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Association between quality of life with depressive symptoms, anxiety, stress and emotional distress in Peruvian cancer patients: a cross-sectional study

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ABSTRACT

Introduction: Cancer patients frequently experience psychological symptoms such as depression, anxiety, perceived stress, and emotional distress, which may negatively affect their quality of life. However, the impact of comorbid mental health symptoms on both mental and physical components of quality of life remains insufficiently explored in Latin American populations.

Objective: To determine the association between depressive symptoms, anxiety, stress, and emotional distress (exposures) and quality of life (outcome) in Peruvian cancer patients.

Method: A cross-sectional study was conducted among 465 adult cancer patients recruited from oncology services. Mental health variables were dichotomized according to established cut-off points. Quality of life (mental and physical components) was categorized into low–medium versus high levels. Generalized linear models with Poisson distribution and robust variance were used to estimate crude and adjusted prevalence ratios (PR) with 95% confidence intervals.

Results: A prevalence of anxious symptoms of 27.5%, depressive symptoms of 20.4%, symptoms of moderate-severe stress of 83.2%, and emotional discomfort of 57.4% were identified. Regarding the Poisson regression model, cancer patients with 12 or more years of education were less likely to have symptoms of emotional distress. Moderate to severe depressive symptoms, anxiety, stress, and emotional distress were significantly associated with low–medium mental quality of life. Comorbidity of psychological symptoms showed a stronger association with impaired mental quality of life compared to individual symptoms.

Conclusions: Emotional distress and stress were found to be the main variables associated with both physical and mental quality of life. Other variables associated with mental health problems include a high level of education. Finally, it was found that lower quality of life (both mental and physical) is associated with greater comorbidity of mental health problems.

Keywords: Mental health, Quality of life, Cancer, Physiological effects.

INTRODUCTION

Cancer is one of the leading causes of morbidity and mortality worldwide (IHME & Global Burden of Disease, 2024; IHME Global Burden of Disease, 2024). By 2020, there were more than 19 million new cases and nearly 10 million deaths for cancer, and projections indicate a substantial increase in both incidence and mortality by 2040 (Cancer (IARC) & The International Agency for Research on Cancer, 2022; Instituto Nacional del Cáncer, 2015). Approximately 70% of cancer deaths occur in low- and middle-income countries; in these contexts, this situation is particularly worrying due to population aging and the persistence of preventable risk factors (Cancer (IARC) & The International Agency for Research on Cancer, 2022; Organización Mundial de la salud, 2021).

Beyond its epidemiological impact, cancer represents a significant burden on patients' quality of life, particularly in low- and middle-income countries, where access to comprehensive cancer care remains limited (Cardone & Arnold, 2023; Ngo et al., 2023). Given that physical and mental health are essential components of quality of life, they play a fundamental role in overall well-being and in people's ability to lead full and satisfying lives (Jamil et al., 2023). In this regard, cancer patients in low- and middle-income countries often experience a decline in their quality of life because of symptom burden, adverse treatment effects, financial toxicity, and inadequate support systems(Adekunle et al., 2025; Ahmad et al., 2025).

In Peru, cancer poses a major public health challenge within a fragmented healthcare system centered in Lima, where many patients face delays in diagnosis, limited access to specialized treatments, and insufficient psychosocial support (Hernández-Vásquez et al., 2025). These conditions can exacerbate the physical and emotional burden of the disease, increasing vulnerability to poor quality of life among cancer patients (Bergerot et al., 2024; Bustamante et al., 2022; Vy et al., 2025).

The experience of receiving a cancer diagnosis (Cao et al., 2017; Fernández de Larrea-Baz et al., 2020) and undergoing treatment (American Cancer Society, 2022; Trayes & Cokenakes, 2021), often involves profound physical and psychological stress for patients and their families due to its association with suffering and death. In this regard, the stage and type of treatment, along with other factors such as the type of cancer, age, sex, and social and environmental conditions (rural residence, illiteracy, and low income), influence the deterioration of patients' physical and psychological functioning, affecting various areas such as family, work, social activities, and emotional and sexual well-being, among others (Wen et al., 2019). Common physical symptoms include fatigue, pain, and insomnia (Berger et al., 2010; Chiu et al., 2015; Fuller et al., 2018; Nipp et al., 2017), while psychological symptoms such as depression, anxiety, and stress are highly prevalent (Antoni & Dhabhar, 2019; Linden et al., 2012; Niedzwiedz et al., 2019; Weber & O'Brien, 2017), particularly among hospitalized patients and those facing substantial treatment-related financial burdens (Gilligan et al., 2018; Lu et al., 2019; Niedzwiedz et al., 2019).

Scientific evidence indicates that the physical, psychological and social problems faced by people with cancer can interfere with their recovery process and significantly deteriorate their quality of life (Weber & O'Brien, 2017). Several studies have demonstrated that this is influenced by individual, social and clinical factors, such as the type and stage of the illness and the treatment received. In particular, the presence of psychological symptoms such as anxiety, depression and stress, unsatisfied needs and advanced stages of cancer are consistently associated with a lower quality of life (Hu et al., 2021; Li et al., 2018; Mace et al., 2021; Ngan et al., 2021). In this vein, patients with breast cancer who present a greater burden of psychological distress and uncertainty have lower quality of life scores, on the contrary, those who show greater awareness of the illness and active emotional strategies (Ngo et al., 2023).

People with cancer may have co-morbidities, which are additional conditions or disorders that coexist with the primary disease (Feinstein, 1970; Sarfati et al., 2016). Such comorbidities affect the development and treatment of people with cancer (Sarfati et al., 2016). Also, cancer patients may have more than one co-morbidity, including a combination of depression and anxiety (Jeffery et al., 2019; Kugbey et al., 2020). This comorbidity of mental health problems allows us to consider transdiagnostic intervention as a viable alternative in the care of nuclear vulnerabilities in cancer patients (Mirapeix, 2017; Tortella Feliu, 2014). On the other hand, the high level of education, high monthly income, adequate care, interventions and early treatment favor the quality of life of cancer patients (Dunne et al., 2017; Ngan et al., 2021). Therefore, it must be ensured that patients receive psychoeducation and palliative care to reduce physical and psychological symptoms (Matsuda et al., 2014; Zhuang et al., 2018). Based on the exposed evidence, the sociodemographic factors are considered for the statistical analysis of this study.

Most studies have concentrated on specific psychological conditions and have been carried out in high-income nations, despite mounting evidence from around the world showing a connection between mental health, including depressive symptoms, anxiety, stress, and emotional distress, and quality of life in cancer patients. Only a small number of studies have systematically measured psychological distress, with reported prevalences ranging from 20% to 70%, despite the rising cancer burden in low- and middle-income countries (where roughly 50% of the world's population resides), this is partly due to a lack of funding and culturally appropriate assessment tools (Bergerot et al., 2024; Walker et al., 2021). Additionally, while research from high-income nations confirms that cancer patients experience high rates of anxiety and depression, the evidence from low- and middle-income nations is still limited and inconsistent, which hinders the development and application of contextualized and successful psychological interventions (Nakie et al., 2024).

To address this gap, we conducted a cross-sectional study to determine the association between depressive symptoms, anxiety, stress, and emotional distress (exposures) and quality of life (outcome) in Peruvian cancer patients. Secondary objectives include determining the association between educational level, type of cancer, and clinical stage and mental health problems in Peruvian cancer patients, as well as analyzing the comorbidity of mental health problems and their association with quality

of life in Peruvian cancer patients. In line with the objective, the hypothesis was proposed that depressive symptoms, anxiety, stress, and emotional distress have a significant association with quality of life in Peruvian cancer patients.

METHODS
Study design

This cross-sectional study was conducted on oncology patients in a Peruvian public institution specializing in cancer. It was selected because it allows for capturing a snapshot of health and mental health problems in a representative sample, facilitating the rapid identification of specific clinical needs and their association with quality of life (Álvarez-Hernández & Delgado-De la Mora, 2015). In addition, the STROBE guidelines were followed to ensure high-quality presentation of the study. These guidelines consist of 22 elements, which are evaluated using a checklist (Supplementary material 1).

Setting

The application of the instruments was performed for two months (July and August 2018) by psychologists and psycho-pedagogues of the Mental Health Unit of the "National Institute of Neoplastic Diseases" (INEN, acronym in Spanish) who were previously trained in the administration of psychometric tests. The tests were administered to each of the patients with confirmed cancer separately, in areas of mental health, hospitalization, and oncology outpatient clinics: Breast and mixed tumors, Gynecology, Medical Oncology, Abdominal, Head and Neck, Urology, Thorax, Neuro-Oncology, and Orthopedics. Individual administration preserves the independence of responses in self-reported instruments like the SF-12 or HADS, strengthening internal validity in cross-sectional designs by preventing social contagion or suggestion effects among patients in shared rooms (Fowler, 2014; Gutiérrez, J P et al., 2013). This approach accounts for confounding factors including tiredness and environmental stress in hospital settings with a high oncological burden.

Participants

The study population consisted of cancer cases (11,894) registered in 2018 by the National Institute of Neoplastic Diseases (Ministerio de Salud, 2026). Due to the nature of the sample, sampling was intentional and non-probabilistic. The inclusion criteria were being over 18 years of age and having the ability to read and write. In addition, patients who experienced physical discomfort during the tests and individuals with cognitive disabilities that limited their comprehension and ability to complete the instruments administered for this study were excluded.

The sample size was calculated a priori using Poisson regression, assuming a small effect size (PR = 1.2), a significance level of 0.05, a statistical power of 90%, and an expected baseline prevalence of 43% for the outcome in the unexposed group, based on previous literature (Suresh & Chandrashekara, 2012). The calculation was performed using G*Power version 3.1.9.3 (Faul et al., 2007, 2009), which resulted in a minimum required sample size of 453 participants. However, due to potential non-response, inability, and missing data, an additional 10% were surveyed, resulting in 500 responses being recruited to ensure the minimum sample size.

Variables

Anxious symptoms: The Beck Anxiety Inventory (BAI) was used to assess anxiety symptoms. Anxiety in BAI can be defined based on the criteria for anxiety described in the DSM-III which are different from depressive symptoms (Beck et al., 1988). Likewise, to differentiate anxious symptoms from depressive symptoms we can define anxiety as fear, tension and apprehension usually associated with anticipatory ideas of what may happen in the future and the activation of the autonomic nervous system (Campo-Arias et al., 2014). The BAI is a 21-item self-applied scale created by Beck et al. in 1988, that measures the severity of anxiety symptoms in adults and adolescents in psychiatric populations (Beck et al., 1988). The BAI is evaluated using a scale from 0 to 3 (0=Not at all, 1=Slightly, 2=Moderately, and 3=Severely), so the minimum score is 0 and the maximum is 63 points. The questions refer to last week and the current moment; administration can take approximately 15 minutes. It shows a high internal consistency (α=0.93) and evidence of internal structure; it also has good convergent validity with respect to other anxiety tests (Vizioli & Pagano, 2020). Anxiety symptoms according to their scores are classified as normal (0-9), low anxiety (10-18), moderate anxiety (19-29), and severe anxiety (30-63) (Julian, 2011).

Perceived stress: The self-reported perceived stress scale with 10 items (PSS-10) was used to assess perceived psychological stress. Perceived stress was defined as the level of stress that the subject experiences as a function of objective stressful events, coping processes, and personality factors, among others (Cohen et al., 1983). PSS-10 is composed using a scale from 0 to 4 (0 = Never, 1 = Almost never, 2 = Occasionally, 3 = Often, and 4 = Very often). Construct validity models of this test have been developed in different countries, obtaining adequate scores for two-factor models, where the psychometric properties of the PSS 10 were superior to those of the PSS 14 test (Campo-Arias et al., 2009, 2014; Lee, 2013). We defined moderate and severe stress symptoms using a cut-off of 14 and higher (Seedhom et al., 2019).

Depression symptoms: The Beck Depression Inventory - Second Edition (BDI-II) was used to assess depression symptoms and is defined in the specific subtype of depression of the Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition (DSM-IV) (Beck et al., 1996). BDI-II is an inventory created by Beck for assessing the severity of depressive symptoms in psychiatric patients and in adolescents and adults (13 to 80 years) during the last 2 weeks (Beck et al., 1996). The BDI-II consists of 21 items and 4 response alternatives ordered from least to greatest severity. The response alternatives are valued from 0 to 3 (0=Not at all, 1=Slightly, 2=Moderately, and 3=Severely), with a maximum score of 63 and a minimum of 0.This inventory has high internal consistency (α = 0.94) and evidence of internal structure supporting two factors (somatic-affective and cognitive) in outpatients. Depressive symptoms, according to their scores, are classified as mild depression (14-19), mod-

erate depression (20-28), and severe depression (29-63) (Farfán & Sánchez-Villena, 2019; Smarr & Keerfer, 2011).

Emotional distress: The Hospital Anxiety and Depression Scale (HADS) was used to assess emotional distress. The National Comprehensive Cancer Network (NCCN) defines distress as an unpleasant multi-determined emotional experience of a psychological, social and spiritual nature that can interfere with the ability to effectively cope with cancer, its physical symptoms and its treatment (Riba et al., 2019). This emotional response ranges from common normal feelings of vulnerability, sadness, and fear to problems that become disabling, such as depression, anxiety, panic, social isolation, and spiritual crisis (Riba et al., 2019). In this sense, emotional distress is based on a transdiagnostic construct due to its ability to capture shared emotional symptoms beyond specific categorical diagnoses, such as anxiety and depression (Galindo Vázquez et al., 2015). In addition, the HADS has proven to be an adequate and sensitive instrument to change both during the disease and in response to psychotherapeutic treatment and psychopharmacological intervention (Fernández-de-las-Peñas et al., 2022; Nikolovski et al., 2024).

Unlike disorder-specific instruments (BDI-II, BAI), the HADS captures a broader, transdiagnostic emotional burden characterized by generalized psychological distress and impaired emotional coping, while minimizing the overlap of somatic symptoms common in cancer populations (Bjelland et al., 2002). Therefore, depressive symptoms, anxiety, and perceived stress were considered specific indicators of the disorder, while emotional distress was treated as a higher-order transdiagnostic construct.

The HADS was created by Zigmond and Snaith in 1983 (Zigmond & Snaith, 1983), and translated from English into Spanish by Tejero et al. (1986). This instrument consists of 14 items and 2 subscales (each of 7 items) that assess symptoms of anxiety and depression at a cognitive and discomfort emotional level in patients with somatic illnesses during the last week. The HADS has a Likert-type response option from 0 to 3, so the scores on each subscale range from 0 to 21. For both scales, if they exceed 8 points, it is considered "case" and scores higher than 11 points are a "probable case" (Zigmond & Snaith, 1983). However, a meta-analysis study suggests that cancer patients consider a cut-off point scores greater than 15 for the total HADS (sensitivity 0.87; specificity 0.88) (Vodermaier & Millman, 2011).The psychometric properties of HADS show high internal consistency (Alpha anxiety = 0.68-0.93 and Alpha depression = 0.67-0.90) in systematic reviews of hospital and chronic populations (Terol-Cantero et al., 2015).

Quality of Life: The quality of life was assessed using the short form 12 questionnaire (SF-12). The SF-12 assesses eight domains of quality of life, four related to physical health (General Health, Physical Functioning, Role Physical, and Body Pain) and four related to mental health (Vitality, Social Functioning, Role Emotional, and Mental Health) (Huo et al., 2018). The response options to the SF-12 items are dichotomous (yes or no) and Likert-type. Response options are scored, weighed, and summed to produce physical and mental component scores ranging from 0 to 100, with higher scores indicating better

quality of life in that domain. The scoring of the SF-12 was performed using the STATA package developed by Bruun (Bruun, 2021). The SF-12 has high internal consistency with Cronbach's alphas above 0.80 and a test-retest correlation of 0.78-0.89 for the general and Spanish populations; it also has convergent and discriminant validity consistent with other tests (Schmidt et al., 2012).

Covariates

Other sociodemographic variables assessed in the study included: sex (women/men); age grouped into four groups of approximately 15 years each, following the life cycle scheme from age 17 onwards (young people: 17 to 29, young adults: 30 to 44, adults: 45 to 59, and older adults: 60 and over) (Instituto Nacional de Estadística e Informática, 2014); type of care (Outpatient clinic, those who have scheduled appointments such as chemotherapy, blood tests, radiation therapy, among others; Outpatient consultation, for patients who are referred for medical or surgical procedures in this specialty; and Hospitalization, one that requires the patient to be admitted) (EsSalud, 2020); Civil status (With a current couple, Separated or Widower, and Single); Educational years (primary education [At least 6 years old], secondary education [7 to 11 years], and superior education [12 to more years]); and laboral status (with work and without work). Also, the variable types of cancer (focused/unfocused) are considered, prioritizing the cancers with the highest mortality worldwide with sufficient frequency (lung cancer [bronchi, lungs, and trachea], colorectal cancer, gastric cancer, breast cancer, cervical cancer, and others focal type of cancer) (Cancer (IARC) & The International Agency for Research on Cancer, 2022). In addition, the clinical stage variable (early stages [0, I], advanced stages [II, III, IV], and there is no record) (Instituto Nacional del Cáncer, 2015) and comorbidity of mental health problems (number of mental health problems that participants have) were included. Given the high degree of conceptual and empirical relationship between specific mental health symptoms and the comorbidity covariate, separate models were analyzed for the latter to avoid multicollinearity and overfitting.

Statistical analysis

Characteristics of the participants: In the descriptive analysis, we report the frequencies and percentages of all sociodemographic variables and the prevalence of depression, anxiety, and stress symptoms. Also, an analysis of the prevalence of moderate to severe symptoms of mental health problems (anxiety, depression, stress, and emotional distress) and quality of life in relation to clinical stage and the types of cancer with the highest overall mortality was performed.

Validity of the models: Based on the conceptual framework (Figure 1), three complementary regression models were specified to assess the association between mental health symptoms and quality of life, minimizing multicollinearity, which was evaluated using variance inflation factors (VIF). In the first model, specific mental health symptoms such as depression, anxiety, and perceived stress were considered independent predictors; the second, transdiagnostic model assessed emotional distress as a higher-order construct; finally, the third model examined

comorbidity as an indicator of cumulative symptom burden. Covariates for multivariable models were chosen based on statistical criteria, clinical plausibility, previous empirical data, and their possible confounding effects. All adjusted models showed VIF values below 5. Variables were first examined in crude models and subsequently entered simultaneously into multivariable models if they met statistical criteria (p < 0.05), had clinical plausibility, or were supported by previous literature as potential confounders.

Mental health and quality of life outcomes: Quality of life (mental and physical components) was considered the outcome variable, while depressive symptoms, anxiety, perceived stress, and emotional distress were treated as exposure variables. Mental health variables included anxiety, stress, depression, and emotional distress. These were dichotomized: mild perceived stress (score of 0 to 13) and moderate to severe perceived stress (score of 14 to 40); normal to mild depressive symptoms (score of 0 to 18) and moderate to severe depressive symptoms (score of 19 and above); normal to mild anxiety symptoms (score of 0 to 18) and moderate to severe symptoms (score of 19 and above); and absence of emotional distress (score of 0 to 10) and probable cases of emotional distress (score of 11 or above), based on the criteria of Zigmond and Snaith, considering the scores with greater clinical specificity (Zigmond & Snaith, 1983). On the other hand, quality of life includes two dimensions: mental quality of life and physical quality of life. The scores obtained were divided into tertiles, which were then dichotomized into low-medium and high (high quality of life was used as the reference category to facilitate interpretation), since there are no universal clinical cut-off points (Bruun, 2021). We consider moderate to severe symptoms and low-medium quality of life to be clinically significant for cancer patients who need mental health support (outcomes). A sub-analysis of the comorbidity of mental health problems was performed for mental quality of life and physical quality of life.

In addition, generalized linear models with the Poisson family were used to calculate crude (crPR) and adjusted (aPR) prevalence ratios and their 95% confidence intervals (95% CI)

between each covariate and the dichotomous outcomes of mental health and quality of life. To determine the covariates that would be included in the adjusted model, the criterion used was that they had a p-value of less than 0.05 in the crude model, to be added to the multivariate model. By including interaction terms in Poisson regression models with robust variance, potential impact modification by sex was investigated in the relationship between emotional distress and both physical and mental quality of life. Since the interaction terms were not statistically significant (p > 0.10), neither model showed any indication of modification of effect by sex. The amount and direction of the relationship between emotional distress and poorer physical and mental quality of life were consistent for both sexes. In addition, sensitivity analyses were performed using log-binomial regression models to estimate prevalence ratios. Although convergence problems and unacceptable predicted values were observed in some specifications, the results were consistent in direction and magnitude with those obtained using robust Poisson regression. Therefore, robust Poisson regression was retained as the primary analytical approach due to its numerical stability and widespread use in cross-sectional studies, while log-binomial models were used only for sensitivity analyses.

Topics of Ethics

The protocol was approved by the INEN Research Ethics Committee and the Research Review Committee (N°239-2018-CIE/INEN). Participants were invited to participate in research according to conventional ethical requirements. Subsequently, signed the written informed consent, and were provided with the questionnaire, which consisted of socio-demographic questions and psychometric tests.

RESULTS
Characteristics of the participants

Initially, 500 participants were evaluated, but those who lacked information on the outcome of interest (n = 27, 5.3%) or who were foreigners (n = 8, 1.6%) were eliminated. There
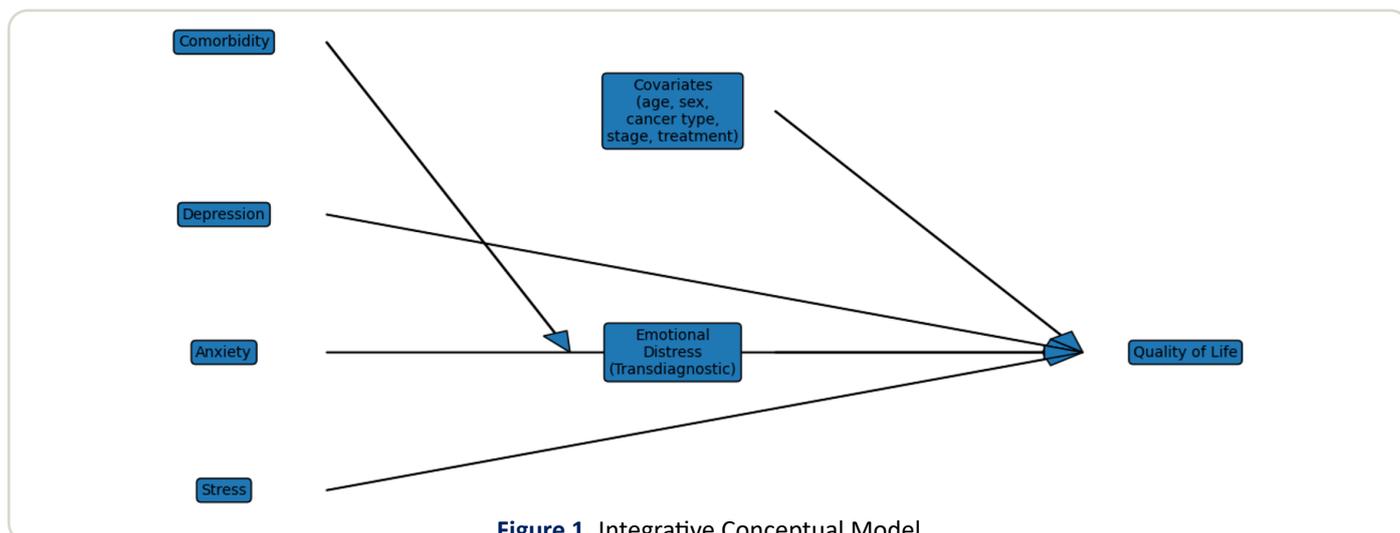

Figure 1. Integrative Conceptual Model

were no missing values. After filtering, a total of 465 participants were obtained, exceeding the minimum sample size required (453). Most participants were women (75.7%), aged between 17 and 84 (mean = 45.9; SD = 14.4), were currently in a romantic relationship (48.2%), had focal cancer (77.6%), were in an advanced stage of cancer (38.3%), and were unemployed (78.3%), mostly homemakers. The characteristics of the participants are presented in Table 1. In addition, the prevalence of anxiety symptoms of 27.5%, depressive symptoms of 20.4%, moderate-severe stress symptoms of 83.2%, and emotional distress of 57.41% was identified. Our study reveals that 87.1% of participants had some mental health problems.

Figure 2 shows the prevalence of factors associated with mental health according to the type of cancer-focused according to gender. The prevalence of symptoms of anxiety (33.33%) and moderate to severe depression (33.33%) is higher in women with gastric cancer compared to men. Likewise, the prevalence of signs of stress and emotional distress are higher in women with colorectal cancer (88.89%), and other types of focused cancer (77.78%). Regarding low to medium quality of life, the prevalence is higher in women with lung cancer (100%) and/or other focal cancers (67.21%). Finally, women with cervical cancer have a higher prevalence of stress (94.20%) and a low to medium mental (81.16%) and physical (71.01%) quality of life. A sub-analysis of the prevalence of mental health and quality of life outcomes by clinical stage can be found in Supplementary Material 2.

Mental health and Quality of Life

In the regression model, participants with cancer who had at least 12 years of education (college or higher technical education) were 33% less likely to have emotional distress, compared to those with basic education (aPR= 0.67, 95%CI=0.48-0.94) (see Table 2). It should be noted that neither cancer (unfocused and focused) nor clinical stage (early stage, advanced stage, and no stage) presented significant values for any of the mental health problems (anxious symptoms, stress, depression symptoms, and emotional distress).

Cancer patients with a low or average quality of mental life are twice as likely to present signs of moderate or severe stress (aPR=2.30, 95%CI=1.42-3.69). Similarly, they are 46% more likely to present symptoms of emotional distress (aPR=1.46, 95%CI=1.10-1.96). In addition, cancer patients with a low and medium physical quality of life are 49% more likely to suffer emotional distress (RPa=1.49, 95%CI=1.18-1.89) than those without emotional distress (see Table 3). It should be noted that neither cancer type nor cancer stage presented significant values for any mental health problems (anxious symptoms, stress, depression symptoms, and emotional distress). In addition, it should be noted that neither cancer (unfocused and focused) nor clinical stage (early stage, advanced stage, and no stage) presented significant values for mental quality of life or physical quality of life (Supplementary material 3 y 4).

The comorbidity sub-analysis identified that as the number of comorbid mental health problems increases, the probability of having a low mental quality of life and physical quality of life increases (see Table 4). Having at least one mental health prob-

lem increases the probability of having a poor mental quality of life (aPR=2.55, 95%CI=1.38-4.69) compared to having no mental health problem. Also, having two or more mental health problems increases the probability of having a poor physical quality of life (aPR=1.68, 95%CI=1.13-2.50) compared to having one or no mental health problem (Supplementary material 5).

DISCUSSION
Main findings and significance of the results

The findings show that mental health symptoms, whether assessed specifically or from a transdiagnostic perspective, are consistently associated with lower physical and mental quality of life in Peruvian cancer patients. Emotional distress and perceived stress act as the main predictors of low well-being, reinforcing the need for a comprehensive and timely assessment of psychological distress beyond the primary cancer diagnosis.

The prevalence of depression (20.4%) and anxiety (27.5%) found is consistent with meta-analyses in low- and middle-income countries. However, the prevalence of stress (83.2%) and emotional distress (57.4%) was higher than reported in international studies on breast or ovarian cancer (Walker et al., 2021). Unlike some studies that suggest variations depending on the type of cancer, our study found no significant association between the type or stage of cancer and mental health problems, which is consistent with literature suggesting that self-awareness of chronic illness is a more determining factor than the specific location of the cancer (Martínez López et al., 2017; Ploos van Amstel et al., 2015; Goebel et al., 2011; Ludwigson et al., 2020).

Empirical evidence remains contradictory regarding differences in mental health outcomes between different types and stages of cancer. While some studies suggest that cancer patients are heterogeneous and experience different psychological problems depending on the type and stage of the disease (Abbas et al., 2021; Aquil et al., 2021; Walker et al., 2021; Wen et al., 2019), others have found no significant differences between different types of cancer (Li et al., 2018). These inconsistencies can be explained by variations in sociocultural contexts at the time of diagnosis, the limited sample sizes in many studies, and the use of different assessment instruments. Furthermore, it is plausible that factors such as awareness of having a chronic illness play a more important role in the development of mental health problems than the specific anatomical location of cancer. Previous research has shown that awareness of having a chronic illness is associated with an increased risk of psychological distress and mental health disorders (Ravindran et al., 2019; Yeh et al., 2021).

From a transdiagnostic approach, the results support that emotional distress is the most important component in predicting poor mental and physical quality of life. Several cross-sectional studies have previously identified an inverse relationship between quality of life, stress, and emotional distress in cancer patients (Prapa et al., 2021; Ravindran et al., 2019; Yeh et al., 2021).The use of three complementary models showed that symptom comorbidity matters more than isolated symptoms; having two or more mental health problems dramatically increases the likelihood of poor physical and mental quality of life

(Table 4 and Supplementary Material 2). One of these models is the hierarchical taxonomy of psychopathology, which posits that emotional distress and perceived stress are the highest-order components within the range of emotional disorders (Kotov et al., 2017). This cumulative burden reflects a clinical severity that requires interventions addressing shared core vulnerabilities.

It was identified that gender is a risk factor for the presence of depressive symptoms. There is ample evidence that gender is a predictor of the presence of depressive symptoms. A global meta-analysis reported that women have a prevalence of 31%, compared to a prevalence of 26% in men (Mejareh et al., 2021). This may be due to a variety of biological and hormonal factors in women that increase the risk of having intense

Table 1. Characteristics of the participants (n=465).

|		n	%
Sex	Men	113	24,3%
	Women	352	75,7%
Age	17 to 29	72	15,5%
	30 to 44	141	30,3%
	45 to 59	164	35,3%
	60 to more	88	18,9%
Type of care	Outpatient clinic	185	39,8%
	Outpatient	154	33,1%
	Hospitalization	126	27,1%
Civil status	With current couple	224	48,2%
	Separated or Widower	74	15,9%
	Single	167	35,9%
Educational years	At least 6 years old	78	16,8%
	7 to 11 years	214	46,0%
	12 to more	173	37,2%
Laboral status	With work	101	21,7%
	Without work	364	78,3%
Clinical Stage	Early stage	187	40,2%
	Advanced stage	178	38,3%
	No stage	100	21,5%
Type of cancer	Unfocused	104	22,4%
	Focused	361	77,6%
Focal type of cancer	Colorrectal cancer	15	3,2%
	Breast cancer	137	29,5%
	Cervical cancer	69	14,8%
	Gastric cancer	19	4,1%
	Lung cancer	14	3,0%
	Otros	211	45,4%
Anxious symptoms	None to Leve	337	72,5%
	Moderate to Severe	128	27,5%
Depression symptoms	None to Leve	370	79,6%
	Moderate to Severe	95	20,4%
Moderate-severe stress	Leve	78	16,8%
	Moderate to Severe	387	83,2%
Emotional Distress	No	198	42,6%
	Yes	267	57,4%
Comorbidity of mental health problems	None	60	12,9%
	One mental health problem	143	30,8%
	Two or more mental health problems	262	56,3%
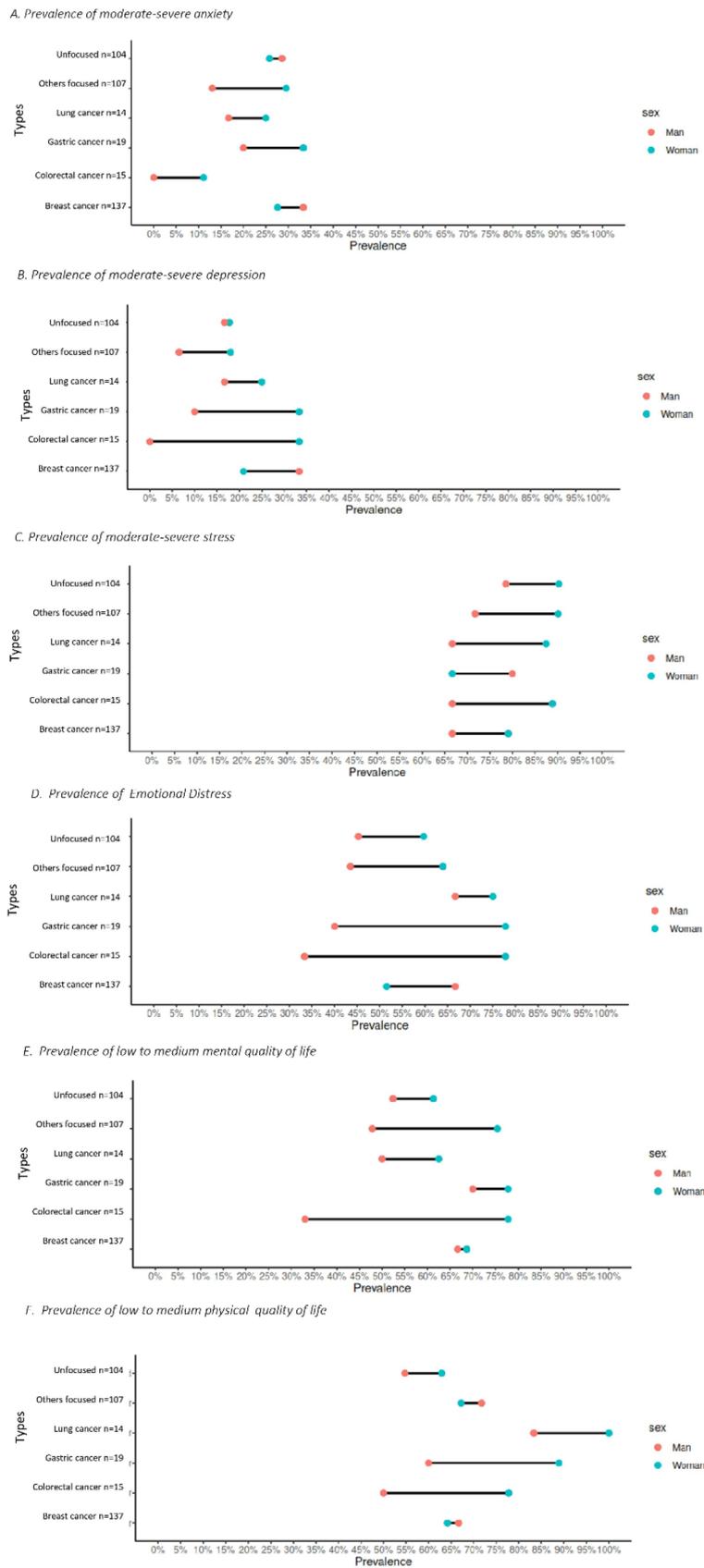
Figure 2. Prevalence of mental health and quality of life outcomes according to type of cancer and gender.

emotional symptoms (Grossman & Wood, 1993). However, as studies have shown that men had higher symptoms (Park & Kim, 2021), this may be due to social patterns. In a society with traditional gender norms masculinity involves hiding concerns and not expressing feelings of vulnerability (Fish et al., 2015). The cancer diagnosis can undermine perceptions of masculinity, coupled with poor control of the effects of the disease, leading to further deterioration of their health in the long term (Park & Kim, 2022). While women are better at identifying emotions (Barabanschikov & Suvorova, 2021; Gordillo-León et al., 2021). So, they would be better able to identify symptoms of sadness and emotional distress and therefore present a higher rate of positive cases.

A higher level of education was identified as a protective factor for emotional distress symptoms. The literature exposes contrary positions, as one systematic review reported that educational level does not predict long-term emotional distress (Cook et al., 2018). Other studies using the distress thermometer instrument, which has acceptable diagnostic performance for measuring emotional distress (Priede et al., 2014), found that lower educational levels are associated with greater distress and patients with lower educational levels are more likely to develop emotional distress (Duan et al., 2021; Kim et al., 2011; Merckaert et al., 2005; Wang et al., 2018). Another possi-

ble explanation is that educational level is a predictor of income level in Peru, and there is evidence that a high-income level is a predictor of the presence of emotional problems, such as depressive symptoms (Villarreal-Zegarra et al., 2020).

Relevance in public health

Quality of life is a relevant outcome within the course of cancer disease (Cao et al., 2017; Fernández de Larrea-Baz et al., 2020; Hu et al., 2021; Li et al., 2018; Lu et al., 2019; Mace et al., 2021; Ngan et al., 2021; Nipp et al., 2017; Ravindran et al., 2019), so healthcare systems should develop interventions and strategies to care for the quality of life of cancer patients. Our study helps to prioritize which mental health problems are associated with poor quality of life (i.e., stress and emotional distress). Therefore, we suggest that future studies focused on mental health problems could be based on the transdiagnostic approach and offer further support for these interventions in cancer patients. Interventions based on a transdiagnostic approach have been shown to have several public health advantages by grouping people with common emotional distress symptoms, associated with a negative impact on their quality of life (González-Blanch et al., 2018). Also, the transdiagnostic approach allows for a low-cost, short-duration implementation that will optimize mental health care by improving the quality

Table 2. Regression model for associated factors to mental health (n=465).

		Anxious symptoms rPR (95% CI)	Moderate-severe stress rPR (95% CI)	Depression symptoms rPR (95% CI)	Emotional Distress rPR (95% CI)	aPR(95%CI)*
Sex	Men	Ref.	Ref.	**Ref.**	Ref.	Ref.
	Women	1.55 (0.98-2.45)	1.16 (0.91-1.47)	**2.02 (1.13-3.64)**	**1.36 (1.00-1.84)**	1.34 (0.98-1.81)
Age	17 to 29	Ref.	Ref.	Ref.	Ref.	-
	30 to 44	1.25 (0.72-2.16)	0.93 (0.68-1.26)	1.26 (0.69-2.29)	1.07 (0.74-1.56)	-
	45 to 59	1.24 (0.73-2.13)	0.94 (0.70-1.26)	0.82 (0.44-1.53)	1.02 (0.70-1.48)	-
	60 to more	0.68 (0.34-1.35)	0.89 (0.64-1.26)	0.82 (0.40-1.67)	1.02 (0.67-1.55)	-
Type of care	Outpatient clinic	Ref.	Ref.	Ref.	Ref.	-
	Outpatient	1.04 (0.70-1.55)	0.98 (0.77-1.24)	1.57 (0.99-2.46)	1.25 (0.95-1.65)	-
	Hospitalization	0.88 (0.56-1.37)	1.00 (0.78-1.29)	0.85 (0.48-1.49)	1.04 (0.77-1.42)	-
Civil status	With current couple	Ref.	Ref.	Ref.	Ref.	-
	Separated or Widower	0.90 (0.53-1.55)	0.98 (0.73-1.31)	0.76 (0.39-1.47)	0.93 (0.65-1.33)	-
	Single	1.27 (0.88-1.84)	1.02 (0.82-1.27)	1.22 (0.79-1.87)	1.00 (0.77-1.30)	-
Educational years	At least 6 years old	Ref.	Ref.	Ref.	Ref.	Ref.
	7 to 11 years	0.89 (0.56-1.42)	0.87 (0.66-1.15)	1.05 (0.61-1.82)	0.78 (0.57-1.06)	0.80 (0.59-1.10)
	12 to more	0.76 (0.46-1.24)	0.90 (0.67-1.19)	0.77 (0.42-1.40)	**0.66 (0.47-0.92)**	**0.67 (0.48-0.94)**
Laboral status	Without work	Ref.	Ref.	Ref.	Ref.	-
	With work	0.71 (0.44-1.13)	0.92 (0.72-1.18)	0.96 (0.59-1.57)	0.73 (0.53-1.01)	-
Clinical stage	Early stage	Ref.	Ref.	Ref	Ref.	-
	Advance stage	0.83 (0.56-1.23)	1.04 (0.83-1.31)	0.81 (0.52-1.27)	0.85 (0.65-1.11)	-
	No stage	0.85 (0.54-1.36)	1.07 (0.82-1.39)	0.72 (0.41-1.26)	0.86 (0.62.1.18)	-
Type of cancer	Unfocused	Ref.	Ref.	Ref.	Ref.	-
	Focused	1.03 (0.68-1.56)	0.96 (0.76-1.22)	1.23 (0.74-2.06)	1.09 (0.81-1.46)	-

Note: rPR = Raw prevalence ratio. aPR = Adjusted prevalence ratio. 95% CI = 95% confidence interval. *Model adjusted for Emotional Distress ajusted by sex and educational years. Values in bold are significant (p<0.05).

Table 3. Regression model for associated dimensions to quality of life outcomes (n=465).

		Mental quality of life (low-middle)		Quality of life Physical (low-middle)	
		rPR (95% CI)	aPR (95%CI)*	rPR (95% CI)	aPR (95%CI)**
Sex	Men	Ref.	Ref.	**Ref.**	-
	Women	1.37 (1.03-1.81)	1.17 (0.88-1.56)	**1.06 (0.82-1.38)**	-
Age	17 to 29	Ref.	-	Ref.	-
	30 to 44	1.03 (0.73-1.46)	-	1.39 (0.96-2.03)	-
	45 to 59	1.02 (0.72-1.42)	-	1.33 (0.92-1.93)	-
	60 to more	0.92 (0.62-1.36)	-	1.33 (0.88-2.00)	-
Type of care	Outpatient clinic	Ref.	-	Ref.	-
	Outpatient	0.97 (0.75-1.26)	-	0.99 (0.76-1.29)	-
	Hospitalization	0.99 (0.75-1.30)	-	1.05 (0.80-1.38)	-
Civil status	With current couple	Ref.	-	Ref.	-
	Separated or Widower	0.97 (0.69-1.35)	-	0.91(0.66-1.26)	-
	Single	1.12 (0.88-1.42)	-	0.92 (0.72-1.18)	-
Educational years	At least 6 years old	Ref.	-	Ref.	-
	7 to 11 years	0.86 (0.63-1.16)	-	0.87 (0.64-1.19)	-
	12 to more	0.82 (0.60-1.12)	-	0.88 (0.64-1.21)	-
Laboral status	Without work	Ref.	-	Ref.	-
	With work	0.85 (0.64-1.12)	-	0.92 (0.70-1.21)	-
Clinical stage	Early stage	Ref.	-	Ref.	-
	Advance stage	1.06 (0.83-1.36)	-	1.15(0.89-1.47)	-
	No stage	0.96 (0.71-1.30)	-	1.00 (0.74-1.36)	-
Type of cancer	Unfocused	Ref.	-	Ref.	-
	Focused	1.20 (0.91-1.59)	-	1.15 (0.87-1.52)	-
Anxious symptoms	No	Ref.	Ref.	Ref.	Ref.
	Yes	1.57(1.25-1.98)	1.10 (0.83-1.43)	1.27 (1.00-1.61)	1.07 (0.82-1.39)
Depression symptoms	No	Ref.	Ref	Ref.	-
	Yes	1.52(1.19-1.95)	1.11 (0.83-1.48)	1.29 (0.99-1.67)	-
Moderate-severe stress	No	Ref.	Ref.	Ref.	-
	Yes	2.92(1.86-4.60)	2.30 (1.42-3.69)	1.36 (0.98-1.90)	-
Emotional Distress	No	Ref	Ref.	Ref.	Ref.
	Yes	1.90(1.48-2.44)	1.46 (1.10-1.96)	1.49 (1.18-1.89)	1.45(1.12-1.88)

Note: rPR = Raw prevalence ratio. aPR = Adjusted prevalence ratio. 95% CI = 95% confidence interval. *Multiple Poisson regression for Mental quality of life ajusted by sex, Anxious symptoms, Depression symptoms, Stress, and Emotional Distress. **Multiple Poisson regression for Quality of life Physical ajusted by Anxious symptoms and Emotional Distress. Values in bold were significant (p<0.05).

Table 4. Regression model of quality of life outcomes by comorbidity of mental health problems (n=465).

		Mental quality of life (low-middle)		Quality of life Physical (low-middle)	
		rPR (95% CI)	aPR (95%CI)*	rPR (95% CI)	aPR (95%CI)*
Comorbidity of mental health problems	None	Ref.	Ref.	Ref.	-
	One	**2.59 (1.41-4.76)**	**2.55 (1.38-4.69)**	1.17 (0.76 - 1.80)	1.17 (0.76-1.81)
	Two or more	**4.27 (2.39-7.64)**	**4.13 (2.30-7.41)**	**1.67 (1.12- 2.48)**	**1.68 (1.13-2.50)**

Note: rPR = Raw prevalence ratio. aPR = Adjusted prevalence ratio. 95% CI = 95% confidence interval. *Multiple Poisson regression ajusted by sex. Values in bold were significant (p<0.05).

of life for a wide range of cancer patients (Dalgleish et al., 2020; González-Blanch et al., 2018).

Our study also serves as an input for cancer insurance policies in low- and middle-income countries, as it reveals a high prevalence and comorbidity of mental health problems. Consequently, it would allow them to plan actions to promote a culture of prevention, early detection and treatment, restoring quality of life to patients. Additionally, the establishment of psychological and psychiatric care plans for cancer patients within their policies is suggested.

In Peru, since 2015, the Ministry of Health and INEN have implemented a budgetary program for the control and promotion of mental health that focuses on the application of psychological support strategies for cancer patients (Instituto Nacional de Enfermedades Neoplásicas, 2017; Ley Nacional del Cáncer, 2021). During the COVID-19 pandemic, mental health support, and self-care strategies for cancer patients were strengthened. One of the main objectives of the program is the improvement of the quality of life through a psychosocial support team (Instituto Nacional de Enfermedades Neoplásicas, 2020; Ministerio de Salud, 2020). Our results support the need to further strengthen this type of health strategy.

Strengths and limitations

This study presents some methodological limitations. First, this study has a cross-sectional design that consists of making a single measurement over some time and analyzing the relationship between variables (Cvetkovic-Vega et al., 2021), so it is not possible to make statements about the causal relationship between variables. Nevertheless, these results are important because they show what associated factors are important for the mental health and quality of life of cancer patients. Second, cancer patients are influenced by their family and social environment, which can increase their risk of mental health problems (Yeh et al., 2021), but it is not possible to assess patients and relatives, so this could introduce a measurement bias. Third, the results are not generalizable to other cancer populations in Peru, because our study is non-probabilistic. Fourth, the sample size is small, so regression analyses cannot be performed for each cancer diagnosis (i.e., gastric cancer, cervical cancer, or others).

Conclusions

In relation to the main objective, it was found that the main factors associated with physical quality of life and mental quality of life are emotional distress and stress. On the other hand, it was observed that a high level of education was a factor associated with emotional distress, but the type of cancer and clinical stage did not obtain significant results. Finally, it was found that the greater the comorbidity of mental health problems, the greater the association with a lower quality of life (physical and mental).

Based on the findings, there is a need for oncology services to incorporate routine mental health screening protocols that assess the presence of comorbid psychological symptoms, which would allow for the early identification of patients at greater risk of deterioration in their quality of life. In this regard, it is suggested that interventions with a transdiagnostic approach be implemented, aimed at reducing emotional distress and stress in oncology patients, considering the comorbidity identified among the symptoms evaluated. Likewise, for future research, it is recommended to use structural equation modelling (SEM) to explore the complex relationships between depression, anxiety, stress, emotional distress, and quality of life, facilitating the assessment of latent constructs and possible mediating mechanisms.

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CONFLICT OF INTEREST
The authors report no conflict of interest when conducting the study, analyzing the data, or writing the manuscript.

REVIEW PROCESS
This study has been reviewed by two external reviewers in double-blind mode by Carlos Narváez Gaitán and another reviewer. The editor in charge was Renzo Rivera. The review process is included as supplementary material 6.

DATA AVAILABILITY STATEMENT
The authors provide the database at https://doi.org/10.6084/m9.figshare.28046711.

DECLARATION OF THE USE OF GENERATIVE ARTIFICIAL INTELLIGENCE

We used DeepL to translate specific sections of the manuscript and Grammarly to improve the wording of certain sections. The final version of the manuscript was reviewed and approved by all authors.

DISCLAIMER

The authors are responsible for all statements made in this article.

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