

# Discussion of the Interconnection Between Mental and Physical Disorders from the Aspect of Oncology

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## ABSTRACT

The fact that mental and physical health are correlated has become more well known in the general public in the recent decades. However, other than the general trend that one's deterioration leads to another's degradation, less is understood about how exactly the body and mind interact. This study is also motivated by the relatively neglected notion of integrated health, that is, general health's composition of physical and mental well-being. Moreover, the incomplete incorporation of mental health care into primary health care and the continuous discrimination and stigma towards those who suffer from poor mental health also motivate this investigation. This research focuses on oncology as an introduction to the manifestation of the intersection of cancer and psychology. This study investigates how mental illnesses cause physical harm. By arranging the analysis thematically, the research focus, psychological factors' impacts, shifts from cancer initiation, progression, and survival rates. In addition, one of the main goals of psychological interventions on cancer patients, quality of life, was also discussed. Findings suggest that mental and physical health interconnect as cross-effects through various physiological pathways; however some gaps in the explanations still exist, such as those seen in the aspect of cancer mortality. This study elaborates on the correlation between cancer and psychology and aims to provide a complete view of the manifestation of the interconnection between mental and physical health.

## **Introduction**

The truth about the seemingly loosely related fields of mental and physical health has been unraveled as the two proved to have a fundamental connection. Rather than a coincidence, a strong link has been proven from patients suffering from mental disorders who also concur with physical illnesses in a 2017 study by Ohrnberger, Fichera, and Sutton; yet, the pathways and exact interactions of both forms of health are still to be investigated. (Ohrnberger, Fichera and Sutton, 2017). The association of mental and physical health is evident in chronic physical diseases (but not limited to), which are shown in patterns of cross effects: poor mental health increases the risks or exacerbates physical conditions, while people with physical illnesses are likely to develop poor mental health (Canadian Mental Health Association, 2022). Concerning the growing prevalence of poor mental health conditions and their contribution to the main causes of mortality and morbidity, this study aims to analyze the impacts and potential hazards that psychological illnesses pose on physical health. From the gradually increasing cancer affliction rate stemming from modern trends such as increasing lifespan, increment of unhealthy lifestyles, and an overall accumulation of environmental carcinogens in addition to the rise of the relatively new field of psycho-oncology, this study will be incorporating ideas about the intersection of psychology and cancer epidemiology. From the aspects of cancer initiation, survival rates, and progression, to cancer patients' life quality, this study will be investigating the connection between oncology and psychological factors. This study will also be incorporating the psychological influences of mental disorders, distress, and psychotherapies. As a side effect of cancer, distress or mental illnesses are commonly experienced by patients coping with the psychological and physical burdens of cancer treatments and cancer trajectory. It is hypothesized and postulated in several studies that psychological interventions for cancer patients influence not merely their

life qualities, but also survival rates and risks of cancer progression probability. Observing from these perspectives, an understanding of the intersection and interconnectedness of the health of body and mind could be gained.

The idea of a mentally healthy state, as defined by the World Health Organization, is the state of well-being in which the individual realizes his or her own abilities and potentials, and can cope and endure through the normal stresses of life. Furthermore, one with a state of mental well-being can work productively, effectively and fruitfully, and is able to make a contribution to his or her community (World Health Organization, 2001). Drastic changes in people's lifestyles over the past century have not only fueled the expanding prevalence of physical chronic diseases, but also the epidemic-like ubiquity of mental illnesses. As depression is dubbed the "disease of modernity", other psychological disorders have also surfaced with high occurrence rates in recent decades and particularly rising tremendously within the younger generations (Hidaka, 2013). Seeing the antagonistic trends, the author believes an examination on the topic would be both meaningful and contributory.

The thought of depression mostly depicts an abnormality; however, the primitive function and purpose of depression is generally neglected. Some researchers have postulated over the evolutionary course of one of the most common mental disorders recently. Commonly understood as an unpleasant abnormality without any function, depression was believed by some researchers to carry purposes from humans' ancestral past and is meant to be preserved as an adaptation through the course of evolution. When researchers Andrews and Thomson examine the physical state of depressed patients, higher energy usage in the brain is observed. Along with this observation, the researchers explained the purpose of depression as a way to solve complex social problems. Moreover, rumination, or the repetitive and excessive contemplation of the same event, is the reason for the evolution of depression, as rumination assists in understanding the cause of the problem. The understanding of the problem leads to contemplation of solutions, therefore, it is concluded that the state of melancholy in depression is a byproduct of rumination (Andrews & Thomson, 2009). The concept of the potential function of depression could introduce us to a deeper understanding of this mental disorder and those similar in nature.

Mental illness is considered as one of the major causes of disabilities and ill-health. Moreover, as the COVID-19 pandemic spread, demands for mental health services also grew (International Science Council, 2020). However, persisting discrimination and stigma towards mental health care continuously hinder the access and availability of psychological (or social) support and resources. By investigating the correlation of mental and physical disorders from the aspect of oncology, this study attempts to heighten the awareness and understanding of the significance of this field and its linkage with physical health. This study aims to illustrate the body-mind interactions by describing the correlation of mental and physical disorders from different aspects by underscoring their mechanisms along with some specific ailments. Moreover, concerning the present state of mental health being one of the most neglected areas of public health, few objectives of this study are to emphasize and raise awareness on the significance of mental health to our general wellbeing.

## Methodology

To achieve an extensive understanding of the interconnection and interaction of physical and mental health from the perspective of oncology, 32 past studies were reviewed and discussed. This research is based on a qualitative analysis of secondary data. The pattern of influences found in both forms of health is established from thematic analysis of an existing body of literature.

## Literature Review

Genetic damages could render malignant developments that dysregulate the normal cellular functions and cycles. Oncogenes, mutated DNA sequences that give rise to cancerous cells, are often created by genetic alterations such as translocations, amplifications, and point mutations (Koeffler, 1991). These genetic mutations change proto-oncogenes

to oncogenes that cause uncontrolled cell growth. Intrinsically mutations, cancer developments are relatively common in the aging population because of their reduced immune functions, accumulated toxins, and increased risks or number of mutated genes that built up through ages of constant cell divisions. The prosperity of medical science, economy, and the overall quality of life has prolonged people's life expectancies, but adversely contributed in escalating the occurrences of cancers. Despite the drawback, cancer patients now experience higher chances of survival. Therefore, as survivorship of cancers increases, the phenomenon of coexistence with the disease becomes prolonged and more prevalent. As cancer patients confront the stress from treatments and disease progression, they become prone to a broad range of mental disorders, including depression, anxiety, sleep disturbances, adjustment disorders and fear of progression. The growing prevalence of comorbidities have made the maintenance of cancer patients' life quality a highlight of a number of studies. In addition, awareness on the idea that psychological therapies can possibly increase cancer survival rates, hinder cancer progression, and reduce physical pain has attracted plenty of attention in the field of psycho-oncology. Noting the probable strong correlations of mental health and cancers, curiosity on whether cancers are causing mental deterioration or mental diseases render cancerous growth has also arisen.

## Cancer Etiology and Mental Illnesses

Studies on the etiology of cancers have accumulated ample evidences to show the positive associations of tumor developments with chemical (such as, exposure to polluted environments, lifestyles, habits, and diets) and physical (such as, long term exposures to radioactive materials, ultraviolet light, or radiations) carcinogens, genetic factors, and hormonal factors. Moreover, cancers can also result directly from infections of oncogenic, meaning cancer causing, viruses (Colditz, Sellers, Trapido, 2006). On the other hand, the contribution to the susceptibility of cancers by psychological factors is still controversial. In investigation of the psychological dimensions of cancers, a fundamental doubt on the cross-effects of neoplasms and psychological distress has been a highlight of several researches: whether psychological disorders are contributing factors in neoplasm etiology or merely side effects stemming from cancers.

However, studies set to explore the relationship between cancer initiation and mental illnesses still yield contradictory and complex results. For example, as opposed to a previous research done by McGinty, a cohort study reported observations in decreasing incidences of cancer in schizophrenia patients and their first degree relatives (Ji et al., 2013). Moreover, as Weinstein and others observed, results tend to vary depending on the study controls, methods, and unspecified behavioral risk factors, such as smoking. Although the results and conclusions regarding the connections between mental disorders and cancer onset have not reached a consensus and are still in controversy, the idea that mental distress and cancer cause higher risks in each other are supported by larger sampled studies and numerous cases (Weinstein et al., 2015).

Convincing traces on the relationship between cancer etiology and psychology are found across research. For example, a longitudinal cohort study by McGinty et al. (2012) demonstrated the connections of heightened risks of cancer development and mental illnesses (McGinty et al., 2012). The cohorts were established according to age, sex, race, and diagnosis of different mental illnesses (bipolar disorder and schizophrenia) for comparisons of cancer incidences in different groups and observations of other potential influencing factors. The results of the study were compared with data on the total cancer incidences among the overall population of the US in order to see the significance of different determinants. The comparison of studies demonstrated sharp rises in cancer risks in patients afflicted with schizophrenia or bipolar disorder: lung, colorectal, and breast cancers. Instead of clarifying the exact pathway of the interactions between cancer onset and psychological disorders, this study only concluded on the positive relationship of the heightened risks of cancer developments in the population with mental illnesses (bipolar and schizophrenia). However, notably, from the prevalence of site-specific cancer occurrences in patients with mental distress, the study mentions the impacts of lifestyle in patients with serious mental illnesses that could be affecting cancer rates. For example, high smoking rates in the population of mentally ill patients could be a reason for the high frequency in lung cancer development. In support and elaboration of this idea, a study conducted by Massetti et al. examined the asso-

ciation of risk factors and cancer occurrences over the course of lifespan in young adults (Masseti et al, 2018). Observing the common characteristic, mental distress, among the cancer risks associated with the population, the study further identified habits or related factors common within the population. For example, smoking, binge drinking, inadequate leisure time, physical activities, or sleep. Analysis of the collected data indicated that mental health issues in young adults are positively related to the prevalence of habits that could heighten cancer risks over their course of lifespan.

A regression analysis in exploring the connections between depression and subsequent cancer risks identified two positive correlations between the mental disorder and liver and lung cancers (Jia et al., 2017). The analysis also revealed evidence to conclude the association between depression and liver and lung cancers. The authors provided a few possibilities to explain how mental distress and cancer development may be associated. For instance, the disruption in interactions of hormone and cell growth regulation and the disturbance in the immune signaling pathway are the two mechanisms hypothesized regarding the correlation between depression and subsequent cancer risks. Stress causes the release of stress hormones (cortisol) into the bloodstream; however, increased plasma cortisol level in depression patients could be interfering with cell growth and regulation, which could ultimately lead to neoplasm development. Another plausible pathway involves the notion that depression exposure alters cytokine productions (inflammation signaling molecule). Specifically, depression is related to the malfunctioning of immune response in overproducing cytokines TNF-a and IL-6, and the heightened concentrations of the cytokines are common in cancer patients.

However, it should be noted that the process may be more complex since some contrasting data has been found depending on cancer types and locations. For example, in analyzing the association of depression to breast cancer, unlike the relationship identified in breast cancer and bipolar and schizophrenia by Massetti et al. (2018), Jia et al. suggested that there was no significant connection. This result is consistent with a study finding the connection between the psychological factors and breast cancer (Bleiker and Ploeg, 1999).

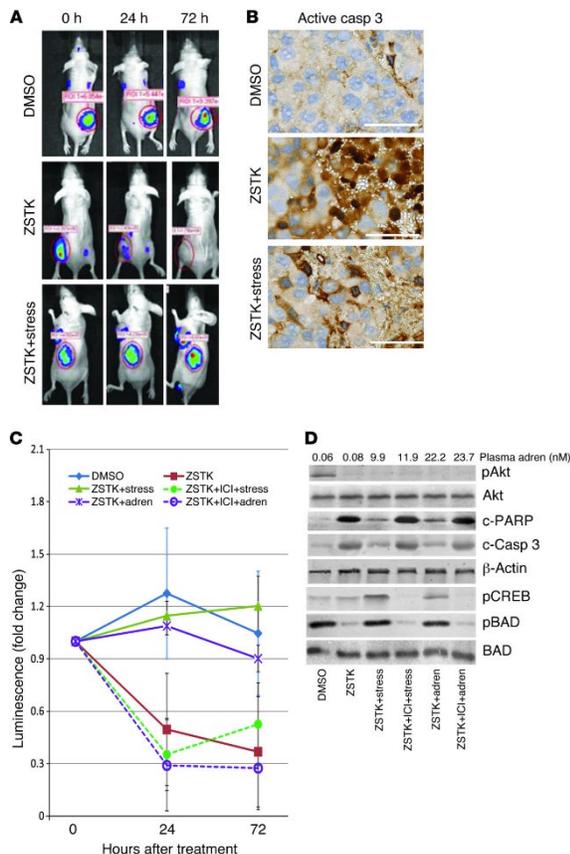
Approaching from a different perspective of the relationship between cancer and mental illness inspires the idea that cancer elevates the rate of mental disorder morbidity or deteriorates mental health. As cancer rates surge in the recent decades, the frequent concurrence of mental disorders has highlighted the significance of psycho-oncology. In a study conducted by Shang and others, the higher risks of cancer patients in developing subsequent mental illnesses than the general population was pointed out (Shang et al., 2020). Aside from lifestyle factors identified by previous researchers, Shang indicated the group of people who are more prone to cancer and mental illness comorbidity: female gender and older age groups. Moreover, pre-existed physical illnesses are also found to correlate with comorbidity. Nonetheless, the study did not specify or postulate the reason behind this correlation. Social factors such as low education and income are also reported to jeopardize patients. In addition, the evaluation of the manifestations of psychological distress subsequent to cancer has become one of the most extensive fields of research. The psychological factors burdening cancer patients have also been addressed. The category of depression included the manifestations of minor depressive mood, major depression, and anxious depressive syndrome, which were all outlined according to symptoms to show severity. Anxiety included specific phobias, such as the chemotherapy-induced anticipatory nausea or vomiting. Among stress-related disorders, post-traumatic disorder is most common in the long-term survivors of cancer patients. A study indicated that 47% of the interviewed cancer patients showed symptoms of mental disorders, such as depressed mood, anxiety, and major depression. Several common psychological consequences that burdens cancer patients after diagnosis and treatment have then been identified, these being depression, anxiety and stress related factors (Caruso et al., 2017). Furthermore, an analysis conducted by McFarland and others in attempt to investigate suicidal rates in cancer patients revealed that thoughts of suicide are most associated with depression, which is prevalent in cancer patients. Moreover, the study revealed psychiatric risk factors that are commonly found in terminally ill patients, such as hopelessness, lack of social support, and the feeling of being a burden to others (McFarland et al., 2019).

High levels in cancer and mental illness comorbidity has been consistently reported. The cause of the trend could be investigated in two perspectives: whether cancer etiology is related to pre-existed mental illnesses, or cancer

diagnosis and treatment induce psychological illnesses. Regarding the first perspective, more studies are found to scrutinize the potentially harmful but also common habits in those suffering from mental illnesses. Several researches also aim to estimate the degree of relatedness between cancer and pre-existed mental illnesses; however, less are found to directly conclude or identify pathways of mental illness leading to cancer initiation or progression.

### Cancer Progression and Psychological Factors

To build from the previously mentioned explanation on psychological factors and cancer development, further studies have been carried out to try and unravel such connections via different animal models. Considering the common comorbidities of stress and anxiety with cancers, a study aimed to investigate the relationship of stress and tumor development by monitoring tumor inhibiting (PI3K/AKT) pathways in mice (Hassan et al., 2013). The study confirmed that psychological factors like stress could prevent prostate cancer xenografts from immune-triggered apoptosis by adrenaline signaling. By inserting prostate tumor xenografts in mice and exposing the treatment mice groups to predator scents to arouse behavioral stress (increased adrenaline concentration in blood), the authors scrutinized the effects of stress on PI3K inhibitors activity and tumor growth (Figure 1). The results of the control group (intact and unstressed mice) showed signs of anti-tumor (PI3K) inhibitors assisting in preventing cancer cell proliferation and indirectly stimulating immune responses simultaneously, as the xenografts volume exhibited substantial reduction. On the other hand, the treatment group with perturbed mice subjected to increased blood adrenaline concentration had continuous tumor development. The authors suggested the results from this animal experimentation is also relevant to human prostate cancer. Therefore, it was extrapolated that the tumor-promoting effects of stress would also be found in patients with increased blood adrenaline concentrations.



**Figure 1:** The results from monitoring xenografts in mice that are under stress. 1. A shows the images of xenografts growth in mice followed by immobilization stress concerning time by monitoring tumors in vivo by luminescent imaging. The immunohistochemical analysis (1B) of cleaved caspase-3 (apoptosis mediating protein) in xenograft tumors demonstrates that active caspase-3 (stained) decreased in cancer cells in mice subjected to stress. 1C indicates the dynamics of luminescence in xenografts. 1D is a Western blot analysis of tumor tissues to detect the presence of specific proteins in mice intact, subjected to stress, or injected with epinephrine.

It is intuitive that cancer patients’ mental states are negatively affected by their diseases. In addition, the causal relationship of psychological factors and cancer progression has been supported in several literature. An animal experimentation yielded similar results to the prior research. However, instead of prostate cancers and the adrenaline signaling pathways, Saul et al. focussed on skin cancer progression and its correlation to suppressive immune responses driven by chronic stress (Saul et al., 2005).

By introducing cohorts of xenograft mice to carcinogens (UV exposure) and stress-causing factors (placing mice in restrainers to initiate stress from physical confinement), the authors concluded a correlation between distress and tumor initiation and metastasis. The results suggested that chronic stress increases vulnerability to skin cancer and its progression by suppressing protective immune responses such as type 1 cytokines and impeding T-cell infiltration (the penetrating or reaching of the T-cells to the tumor bed). Moreover, the authors mentioned that distress also activates endogenous immunosuppressive mechanisms (by mobilizing regulatory T-cells). Using a linear mixed-effects model, the outcomes showed that the weekly increase in the number of tumors was higher in the stressed mice. In addition, stressed mice are found to develop more tumors on average at week 34 than those non-stressed. Therefore, the authors postulated that chronic stress propels tumor emergence, progression, and decreases tumor regression.

Along with the evidence pointing out that psychological factors facilitate cancer progression and mortality, a study showed the direct linkage of chronic stress and tumorigenesis *in vivo* through the underlying genetic mechanisms (Feng et al., 2012). A major tumor suppressor gene, p53 activates and inhibits cell division in response to damaged or mutated genes. The results of this animal experimentation demonstrated that chronic restraint attenuates p53 gene's transcriptional activity, which causes the weakening of p53's function to induce apoptosis in tumor cells. Therefore, this study established that chronic stress models (restraint and social isolation) that mimic stress-induced neuroendocrine signaling and anxiety states in humans promotes tumor growth.

## Cancer Mortality and Psychotherapy

There are several studies aiming to estimate the positive relationship between mental distress and cancer mortality. As mental distress is more prevalent in cancer patients, Satin et al. aimed to find the correlation of cancer trajectory and the degree of depressive symptoms (Satin et al., 2009). The study yielded results that suggested depression predicts mortality rather than cancer progression. Furthermore, cancer patients with more severe depressive symptoms experience higher chances of mortality (39%), while those with milder distress have lower rates of mortality (26%). Therefore, it was hypothesized that psychological treatments could affect mortality rates by ameliorating depressive symptoms. Nonetheless, evidence regarding this topic is still inconsistent and insufficient to conclude on the linkage of cancer survival rates with psychotherapies (Lang-Rollin and Berberich, 2018). In addition, Satin et al. have not addressed the probability that the level of distress depends on different types of cancer. Notably, the severity of different types of cancer could be a variable likely influencing mental states. For example, glioblastoma, an aggressive type of brain cancer, could be more fear arousing than cancers with higher curing rates like prostate cancer.

There are several studies attempting to model the relationship of psychological interventions with cancer mortality by observing study cohorts, but it is most widely found that psychological support programs generally have an insignificant impact on patients' survival. According to a retrospective cohort study, psychological support programs generally don't create a favorable impact on patients' survival (Gellert and Siegel, 1993). However, the study suggested that psychological support programs could have beneficial effects on patients' quality of life. In a randomized prospective trial aiming to evaluate the effectiveness of psychotherapy on cancer patients' survival, breast cancer patients were divided in two cohorts with the treatment group receiving regular psychotherapy treatments and the control group receiving self-directed education interventions (Spiegel et al., 2007). The educational control sample had a median survival time of 33.3 months while that of the treatment group was 30.7 months. The outcomes were similar to the majority of the yielded results, there were no significant treatment effects found.

Aside from the similar outcomes of most studies, a meta-analysis pointed out that psychosocial interventions only improved short-term survival (one- and two-years overall survival) of cancer patients, while the effects on long-term survival rates would require further research (Fu et al., 2016).

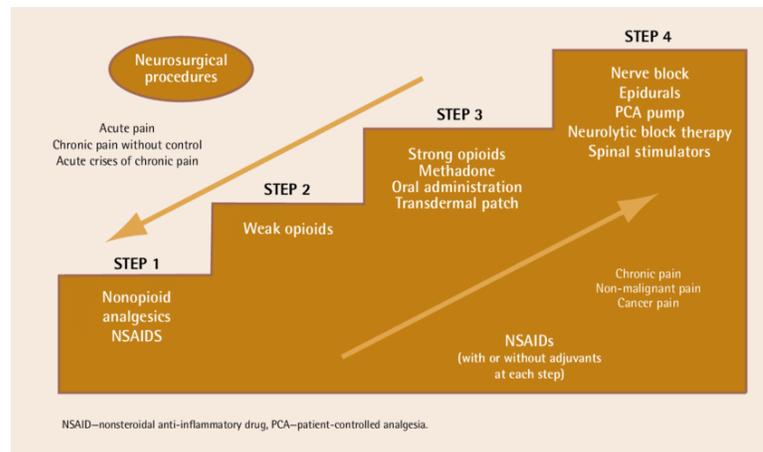
## Psychological Interventions and Cancer Patients' Quality of Life

Quality of life refers to the integrated states of the physical and the socioemotional (Torre-Luque et al., 2015). Cancer patients' life quality is a crucial subject during all stages of cancer trajectory and especially during treatments. Battling cancers, patients often confront immense physical discomfort and psychological distress and could develop insomnia, depression, and adjustment disorder, which are all symptoms that lower the quality of life. The effect of psychological interventions in cancer patients has raised considerable interest. As mentioned by several previously mentioned studies, the effects of psychological interventions are, in fact, more profound in enhancing patients' quality of life than in impacting the survival rates and cancer progression (Lang-Rollin and Berberich, 2018). Moreover, not only improvements in mood and coping abilities are found, the physical ameliorating effects of psychological treatments for cancer patients are also confirmed in numerous studies in addition to the degree of life quality enhancement.

A randomized controlled study exploring psychotherapy's level of mitigation in fears and improvement in quality of life has shown positive results (Rudolph et al., 2018). Fear of progression is a response commonly exhibited in cancer patients when confronting cancer trajectory, the physical pain of treatments, and the threat of cancer recurrence. The results of post-treatment questionnaires showed that cognitive-behavioral group therapy caused a significant decline in fear of progression in cancer patients. Therefore, it was concluded that the group therapy program is probably effective in managing the stress, fears, and life quality of cancer patients.

In support of the previous study, a research by Cain et al. also investigated the effectiveness of psychotherapy in gynecologic cancer patients (Cain et al., 1986). Unlike others, Cain et al. especially addressed the question of whether the effects of additional thematic counseling that focus on the needs of patients would be more impactful than general short-term support groups. The strategies of the psychotherapy were categorized according to each theme based in the counseling, such as, encouragement in identifying and expressing feelings, encouragement in seeking communications and connections, and learning to anticipate any difficulties. By comparing the results from the control and treatment groups (measured according to the Hamilton rating scales of depression, anxiety, and adjustment disorders), the data showed improvements in depression, anxiety, and the degree of psychosocial impairment. Moreover, the overall improvement in psychological functioning and the reduction in long-term mental distress are also manifested in the patients' continued enhancement in performing other activities, such as, improved work efficiency and domestic activities. However, patients in the control group were found to become more psychologically distressed as shown in their decline in participation in leisure activities and increased difficulties in domestic chores. In conclusion, the authors postulated that psychotherapies in response to the needs of cancer patients are more effective in mitigating long-term stress.

Attempts to enhance cancer patients' quality of life has led to several discussions on the psychotherapies' efficacy on ameliorating the physical burdens caused by cancer treatments. As one of the most common and feared physical symptoms confronted by cancer patients, pain is often managed through pharmacological and psychosocial therapies (Gorin et al., 2012). The most frequently used pharmacological treatments for pain management are opioid treatments and non-opioid treatments, such as, acetaminophen, nonsteroidal anti-inflammatory drugs, and adjuvant medications (drugs that provide analgesic effects either independently or additive; for example, antidepressants) (Scarborough and Smith, 2019). The analgesic ladder is a tool that explains which intervention to use depending on the pain levels, from mild (where non-opioids and non steroidal would be prescribed) to severe (where stronger opioid treatments would be applied) (Figure 2). In addition to the non-opioid treatments, radiation therapy and psychological interventions are also ways to reduce pain.



**Figure 2.** An adaptation of the analgesic ladder first created by the World Health Organization (Vargas-Schaffer, 2012). The analgesic ladder is a guideline for the usage of pain-management drugs.

Estimating the strengths of psychological supporting treatments in pain mediation, Gorin et al. analyzed randomized controlled studies (published from 1996 to 2010) that focus on the pain-mediating effects of psychological interventions among adult cancer patients (Gorin et al., 2012). Psychological interventions were defined as, “any approach involving cognitive-behavioral techniques, stress management, relaxation training, education, hypnosis, or any other experiential techniques.” From the positive relationships between interventions and cancer-caused pain reduction derived from the study assessments, the authors concluded that psychological support is effective in assisting other forms of pain management. In addition, the efficacy of psychotherapy in reducing cancer-caused pain was also investigated and discussed by Breibart, who outlined several approaches of psychological interventions aiming to reduce pain and enhance the life quality of cancer patients (Breibart, 1989). Moreover, it was confirmed by Pearson and Bond that psychological factors such as anxiety and depression influence cancer patients’ experience of pain, as cancer patients with mild symptoms of anxiety or depression are less likely to report pain (Pearson and Bond, 1969). Breibart claimed that cancer caused psychiatric complications increase mortality and morbidity, and minimizing mood disturbance in patients helps reduce pain. The author also stated that a multimodal approach - the combination of psychological, pharmacological, cognitive behavioral, anesthetic, and rehabilitative therapies - would optimize pain-managing effects.

Cancer chemotherapy-induced side effects are most common and severe in nausea and vomiting, which can significantly reduce the overall quality of life. As chemotherapy’s effectiveness and prevalence increased, Eyre and Ward examined the feasible pharmacological and psychological therapies in mediating the side effects of chemotherapy (Eyre and Ward, 1984). The mechanism of chemotherapy-induced nausea and vomiting (CINV) involves the interaction of the peripheral and central nervous systems (Adel, 2017). The symptoms can be classified into acute and delayed CINV. Acute CINV is triggered by toxic chemotherapeutic agents that stimulate the release of serotonin from enterochromaffin cells in the gastrointestinal tract. Serotonin controls the production and release of gastric and colonic mucus and the mobility of food (how fast food moves) through the gastrointestinal (GI) tract. Rise in serotonin secretion normally triggers more rapid peristalsis movement in the GI tract, causing nausea or vomiting of noxious or upsetting food. (Canadian Society of Intestinal Research, 2004). Specifically, the intestinal vagal afferent nerves’ binding of serotonin then causes vomiting reflex. Moreover, delayed CINV mainly involves the reception of substance P, a neurotransmitter, and the brain stem. It was considered that chemotherapy drugs induce the release of substance P from the central and peripheral nervous systems, which triggers vomiting response when bound to the nucleus of the solitary tract (a fiber bundle that spreads longitudinally through the medulla oblongata). Eyre and Ward also explored the syndrome of anticipatory nausea and vomiting, a disorder observed after repeated exposure to chemotherapy. “This syndrome is defined as nausea and vomiting before, and in anticipation of, chemotherapy administration.”

It was found that anti-anxiety and antiemetic drugs are unsupportive in controlling the anticipatory nausea and vomiting responses. However, studies that used hypnosis, behavior modification, and guided mental imagery suggested encouraging stress-reducing and antiemetic effects. The results demonstrated that relaxation training could diminish anxiety, nausea, and stress sensations.

## Discussion

The notion of a tightly knitted interaction between the physical and mental health is normalized in the general public. However, it is found that the current understanding from the investigations of this field does not suggest a definite relationship. Essentially, focusing on the realm of psycho-oncology, this research demonstrates the relationship of the tangible and intangible. Moreover, the investigation of the association also underscored a few phases of cancer trajectory: etiology, progression, and mortality.

Among numerous variables, such as environmental, social, and genetic factors, that are known to control the onset of cancer, it has been suggested that psychological factors, such as pre-existed mental illnesses and distress, are also intertwined in between. This is also substantiated by the prevalence of the comorbidity of cancer and mental illnesses. However, several studies refute the idea of psychological factors being risks of cancer onset, claiming the inconsistency and variation of experimental controls and methods across studies. The abundance and the complexity of the involved variables stir controversy and conflicts between conclusions of various studies. Therefore, a definite relationship cannot be extrapolated.

From animal studies, various physiological mechanisms and pathways were extrapolated to connect the progression of xenograft tumors and distress. Research within this field generally supports the positive relationship of cancer advancement and psychological factors. However, consensus and certainty has not been reached on the exact pathway of the interaction. Hypothesized pathways are discussed in this research, including the adrenaline signaling (PI3K/AKT) pathway, immune signaling pathway, and the p53 genetic mechanism. Since different types of xenograft tumors and different stress models pose insignificant influence on the positive correlation, it can be concluded that stress and cancer exacerbation have intimate connection.

Although there is research asserting the positive correlation between the presence of mental distress and higher rate of cancer mortality, it has been shown across various studies that psychological interventions have insignificant influence in reducing cancer mortality. Therefore, it can be suggested that unidentified confounding factors could be present in this connection.

Despite the weak correlation between cancer mortality and psychological interventions, the alleviating effects of psychotherapies are manifested in cancer patients' life quality, specifically in mediating physical pains and mental unease. Investigated physical discomfort includes pain and chemotherapy-induced nausea and vomiting. Moreover, it is found that the combination of psychotherapies and pharmaceutical treatments could induce greater efficacy in managing pain. It is also widely suggested that psychotherapies could enhance cancer patients' mental well-being and improve work efficiency.

Although the cross-effects of mental and physical health is thought of as a consolidated and widely believed notion by the public. From the analysis of various past studies, it can be concluded that a definitive causal relationship is yet to be confirmed. However, general trends can be identified that psychological factors, specifically distress, a common precursor or symptom of mental illness, have positive correlation with cancer progression. Moreover, cancer mortality and distress are also believed to share an association. On the other hand, psychological interventions and patients' quality of life are also suggested to share a positive correlation.

## Limitations

The scope of this study is narrowed, in which a complete inclusion and analysis of previous studies (for example, numerous alternate pathways and mechanisms) were restrained. Given the limited space and time for analysis, the above discussion only focuses on the interconnection between oncology and mental health disorders. However, it is important to note that other systems are integrated in this realm of study. Further discussions and elaboration on other fields of study that manifest the intersection of both forms of health, such as immunology, are needed. In addition, the lack of access to laboratory and available data on cancer patients also limited the inclusion of quantitative analysis.

## Conclusion

It was found across studies that physical health conditions and mental health seem to correlate in a form of cross effect, specifically, mental illnesses elevate the risks of communicable and non-communicable disease afflictions, while physical health increases the frequency and risks of mental state deterioration. Although the exact pathways of the cross interactions are still unclear and unconfirmed, advancement in psycho-oncology and immunology has unveiled insights of several probable pathways and mechanisms involved in the interconnection. As a cause of morbidity and mortality, mental health has to gain more awareness, and its significance in terms of one's general wellbeing has to be understood. In finding the intersection of cancer epidemiology and psychology, aspects of cancer etiology, trajectory, and mortality were considered. These explorations of psycho-oncology envision another perspective of cancer, one of the most common causes of death and morbidity in recent decades. Furthermore, the impacts of psychological interventions on the trajectory of cancer have also been investigated. Numerous research has shown significant correlation between certain stages of cancer and psychological factors. For example, the positive correlation of pre-existed mental disorders (or distress) and cancer initiation, the molecular evidence of stress leading to higher risks of cancer progression, and the impacts of psychological interventions in boosting cancer patients' stress coping abilities and life quality.

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