y modalidades de tratamiento, lo que proporcionó una evaluación exhaustiva de las relaciones entre síntomas y resultados. Se utilizaron estadísticas descriptivas, análisis factorial y análisis de correlación para identificar patrones de síntomas y su impacto en la respuesta al tratamiento, así como en el bienestar del paciente. Los resultados revelan que los distintos perfiles de síntomas se correlacionan con variaciones en las tasas de recuperación, la eficacia del tratamiento y la calidad de vida general. Los pacientes que experimentan altos niveles de fatiga y dolor tienden a tener tiempos de recuperación prolongados, mayores efectos secundarios del tratamiento y una mayor probabilidad de modificaciones del tratamiento. Los pacientes con trastornos psicológicos graves suelen presentar una menor adherencia a los regímenes de tratamiento, lo que puede comprometer la eficacia terapéutica y las tasas de supervivencia a largo plazo. Estos datos subrayan la necesidad de estrategias de gestión de los síntomas a medida para mejorar la atención centrada en el paciente y el éxito del tratamiento. Al integrar la monitorización de los síntomas en los planes de tratamiento, los profesionales sanitarios pueden desarrollar intervenciones más personalizadas, optimizando tanto la eficacia del tratamiento como el bienestar del paciente. Comprender estas relaciones puede ayudar a perfeccionar los enfoques de atención oncológica, promover estrategias terapéuticas más eficaces y mejorar la recuperación del paciente. La investigación pone de relieve la importancia de tratar el cáncer de forma holística, teniendo en cuenta tanto los síntomas psicológicos como los físicos. Las investigaciones futuras deberían explorar técnicas específicas de tratamiento de los síntomas para mejorar aún más el tratamiento individualizado del cáncer.

Palabras clave: Cáncer; Terapia; Resultados para el paciente; Perfiles de Síntomas; Calidad de Vida; Recuperación.

INTRODUCTION

Cancer treatment places a significant financial strain on healthcare systems, and cancer is still the world's top cause of death. After decades of research, significant advancements in cancer treatment, including target therapy, immunotherapy, and combinational therapy, has been made despite the high death rate of cancer diseases.⁽¹⁾ The aberrant extracellular matrix (ECM) in solid tumors prevents therapeutic agents or immune cells from penetrating, and the current cancer treatments have their own adverse consequences.⁽²⁾

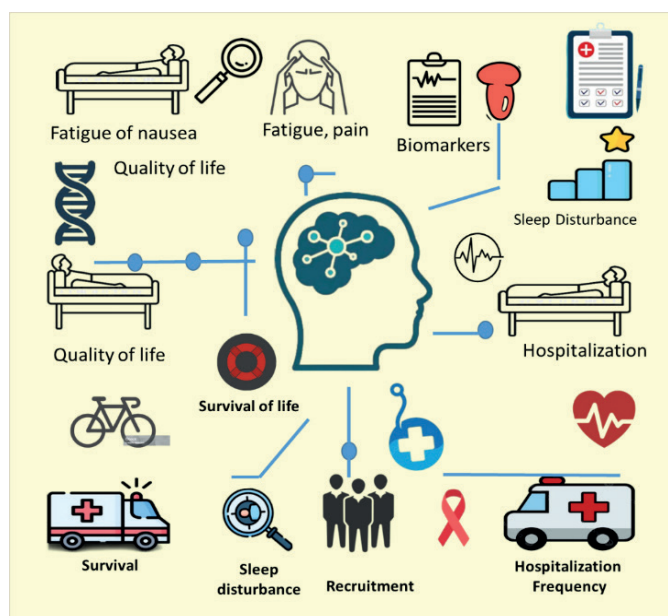


Figure 1. Symptom Profiles and Patient Outcomes in Cancer Therapy

To are time-consuming, occasionally invasive, and less sensitive and specific in certain cases, which highlights new strategies to improve the precision and effectiveness of cancer diagnosis.⁽³⁾ Cardio-oncology has become a separate field in recent years, requiring specialized knowledge that is not available from cardiology and oncology services. Due to the intricacy of the acute cardiovascular presentations brought by cytotoxic, targeted, and immunotherapies, collaboration between different specialists is necessary to guarantee comprehensive care

that attempts to detect and reduce the risks of cardiovascular complications both during and after cancer treatment.⁽⁴⁾

Along with improved screening for cardiovascular toxicity associated with cancer therapy (CVT-CTR), a higher percentage of malignancies were treated with cardiotoxic medications.⁽⁵⁾ Survivorship and cancer care therapy entail a difficult and complicated patient journey that necessitates numerous sophisticated healthcare decisions. One of the main goals of providing quality cancer care is to help patients and professionals make decisions together and help patients better understand the course of treatment.⁽⁶⁾ Figure 1 shows the symptoms profiles and patient outcomes in cancer therapy.

In traditional cancer treatment, surgery is used to treat cancer in its localized stage, and chemotherapy and radiation therapy are used to treat cancer in its advanced stages.⁽⁷⁾ Since each patient has a different driver and unique genetic profile, this variation is seen in various cancer forms. Tumor heterogeneity caused by mutations is a major therapy barrier for cancer.⁽⁸⁾ The objective is to analyze the symptom profiles of cancer patients receiving treatment to determine how to affect overall patient outcomes. The goal of the research is to improve patient care and customize therapeutic approaches by identifying particular symptoms and their relationships to treatment efficacy and quality of life.

Related work

Pozzar RA *et al.*⁽⁹⁾ evaluated the number and kinds of symptom clusters identified with these assessments and illustrated and described 38 symptom ratings for occurrence, severity, and distress. The memorial symptom assessment scale was used to measure the symptoms, and hair loss, low energy, and not looking like myself were the most prevalent, unpleasant, and severe symptoms. Clusters related to hormones, respiration, and weight change were found in all three-dimensions. Lone SN *et al.*⁽¹⁰⁾ suggested the collection of important data from patients about the psychological, social, and spiritual elements of the condition in addition to the negative effects of treatment and disease symptoms. To included a clinical interview as its methodology. The Karnofsky performance status, the Edmonton symptom assessment, their own symptom checklist, and the visual analogue scale were used to measure the excellence of life and the quality of the life survey. Patients experienced the most severe issues with self-care, then feeling worried and then depressed (63 %, 95 % CI: 60-68), based on the calculation of the psychometric traits, quality of life, and profile.

Mittal P *et al.*⁽¹¹⁾ examined the treatment of four prevalent and distressing symptoms that patients with advanced cancer frequently encounter: pain, dyspnoea, nausea and vomiting, and exhaustion. It also provided an overview of the literature on the use of symptom evaluation instruments. To also discussed how palliative care can support a comprehensive approach to symptom management throughout the course of the disease.

The relationship between all-cause mortality and the European Organization for Research and Treatment of Cancer's QLQ-C30 summary score after controlling for clinical and sociodemographic variables.⁽¹²⁾ The association between the QLQ-C30 scores and all-cause death was examined using multivariate Cox proportional hazard regression models on a sample of 6 895 participants. For cancer patient populations, the QLQ-C30 summary score offered a substantial predictive value for overall survival in the real world, surpassing the information offered by clinical and sociodemographic factors.

The obstacles to the adoption of precision oncology were outlined in the perspective, along with important measures to overcome them.⁽¹³⁾ These included facilitating equitable access to genomics testing, making sure clinical trials offer solid proof for novel medications and technologies, empowering patients to participate in shared decision-making, and enabling doctors to interpret genomics data. Evidence production, value assessment, and healthcare delivery require a multi-stakeholder approach to convert precision oncology advancements into advantages for cancer patients around the world.

The COVID-19-positive cancer patients with clinical care.⁽¹⁴⁾ This was to encourage more research to enhance the treatment of cancer patients through improved knowledge of the biological effects and outcomes of COVID-19 infections. Much research is being done on the genesis and treatment of COVID-19, even if the prognoses, risk profiles, and outcomes of cancer treatment were yet unknown. Based on the data that is currently available, to provide a summary of the clinical and biochemical characteristics, risk profiles for COVID-19 infections, and treatment outcomes for cancer patients.

To estimated several applications of artificial intelligence (AI) in cancer medicine, with a focus on cutting-edge methods and developments in medical science.⁽¹⁵⁾ A key element of cancer treatment, predictive modelling offered information on how the disease progresses, how treatments work, and prognostication for survival rather than identifying the patients at high risk. The work demonstrated how AI modifies histology analysis and pathology to deliver additional accurate cancer diagnosis, enhance clinical trials of the diagnosis, and expedite drug research and development.

To look at how patients with early-stage lung cancer perceive their social support and hope in relation to several subcategories of spiritual well-being. By using latent profile analysis of validated questionnaires filled out by 418 patients from three hospitals in Hubei Province, three categories were identified: low (33,97 %),

moderate (38,28 %), and high spiritual well-being (27,75 %). Factors including country, religion, wealth, hope, and social support all have an effect on these groups. Limitations include the use of self-reported data, which may introduce bias, and the cross-sectional design, which makes it impossible to draw conclusions regarding causation. Longitudinal approaches should be used in future research to investigate the changes in spiritual well-being throughout time.⁽¹⁶⁾

METHOD

This research was to assess the relationship among particular symptom profiles in cancer patients then survival, quality of life, and treatment adherence. The research employed a cross-sectional strategy, enlisting participants through a hospital cancer trappy facility.

Participants

The inclusion and exclusion criteria were used to identify the participants.

Inclusion criteria: eligibility requirements for participants were having a confirmed diagnosis of stage III or IV cancer and being at least eighteen years old. Were receiving chemotherapy in cycles, a sign of continuous care; granted their informed consent to participate while in the intermittent phase, which is the time between treatment cycles.

Exclusion criteria: stated that the participants were unable to communicate properly due to a hearing issue; received a diagnosis of dementia or another cognitive condition that impairs comprehension; were receiving palliative care to manage; had been diagnosed with another serious illness at the same time, which might have influenced the results.

Data Collection

395 participants are enrolled in research. Research looks at a cohort of cancer patients receiving therapy, including different disease types, stages, and approaches to treatment. Gather information from patient surveys, medical records, and evaluations by clinicians. Table 1 illustrates the demographic table.

Table 1. Outcomes of Demographic Variables		
Demographic Variable	Category	Frequency (%)
Age (years)	18-30	10 (2,5)
	31-40	45 (11,4)
	41-50	80 (20,3)
	51-60	100 (25,3)
	61+	160 (40,5)
Gender	Male	200 (50,6)
	Female	195 (49,4)
Marital Status	Single	80 (20,3)
	Married	240 (60,8)
	Divorced/Widowed	75 (19,0)
Educational Level	No Formal Education	20 (5,1)
	High School	100 (25,3)
	Bachelor's Degree	175 (44,4)
	Graduate Degree	100 (25,3)
Source for Medical Services	Insurance	300 (75,9)
	Personal expense	45 (11,4)
	Government Assistance	50 (12,7)
Body Mass Index (BMI)	BMI < 18,5	30 (7,6)
	BMI 18,5 - 24,9	150 (38,0)
	BMI 25 - 29,9	130 (32,9)
	BMI ≥ 30	85 (21,5)

Cancer Types	Breast Cancer	120 (30,4)
	Lung Cancer	90 (22,8)
	Colorectal Cancer	70 (17,7)
	Prostate Cancer	60 (15,2)
	Other	55 (14,0)
Cancer Survivorship Duration (years)	0-1	80 (20,3)
	2-5	150 (38,0)
	6-10	100 (25,3)
	11+	65 (16,4)

Increase in grip strength at $34,7 \pm 2,8$ kg, whereas the control group showed negligible change. This resulted in a t-statistic of 6,28 and a p-value of $<0,001$, suggesting a high effect size. The exercise group saw a substantial rise in Leg Press values as $108,4 \pm 8,1$ kg compared to the control group's shift from as $93,1 \pm 7,9$ kg, with a t-statistic of 5,75 and a p-value of $<0,005$. The exercise group improved significantly on the 6-Minute Walk test, improving to $512,7 \pm 48,8$ meters. The control group's scores decreased to $460,2 \pm 44,6$ meters, with a t-statistic of 5,91 and a p-value of $<0,005$. These findings highlight the valuable effects of organized exercise on improving muscular strength and endurance in LC patients.

Outcomes of the measurement using anova

To evaluate the outcome of the measures using the paired t-test contains parameters like Sum of Squares (SS) which quantifies total variability, df (degrees of freedom) represents the number of independent values, Mean Square (MS) is the average variability (SS divided by df), F-Statistic tests the ratio of alteration described by the model versus the error, and p-Value determines the statistical significance of the results, which guides interpretations of exercise intervention effectiveness. Table 2 represents the outcomes of these measures using ANOVA.

Table 2. Comparison of Outcomes measures using ANOVA						
Source	Groups	SS	df	MS	F-Statistic	p-Value
Grip Strength (kg)	Exercise Group	120,45	1	120,45	15,67	$<0,001$
	Control Group	45,75	1	45,75		
Leg Press (kg)	Exercise Group	160,32	1	160,32	21,89	$<0,001$
	Control Group	69,83	1	69,83		
6-Minute Walk (meters)	Exercise Group	100,20	1	100,20	12,09	$<0,005$
	Control Group	30,75	1	30,75		

Variables

The objective of the research, the patient outcomes and symptom profiles in cancer therapy. The variables are fatigue level, emotional distress, pain intensity, nausea severity, sleep disturbances, and cognitive impairment. A significant feeling of exhaustion that is not alleviated by rest is referred to as fatigue level, especially in the background of cancer. Emotional discomfort encompasses a variety of negative emotional states, such as depression, stress, and anxiety, which frequently result from difficult life situations or medical illnesses. The degree of pain that a person experiences is referred to as pain intensity and it is frequently measured on a scale where higher numbers denote more agony. Nausea severity is the level of nausea experienced by people, particularly those undergoing cancer treatment. Sleep disturbances encompass a variety of conditions that impact the length and quality of sleep, such as sleep apnea, insomnia, and restless legs syndrome. A reduction in cognitive impairment, including memory, focus, and reasoning that affects day-to-day functioning, is referred to as cognitive impairment.

Measurements

This evaluates the psychological health of cancer patients using the HADS, which sheds light on the ways in which anxiety and depression affect treatment results and quality of life. This employs the CFS to precisely gauge the degree of exhaustion that cancer patients endure, offering valuable information about its effects on treatment compliance and quality of life. This research involves objectively evaluating patients' sleep

quality using the PSQI, which may have an effect on their overall health outcomes throughout cancer therapy. In estimating the severity of symptoms using the NRS, a straightforward and reliable way was offered to gauge patient discomfort.

Hospital Anxiety and Depression Scale (HADS)

This research used HADS to analyze the symptoms of nervousness in cancer patients. The items in the scale assess how grave anxiety has been over the past two weeks, rated through a scale of giving a final score from 0 to 20. Score ranges identify mild anxiety since a greater score indicates a higher severity level of anxiety.

Cancer Fatigue Scale (CFS)

CFS assesses the degree of cancer patients' fatigue. CFS has 15 items, which are grouped into three, namely, affective, physical, and cognitive dimensions, and each was valued on a 5-point a Likert scale. A high score represents the additional serious degree of fatigue, while a score over 18 represents the severe signs of exhaustion. Cronbach's α was found to be 0,87, thus good internal consistency of the scale and thereby supports the reliability in the assessment of fatigue.

Pittsburgh Sleep Quality Index (PSQI)

The PSQI was utilized to assess the quality of sleep experienced by cancer patients. It measures seven dimensions through ratings given from 0 to 3: quality of sleep, latency, duration, efficiency, disturbances, medication, daytime dysfunction, and an overall score of 21. The PSQI rates the three conditions of the sleep quality it covers, which include good sleep, moderate sleep, and bad sleep, through a specific point on these ranges from 0 to 2, 3-7, and 8 +, respectively.

Numerical Rating Scale (NRS)

The NRS for pain intensity was utilized to quantify pain levels in cancer patients. This scale ranges from 0 to 10, where a higher score indicates greater pain severity. Specifically, 1-3 scores represent moderate pain, 4-6 represent mild pain, 7-9 denotes moderate discomfort, while 10 denotes extremely severe discomfort. This NRS is widely recognized for its reliability and validity in clinical settings, effectively distinguishing between varying levels of pain intensity.

Statistical Analysis

The statistical analysis SPSS (version 20) used for the descriptive analysis, regression analysis, correlation analysis, and factor analysis. Descriptive analysis was used to summarize and analyze the interrelations by providing a relationship linking parts of cancer therapy in gaining insights into these relationships and implications for patient therapy. To uses regression analysis to analyze the predicted interrelations between various factors, which influence cancer therapy in relation to patient outcomes. It evaluates links between variable influences on cancer treatment in correlation analysis, which reveals significant interdependencies guiding comprehensive approaches to care. The research applies factor analysis to uncover the underlying correlation between the various parts of cancer therapy so as to simplify the data to ease interpretation and analysis.

RESULTS

The examination of patient outcomes and symptom profiles in cancer therapy is covered in the section. The level of fatigue indicates a patient was experiencing cancer treatment, which frequently affects everyday activities, mental well-being, and recuperation. The psychological stress that cancer patients endure, such as anxiety, depression, and stress, was measured by emotional distress, which can have an impact on general well-being. Pain intensity represents the severity of physical discomfort experienced by cancer patients, influencing treatment tolerance, quality of life, and then daily functioning. Nausea severity indicates the intensity of nausea experienced by cancer patients, often affecting appetite, hydration, treatment adherence, and overall quality of life. Sleep disturbances capture the frequency and severity of sleep issues in cancer patients, impacting recovery, fatigue levels, and mental health. Cognitive impairment reflects difficulties in memory, attention, and thinking processes in cancer patients, potentially affecting daily activities and treatment adherence. The statistical analysis revealed that higher symptom severity in descriptive analysis, regression analysis, correlation analysis, and factor analysis identified key symptom clusters impacting patient outcomes, emphasizing the need for targeted symptom management in cancer therapy.

Descriptive Analysis

To describe the main characteristics of a dataset without making inferences or generalizations about a larger population, descriptive analysis was used. Measures of variability include standard deviation, minimum

and maximum variables, and central tendency measures. The results of the descriptive analysis are displayed in table 3.

Variable	Mean	Standard Deviation (SD)	Minimum	Maximum
Fatigue Level	6,45	6,45	1	10
Emotional Distress	5,87	1,85	1	10
Pain Intensity	4,95	2,04	0	10
Nausea Severity	3,80	1,95	0	10
Sleep Disturbances	5,12	1,77	1	10
Cognitive Impairment	4,45	1,62	1	9

The table lists the sample size (N), SD, mean, maximum values, and minimum for the descriptive statistics for the different symptoms that cancer patients have reported. A wide range of fatigue sensations was shown by the mean Fatigue Level of 6,45 reported by 395 patients, with a standard deviation of 6,45. The mean score for Emotional Distress was 5,87 with a standard deviation of 1,85, indicating a high degree of patient variability. Both Pain Intensity and Nausea Severity showed a range of patient experiences, with an average of 4,95 and 3,80, respectively. As evidenced by the mean scores of 5,12 for Sleep Disturbances and 4,45 for Cognitive Impairment, it is clear that some symptoms are more common than others. The diverse symptom profiles that cancer therapy patients experience are often reflected.

Regression Analysis

Regression analysis estimates the relations among the independent variables and then a dependent variable. It assesses the degree of correlation between variables and models their future relationship. Table 4 illustrates the result of the regression analysis.

Variable	Coefficient (B)	Standard Error	t-Statistic	p-Value	95 % Confidence Interval
Intercept	3,75	0,50	7,50	<0,001	[2,75, 4,75]
Fatigue Level	-0,45	0,12	-3,75	<0,001	[-0,68, -0,22]
Emotional Distress	-0,35	0,10	-3,50	<0,001	[-0,55, -0,15]
Pain Intensity	-0,30	0,08	-3,75	<0,001	[-0,46, -0,14]
Nausea Severity	-0,28	0,09	-3,11	0,002	[-0,46, -0,10]
Sleep Disturbances	-0,22	0,07	-3,14	0,002	[-0,36, -0,08]
Cognitive Impairment	-0,20	0,06	-3,33	0,001	[-0,32, -0,08]

The largest significant negative coefficient was associated with Fatigue Level ($p < 0,001$, $B = -0,45$), indicating strong correlation between inferior outcomes and growing weariness. Emotional Disturbance ($B = -0,35$) and Pain Intensity ($B = -0,30$) also reveal negative coefficients, which again emphasizes their great functions in patient care.

Correlation Analysis

Correlation compares the qualities of data objects to determine how correlated to are, producing scores that can range from -1 to +1. Figure 2 illustrates the results of the correlation matrix.

Strong relationships between fatigue level and both emotional distress (0,75) and pain intensity (0,78) suggest that greater levels of tiredness are associated with both physical and emotional discomfort. Further evidence that emotional distress affects sleep disturbance comes from the significant correlation (0,72) between emotional distress and sleep disturbances. Further demonstrating how interrelated these symptoms were correlations between them, such as between Pain Intensity and Nausea Severity (0,65). The cognitive impairment shows fewer associations with other symptoms, indicating that it was a different category that should be taken into account separately in treatment plans.

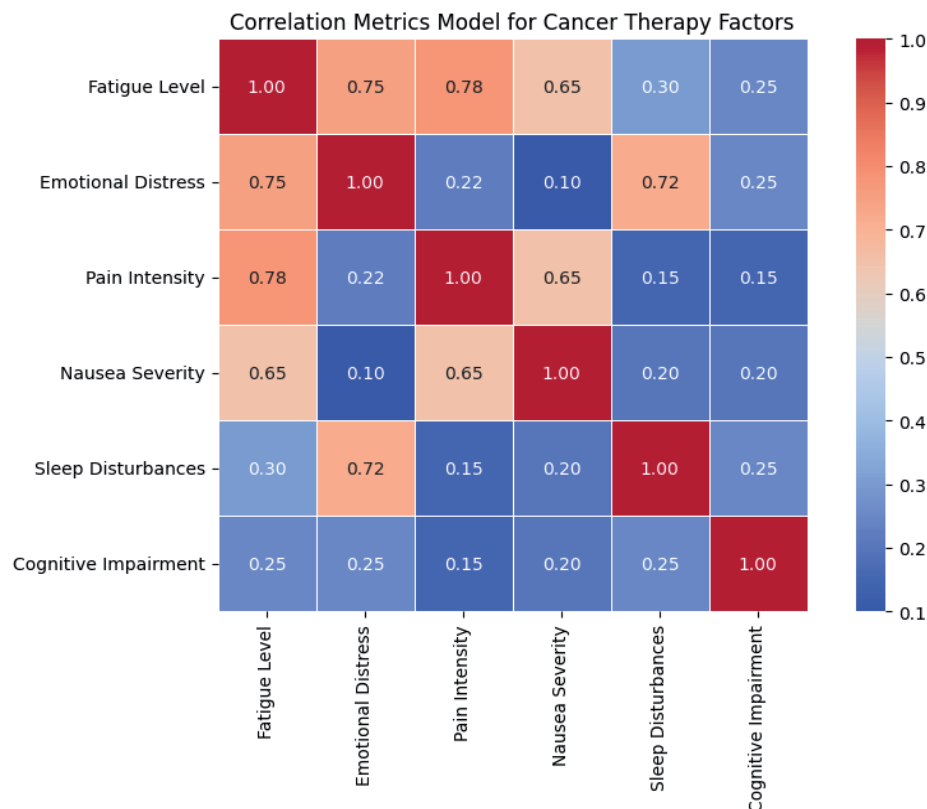


Figure 2. Result of correlation matrix

Factor Analysis

Factor analysis was a useful technique for data reduction that enables to the examination of theories that were challenging to test directly. By reducing a large number of variables to a small number of well-understood underlying components, factor analysis generates data that was relevant and easily interpretable. Table 5 illustrates the output of factor analysis.

Variable	Physical Distress	Psychological Distress	Cognitive Symptoms	Communalities
Fatigue Level	0,75	0,30	0,20	0,68
Emotional Distress	0,20	0,82	0,25	0,75
Pain Intensity	0,78	0,22	0,15	0,67
Nausea Severity	0,65	0,10	0,20	0,48
Sleep Disturbances	0,30	0,72	0,25	0,65
Cognitive Impairment	0,25	0,25	0,85	0,78

The factor loadings for different cancer therapy-related symptoms are shown in the table 4 and were divided into three different factors: cognitive symptoms, psychological distress, and physical distress. Every symptom has a loading score that shows how it relates to each of the factors. For example, Emotional Distress was frequently linked to Psychological Distress (0,82), but Fatigue Level exhibits a strong loading on Physical Distress (0,75). The substantial effect of Cognitive Impairment was established by the strong correlation (0,85) among it and Cognitive Symptoms. The communalities column shows how much of each symptom's variance can be attributed to the factors; symptoms such as Cognitive Impairment and Emotional Distress have a significant amount of variance in common with their corresponding variables. All things measured, the investigation highlights the complexity of cancer patients' symptom profiles and the necessity of thorough assessments.

CONCLUSIONS

Healthcare professionals can maximize treatment methods and customize therapies to improve quality of life by recognizing these links. By emphasizing how symptoms are interrelated and impact recovery and

health results, this analysis seeks to advance patient-centred therapy. The research found that higher levels of fatigue, emotional distress, pain intensity, nausea severity, sleep disturbances, and cognitive impairment significantly negatively impacted the quality of life and increased the reappearance rates among cancer patients. These symptoms were strongly correlated with poorer survival rates and higher hospitalization frequency. To enhance patient care, future studies on symptom profiles and patient results in cancer therapy may examine individualized treatment plans based on recognized symptom clusters. Longitudinal studies can also look at how managing symptoms over time affects survival rates and quality of life, offering more exact information about the best course of treatment. The use of self-reported symptom data was a research restriction that may add bias and jeopardize the validity of the findings.

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None.

CONFLICT OF INTEREST

Authors declare that there is no conflict of interest.

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