

Health Related Quality of Life and Depression among Blood Cancer Patients in Pakistan: The Missing Public Health Link

Abstract

Introduction: Limited access to health care facilities, less number of qualified oncologists, lack of technical equipment for diagnosis are the major factors effecting adequate control and prevention of blood cancer in Pakistan. **Objective:** The objective of the study was to assess health related quality of life and depression among blood cancer patients in Pakistan. **Methodology:** A descriptive cross-sectional study design was used. Two pre validated questionnaires i.e. SF 36 and HADS were self-administered to a sample of 400 blood cancer patients' selected using convenience sampling technique for measuring HRQoL and depression, respectively. After data collection, data was cleaned, coded and entered in SPSS. **Results:** The results highlighted that lowest scores for HRQoL among blood cancer patients were observed in the domain of role emotional (33.55, \pm 27.528) followed by bodily pain (42.93, \pm 30.838) whereas highest scores were observed in the domain of mental health (73.7, \pm 18.488). Significant difference ($p \geq 0.05$) was observed in HRQoL of cancer patients with different marital status, stages of blood cancer and receiving different types of therapies. **Conclusion:** The present study concluded that blood cancer patients had poor HRQoL and moderate depression in spite of advanced therapeutic strategies.

Keywords: Blood cancer, health related quality of life, depression, SF 36, HADS, Pakistan.

Introduction

Cancer and its treatment often produce significant morbidities that undermine the health of cancer survivors [1]. Cancer patients experience many persistent symptoms including pain, nausea, vomiting, lack of appetite, physical discomfort, psychological distress which affects the treatment outcomes of the cancer patients [2]. Better quality of life is associated with increased level of optimism, lower level of psychological distress and by social support. Quality of life

among cancer patients can improve treatment outcomes as well as survival of an individual [3]. Health related quality of life (HRQoL) is a multidimensional construct of physical, psychological and social well-being, evaluating individuals own assessment of his / her health and capacity to perform daily activities of life [4, 5]. It is a significant measure in hematological malignancies and is a major concern while treating the cancer patients due to severity of symptoms and duration of treatment [6]. Cancer patients often experience multiple concurrent symptoms which are the predictors of changes in patient normal functioning, treatment failures and therapeutic outcomes. Most of the blood cancer patients were reported with worst health-related quality of life with varying symptom including fatigue, pain, psychological distress and impairing treatment outcomes in USA [7]. Similarly, patients of blood cancer showed substantial symptom burden in disease trajectory affecting overall wellbeing in Germany and Canada [8, 9]. Symptoms like nausea, vomiting, anxiety, depression, dyspnea, fatigue, pain and insomnia affected prognosis, quality of life and working status of cancer patients in Spain [10, 11]. Physical and psychological symptoms along with socioeconomic factors were also reported to contribute towards good health of cancer patient in Brazil [12]. **A study from Iran highlighted that physical symptoms like fatigue, pain can effect quality of life but these symptoms can be improved by proper counseling resulting in improved quality of life of cancer patients** [13]. Similarly, another study from Iran reported that patients with cancer had lower quality of life during chemotherapy and off treatment [14].

Depression is an independent predictor of morbidity and mortality in cancer patients [15]. Depression and hopelessness is common among cancer patients associated with high morbidity and mortality rates [16]. **Hematological cancer patients suffers from anxiety and depression which effect their daily life activities, body image and self-esteem.** The compliance of the patient

towards treatment decreases with increased depression [17]. Higher level of anxiety, depression, fatigue, pain, insomnia influencing health outcomes among blood cancer patients were reported in Malaysia [18].

Blood cancer has been considered as an emerging non-communicable public health threat in Pakistan. Lower educational background, poor socio-economic status, socially stigmatized situation and paucity of early detection programs also add to the burden of cancer disease in Pakistan. Limited access to health care facilities, less number of qualified oncologists, lack of technical equipment for diagnosis are the major factors effecting adequate control and prevention of blood cancer in Pakistan. A study conducted in Multan reported high level of depression and anxiety especially among the younger population suffering from blood cancer [19]. Similarly, elderly cancer patients were identified as more vulnerable group to psychological problems including anxiety, sadness, depression, isolation, insomnia and dementia in Pakistan [20]. The importance of health related quality of life and its determinants including physical, emotional and functional domains along with depression among blood cancer patients has long been recognized in developed world but in developing countries this concept is in infancy, although its rate has been increasing at an alarming rate in Pakistan. Therefore, this study was designed to assess health related quality of life and depression among blood cancer patients in Pakistan.

Methodology

A descriptive cross-sectional study design was used to assess health related quality of life and depression among blood cancer patients in twin cities (Islamabad and Rawalpindi) of Pakistan. Study approval was taken from the Ethical Committee of Hamdard University (BASR-81-5.2). All health care facilities both from public and private sector treating blood cancer patients

located in twin cities were included in study. Study respondents included patients diagnosed with blood cancer. Inclusion criteria for this study were blood cancer patients aged between 18-65 years, both genders, having any comorbidity and patients receiving chemotherapy, radiotherapy and Imatinib. All cancer patients other than blood cancer and those below or above the age range of 18-65 years were excluded. **Blood cancer patients with any disease effecting HRQoL in similar manner or any other surgery leading towards depression were also excluded.** Approval was also taken from Medical superintendents of different healthcare facilities of Rawalpindi and Islamabad. Patients were briefed regarding nature and objectives of the study. Verbal and written consent were obtained prior to data collection. Respondents were ensured of the confidentiality of their responses along with full right to withdraw from the study at any time. The sample size was calculated by using Rao soft at 95% confidence interval and 5% margin of error which came to be 400. Convenience sampling technique was used for selection of respondents available and willing to participate at the time of data collection. Prospective data was collected from primary sources by self-administering two pre validated questionnaires i.e. SF 36 and HADS for assessment of HRQoL and Depression, respectively. The questionnaires were filled by the patients on spot and collected back to avoid biasness. SF-36 consist of eight subscales including: perceived mental health (5 items), physical functioning (10 items), general health perceptions (5 items), role limitations due to physical problems (4 items), role limitation due to emotional problems (3 items), social functioning (2 items), vitality (4 items) and bodily pain (2 items) [22] while Hospital Anxiety and Depression Scale (HADS) consists of 7 items each for anxiety and depression [23]. Pilot testing was performed on 10% of the sample size for assessing reliability of the tool. The value of Cronbach's alpha for SF 36 was 0.73 and 0.69 for Hospital Anxiety and Depression Scale (HADS). After data collection, data was cleaned, coded and entered in SPSS.

Descriptive statistics comprising of frequency and percentages were calculated. Non-parametric tests Kruskal Wallis and Mann Whitney tests ($p \geq 0.05$) were performed to find out the differences among different variables.

Results

Blood Cancer Patients Demographic Characteristics

Out of 400 respondents, 55.75 % (n=223) were males and 44.25 % (n=177) were females. Of the total respondents, 40 % (n=160) were illiterate and 5.25 % (n=21) were having master's degree. Moreover, 37.5 % (n=150) were residents of urban settings whereas 62.5% (n=250) were from rural settings. Moreover, 12.75 % (n=51) of the cancer patients were also suffering from diabetes, 19 % (n=76) from hypertension whereas 68.5 % (n=274) were free from any comorbid conditions. Patients receiving chemotherapy were 50.75 % (n=203), radiotherapy 14.5 % (n=58) and Imatinib treatment was 35 % (n=140). A detailed description of demographic characteristics is given in (Table 1).

Table 1 Blood Cancer Patients Demographic Characteristics

Indicator	n (%)	
Age	18- 28 Y	103 (25.75)
	29-39Y	78 (19.5)
	40-49Y	73 (18.25)
	50-59Y	70 (17.5)
	>60Y	78(19.5)
Hospital	Public	356 (95.5)
	Private	44(4.5)
Province	Federal	39 (9.75)
	Punjab	248 (62)
	Sindh	17 (4.25)
	KPK	80 (20)
	Baluchistan	16(4)
Gender	Male	223 (55.75)

	Female	177 (44.25)
Marital Status	Married	287 (71.75)
	Unmarried	177 (44.25)
Qualification	Illiterate	160 (40)
	Primary	133 (33.25)
	Secondary	54 (13.5)
	Bachelor	34 (8.5)
	Masters	21 (5.25)
No of children	None	51 (12.75)
	One	60 (15)
	Two	76 (19)
	Three	84 (21)
	More than three	130 (32.5)
Setting	Urban	150 (37.5)
	Rural	250 (62.5)
Stage of blood cancer Type of comorbidity	Acute	218 (54.5)
	Chronic	182 (45.5)
	None	274 (68.5)
	Diabetes	51 (12.75)
	Hypertension	76 (19)
Type of therapy	Chemotherapy	203 (50.75)
	Radiotherapy	58 (14.5)
	Imatinib	140 (35)

Health Related Quality of Life among Blood Cancer Patients

The results highlighted that lowest scores for HRQoL among blood cancer patients were observed in the domain of role emotional (33.55, \pm 27.528) followed by bodily pain (42.93, \pm 30.838) whereas highest scores were observed in the domain of mental health (73.7, \pm 18.488).

A detailed description is given in (Table 2).

Table 2 Health Related Quality of Life among Blood Cancer Patients

Indicator	Mean	Standard Deviation (\pm)
Physical Health	66.43	32.474
Bodily pain	42.93	30.838
General health	48.19	19.798
Social functioning	57.69	19.173
Role emotional	33.55	27.528
Vitality	63.79	17.451
Mental health	73.77	18.488

Comparison of HRQoL among Blood Cancer Patients by Demographic Characteristics

Significant difference ($p \geq 0.05$) was observed in HRQoL of cancer patients of different marital status, different stages of blood cancer and receiving different types of therapies. Unmarried patients, those in acute stage and receiving radiotherapy had comparatively better HRQoL. However, no significant difference ($p \leq 0.05$) was observed in HRQoL of blood cancer patients receiving treatment from different sectors, belonging to different age groups or gender, having different qualification level and number of children. A detailed description given in (Table 3).

Table 3 Comparison of HRQoL domains by Demographic Characteristics

Demographics	Physical health component				Mental health component				Composite score			
	n	Mean rank	Test stats	P value	n	Mean rank	Test stats	P value	n	Mean rank	Test stats	P value
Gender	Male= 223	195.11	17204.500 ^a	0.236	223	194.60	17313.500 ^a	0.271	223	196.24	16961.500 ^a	0.171
	Female=177	186.91			177	187.56			177	185.46		
Sector	Public= 356	189.53	1129.0 ^a	0.119	223	189.14	981.500 ^a	0.054	223	189.63	1164.00 ^a	0.150
	Private= 44	235.38			177	253.81			177	231.00		
Province	Federal= 39	174.44	17.360 ^b	0.002	39	200.12	6.04 ^b	0.298	39	185.03	12.75 ^b	0.02
	Punjab= 248	195.64			248	190.70			248	194.71		
	Sindh= 17	129.70			17	168.20			17	134.30		
	KPK= 80	165.43			80	176.49			80	167.17		
	Baluchistan = 16	205.00			16	158.50			16	213.00		

Age	18-28= 103	212.22	6.492 ^b	0.165	103	206.74	6.516 ^b	0.159	103	214.23	8.342 ^b	0.079
	29-39= 78	195.22			78	193.55			78	193.63		
	40-49= 73	178.14			73	163.99			73	172.45		
	50-59= 70	190.06			70	198.14			70	195.24		
	60-65= 78	173.80			78	188.78			78	173.39		
Marital status	Married= 287	181.50	11675.50 ^a	0.002	287	183.53	12241.00 ^a	0.011	287	180.43	11377.500 ^a	0.001
	Unmarried= 113	218.24			113	212.80			113	221.10		
Level of education	Illiterate= 160	173.74	11.77 ^b	0.020	160	174.36	10.01 ^b	0.037	160	171.58	12.68 ^b	0.011
	Primary= 133	205.42			133	192.92			133	202.18		
	Secondary= 54	225.42			54	226.74			54	230.01		
	Bachelor= 34	173.10			34	202.15			34	181.23		
	Master=21	181.50			21	215.53			21	198.15		
No of children	None= 51	142.20			51	128.93			51	141.36		
	1= 60	133.65	1.34 ^b	0.857	60	125.73	0.18 ^b	0.995	60	133.29	1.009 ^b	0.906
	2= 76	129.63			76	128.15			76	128.38		
	3= 84	122.43			84	131.92			84	125.35		
	More than 3= 130	126.72			130	127.56			130	126.00		

Setting	Urban=150 Rural= 250	189.19 191.26	16616. 500 ^a	0.433	150 250	196.17 187.19	16006.500 ^a	0.213	150 250	190.70 190.38	16772.00 ^a	0.486
Stage of blood cancer	Acute= 218 Chronic= 182	198.53 183.01	16609. 500 ^a	0.086	218 182	200.26 180.92	16247.500 ^a	0.043	218 182	199.64 181.66	16377.000 ^a	0.05
Type of comorbidity	None= 274 HTN= 76 Diabetes= 51	137.52 133.69 125.86	0.464 ^b	0.930	274 76 51	137.34 127.20 167.21	2.225 ^b	0.545	274 76 51	137.78 129.75 135.93	0.596 ^b	0.906
Type of therapy	Chemothera py= 203 Radiotherap y= 58 Imatinib= 140	126.66 160.00 106.59	5.958 ^b	0.048	203 58 140	125.84 185.75 106.83	7.894 ^b	0.016	203 58 140	126.30 164.13 107.04	5.887 ^b	0.048

Mann-Whitney Test^a ($p \geq 0.05$), Krsukal Wallis Test^b ($p \geq 0.05$).

UNDER

Depression among Blood Cancer Patients

Comparison of severity of depression among blood cancer patients having different demographic characteristics revealed that blood cancer patients of all age groups, gender, marital status, having different qualification and job status were found severely depressed. Moreover, the results revealed that blood cancer patients who were having secondary education, living in urban areas were moderately depressed. A detailed description is given in (Table 4).

Table 4 Depression among Blood Cancer Patients

Indicator	Mean depression score (0-21)	Depression Severity
Age	18-28Y= 10.47	Severe
	29-39Y= 12.37	Severe
	40-49Y= 10.92	Severe
	50-59Y= 9.40	Moderate
	>60Y= 10.80	Severe
Gender	Male= 11.28	Severe
	Female= 10.92	Severe
Marital status	Married= 10.84	Severe
	Unmarried= 10.73	Severe
Qualification	Illiterate= 11.21	Severe
	Primary= 10.47	Severe
	Secondary= 9.45	Moderate
	Bachelor= 11.77	Severe
	Masters=11.50	Severe
Number of children	None= 11.11	Severe
	One = 12.52	Severe
	Two = 9.04	Moderate
	three= 10.65	Severe

	Four= 9.69	Moderate
	More than four= 11.31	Severe
Settings	Urban= 9.62	Moderate
	Rural = 11.43	Severe
Stage of blood cancer	Acute= 11.13	Severe
	Chronic= 10.44	Severe
	None= 10.46	Severe
Type of co morbidity	Diabetes= 12.96	Severe
	Hypertension= 14.42	Severe
Type of therapy	Chemotherapy= 11.15	Severe
	Radiotherapy= 13.0	Severe
	Imatinib= 11.20	Severe

Comparison of Severity of Depression among Blood Cancer Patients according to Different Demographic Characteristics

Significant difference ($p \geq 0.05$) was observed in level of depression among blood cancer patients having comorbidities. However, no significant difference ($p \leq 0.05$) was observed for depression among different age groups, marital status, qualification level, children, stages of blood cancer, type of therapy, cancer patients treated in different sectors, provinces, setting, and gender. A detailed description is given in (Table 5).

Table 5 Comparison of Severity of Depression among Blood Cancer Patients according to Different Demographic Characteristics

Demographics		Composite score		
		n	Mean rank	Test statistics
Gender	Male= 223	196.13	16984.500 ^a	0.178
	Female=177	185.60		
Marital status	Married= 287	194.14	13722.00 ^a	0.218
	Unmarried=113	184.44		
Sector	Public= 356	190.92	1330.00 ^a	0.302
	Private= 44	170.75		
Province	Federal= 39	170.03	1.912 ^b	0.752
	Punjab= 248	174.99		
	Sindh= 17	155.90		
	KPK= 80	183.81		
	Baluchistan= 16	283.50		
Age	18-28 yrs= 103	217.19	3.051	0.552
	29-39 yrs= 78	205.32		
	40-49 yrs= 73	176.91		
	50-59 yrs= 70	185.22		
	>60 yrs= 78	162.51		
Setting	Urban= 150	182.13	15628.500 ^b	0.131
	Rural= 250	195.38		
Level of education	Illiterate= 160	196.13	1.567 ^b	0.815
	Primary= 133	188.83		
	Secondary= 54	180.13		
	Bachelors= 34	186.07		

	Masters= 21	212.38		
Number of children	None= 51	139.25	2.042 ^b	0.728
	1= 60	124.61		
	2= 76	137.50		
	3= 84	119.65		
	More than 3= 130	127.98		
Stage of blood cancer	Acute= 218	194.31	17492.00 ^a	0.276
	Chronic= 182	188.11		
Type of comorbidity	None= 274	131.85	8.689 ^b	0.034
	Hypertension= 76	161.55		
	Diabetes= 51	193.50		
Type of therapy	Chemotherapy= 203	146.93	5.00 ^b	0.171
	Radiotherapy= 58	148.25		
	Imatinib= 140	144.48		

MannWhitney^a:Kruskalwallis^b test (p ≥ 0.05)

Discussion

Blood cancer has become one of the most prevailing cancer worldwide affecting overall standards of living of an individual. Due to prolonged therapy and recurrence of blood cancer, patients suffer from physical, emotional and social discomfort leading towards poor disease outcomes. Estimation of HRQoL is important in blood cancer, as it helps both patients and physicians in choosing better treatment options which in return can improve health outcomes. The results of this study reported a consequential impact on several domains of HRQoL of blood cancer patients in Pakistan. Minimal scores for HRQoL were observed in the domain of role emotional followed by bodily pain whereas maximum scores were observed in the domain of mental health. These findings were supported by study conducted in Brazil which also reported

highest mental health score among blood cancer patients [24]. However, in blood cancer specific domains; the present study results showed lowest score in the domain of symptom scale that is constipation followed by cognitive function whereas highest scores were seen in the domain of fatigue followed by pain. These findings are in line with results of a study from USA which reported fatigue and pain affecting quality of life the most in blood cancer patients [25].

Most of the blood cancer patients enrolled in this study perceived that their physical functioning was limited a lot especially in regard to vigorous activities and few of them had difficulty while performing activities like moving a table, sweeping the floor, gardening, or bicycling, bending kneeling or stooping and in bathing or dressing. Similarly, findings from a study conducted in Germany reported that impaired physical performance was seen as the most common problem among cancer patients during and after treatment [26].

In the domain of role physical, the results of the current study showed that blood cancer patients were of the view that they had to cut down on the amount of time spent in performing work. Similarly, patients in Germany also reported difficulty in performing various activities affecting their quality of life [27]. Moreover, in the domain of bodily pain, the results of the current study revealed that severe body pain interfered with normal work activities of the blood cancer patients. These findings were supported by a study conducted in Italy which reported severe body pain among blood cancer patients at the time of diagnosis, during and after treatment [28].

In general health domain, the results of the present study showed that overall general health of blood cancer individuals undergoing treatment was good. These findings are consistent with the study from Denmark which reported that blood cancer patients treated through chemotherapy and receiving counseling reduced the symptom burden and interference in daily life activities [29]. The results of the current study reported that only few of the respondents felt full of life and

energy. Similarly, most of the cancer patients experienced low energy which impaired their standard of living in Italy [30].

The results of the present study highlighted that patients social activities, support were limited which are in concordance with findings of study conducted in Turkey which showed a positive correlation between social support and quality of life [31]. Most of the cancer patients enrolled in the present study revealed that their activities were affected due to their emotional problems. These finding are in consistent with the study from USA which reported that cancer patients accomplished less work, missed working days than usual due to fatigue and emotional problems [32].

The results of the current study reported that blood cancer patients who were unmarried or those in acute stage or receiving radiotherapy had comparatively better HRQoL which might be due to their positive attitude or hope for the future to cope up with this disease, support from the family, friends or community and might be due to the known treatment side effects. These findings are consistent with studies from USA and Sweden in which patients receiving radiotherapy and in acute stage had relatively better quality of life [33, 34].

Blood cancer patients are usually at high risk of experiencing depression and anxiety during and after course of illness. The results of this study revealed that some of the blood cancer patients had definitely lost interest in their appearance and felt frightened very frequently and enjoyed a book or radio or TV program very seldom while most of them felt tensed from time to time occasionally and got sudden feeling of panic and had worrying thoughts occasionally. These findings are in line with the findings from a study of Germany which reported moderate to high level of depression among blood cancer patients [35].

Moreover, the results of the present study reported that young people, males, married, illiterate, those not having any children, in acute stage, having hypertension as comorbidity, patients undergoing chemotherapy scored higher on depression scale. Similarly, studies from Netherland, America, India, and Canada reported that patients undergoing treatment, in late twenties, low literacy, in acute stage and those having co morbid chronic conditions had higher levels of depression [17, 36-39].

Limitations of the Study

The main issues faced during the study were time and financial constraints and cross sectional study design which does not show cause and effect relationship. Furthermore, the results of this study are limited to twin cities of Pakistan and may not be generalized to other parts of country.

Conclusion

The present study concluded that blood cancer patients had poor health related quality of life and moderate depression in spite of advanced therapeutic strategies. The results highlighted that lowest scores for health related quality of life were observed in the domain of role emotional, followed by bodily pain. Unmarried patients, those in acute stage and receiving radiotherapy had comparatively better health related quality of life. Moreover, blood cancer patients of all age groups, gender, marital status, having different qualification and job status were found severely depressed. Health care providers should regularly assess health related quality of life to improve treatment outcomes. Appropriate health educational and psychological interventional programs specifically targeting patients with lower educational programs should be initiated to improve awareness regarding cancer and its coping strategies and to reduce depression among blood cancer patients. **Future research should be conducted to explore the relationship between blood cancer and depression in terms of different patients' sociodemographic characteristics.**

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References

1. Montazeri, A., *Quality of life data as prognostic indicators of survival in cancer patients: an overview of the literature from 1982 to 2008*. Health and quality of life outcomes, 2009. **7**(1): p. 102.
2. Ainuddin, H.A., et al., *Quality of Life of Cancer Patients in Malaysia: A literature review*. Asian Journal of Quality of Life, 2018. **3**(11): p. 135-143.
3. Roland, K.B., et al., *Cervical cancer screening among young adult women in the United States*. Cancer Epidemiology and Prevention Biomarkers, 2013. **22**(4): p. 580-588.
4. Bullinger, M., *Erfassung der gesundheitsbezogenen Lebensqualität mit dem SF-36-Health Survey*. Bundesgesundheitsblatt-Gesundheitsforschung-Gesundheitsschutz, 2000. **43**(3): p. 190-197.
5. Essig, S., et al., *Health-related quality of life in long-term survivors of relapsed childhood acute lymphoblastic leukemia*. PloS one, 2012. **7**(5): p. e38015.
6. Pinguat, M., et al., *Social support and survival in patients with acute myeloid leukaemia*. Supportive Care in Cancer, 2007. **15**(1): p. 81-87.
7. Phillips, K.M., et al., *Quality of life outcomes in patients with chronic myeloid leukemia treated with tyrosine kinase inhibitors: a controlled comparison*. Supportive Care in Cancer, 2013. **21**(4): p. 1097-1103.
8. Zimmermann, C., et al., *Symptom burden and supportive care in patients with acute leukemia*. Leukemia research, 2013. **37**(7): p. 731-736.
9. Dasch, B., et al., *Care of cancer patients at the end of life in a German university hospital: a retrospective observational study from 2014*. PloS one, 2017. **12**(4): p. e0175124.
10. Fan, G., L. Filipczak, and E. Chow, *Symptom clusters in cancer patients: a review of the literature*. Current Oncology, 2007. **14**(5): p. 173.
11. Dong, S.T., et al., *Symptom clusters in advanced cancer patients: an empirical comparison of statistical methods and the impact on quality of life*. Journal of pain and symptom management, 2016. **51**(1): p. 88-98.
12. Freire, M., et al., *Health-related quality of life of patients with cancer in palliative care*. TextoContextoEnferm, 2018. **27**(2): p. e5420016.
13. Zeighami Mohammadi, S., et al., *The relationship between anemia and severity of fatigue and quality of life in cancer patients undergoing chemotherapy*. Medical Science Journal of Islamic Azad University-Tehran Medical Branch, 2011. **20**(4): p. 265-272.
14. Faranoush, M., et al., *Assessment of health related quality of life in children and adolescents suffering from cancer on chemotherapy and off treatment*. Koomesh, 2013. **14**(2): p. 215-222.
15. Prieto, J.M., et al., *Role of depression as a predictor of mortality among cancer patients after stem-cell transplantation*. Journal of Clinical Oncology, 2005. **23**(25): p. 6063-6071.
16. Barrera, I. and D. Spiegel, *Review of psychotherapeutic interventions on depression in cancer patients and their impact on disease progression*. International review of psychiatry, 2014. **26**(1): p. 31-43.

17. Gheihman, G., et al., *Depression and hopelessness in patients with acute leukemia: the psychological impact of an acute and life-threatening disorder*. *Psycho-Oncology*, 2016. **25**(8): p. 979-989.
18. Pasquini, M. and M. Biondi, *Depression in cancer patients: a critical review*. *Clinical Practice and epidemiology in mental health*, 2007. **3**(1): p. 2.
19. Ng, D.L., Y. Leong, and G.G. Gan, *Quality of life amongst lymphoma survivors in a developing country*. *Supportive Care in Cancer*, 2016. **24**(12): p. 5015-5023.
20. Jadoon, N.A., et al., *Assessment of depression and anxiety in adult cancer outpatients: a cross-sectional study*. *BMC cancer*, 2010. **10**(1): p. 594.
21. Irshad, M.K. and A.G. Chaudhry, *PSYCHOLOGICAL DISORDERS; OLD AGE AND PREVALENCE*. *Professional Medical Journal*, 2015. **22**(7).
22. Pulgar, Á., A. Alcalá, and G.A. Reyes del Paso, *Psychosocial predictors of quality of life in hematological cancer*. *Behavioral Medicine*, 2015. **41**(1): p. 1-8.
23. Oberoi, D., et al., *The course of anxiety, depression and unmet needs in survivors of diffuse large B cell lymphoma and multiple myeloma in the early survivorship period*. *Journal of Cancer Survivorship*, 2017. **11**(3): p. 329-338.
24. Petrilli, A.S., et al., *Results of the Brazilian Osteosarcoma Treatment Group Studies III and IV: prognostic factors and impact on survival*. *J Clin Oncol*, 2006. **24**(7): p. 1161-1168.
25. Kindler, T., et al., *Efficacy and safety of imatinib in adult patients with c-kit-positive acute myeloid leukemia*. *Blood*, 2004. **103**(10): p. 3644-3654.
26. Dimeo, F., et al., *Effects of endurance training on the physical performance of patients with hematological malignancies during chemotherapy*. *Supportive Care in Cancer*, 2003. **11**(10): p. 623-628.
27. Oechsle, K., et al., *Physical activity, quality of life, and the interest in physical exercise programs in patients undergoing palliative chemotherapy*. *Supportive Care in Cancer*, 2011. **19**(5): p. 613-619.
28. Ripamonti, C.I., et al., *Patient dignity inventory (PDI) questionnaire: the validation study in Italian patients with solid and hematological cancers on active oncological treatments*. *Tumori Journal*, 2012. **98**(4): p. 491-500.
29. Roos-Weil, D., et al., *Stem cell transplantation can provide durable disease control in blastic plasmacytoid dendritic cell neoplasm: a retrospective study from the European Group for Blood and Marrow Transplantation*. *Blood, The Journal of the American Society of Hematology*, 2013. **121**(3): p. 440-446.
30. Massimino, M., et al., *Relapse in medulloblastoma: what can be done after abandoning high-dose chemotherapy? A mono-institutional experience*. *Child's Nervous System*, 2013. **29**(7): p. 1107-1112.
31. Pehlivan, S., et al., *Relationship between hopelessness, loneliness, and perceived social support from family in Turkish patients with cancer*. *Supportive Care in Cancer*, 2012. **20**(4): p. 733-739.
32. Henry, D.H., et al., *Symptoms and treatment burden associated with cancer treatment: results from a cross-sectional national survey in the US*. *Supportive care in cancer*, 2008. **16**(7): p. 791-801.
33. Vallurupalli, M.M., et al., *The role of spirituality and religious coping in the quality of life of patients with advanced cancer receiving palliative radiation therapy*. *The journal of supportive oncology*, 2012. **10**(2): p. 81.
34. Berterö, C., B. Eriksson, and A. Ek, *Explaining different profiles in quality of life experiences in acute and chronic leukemia*. *Cancer nursing*, 1997. **20**(2): p. 100-104.
35. Inhestern, L., et al., *Anxiety and depression in working-age cancer survivors: a register-based study*. *BMC cancer*, 2017. **17**(1): p. 347.

36. Krebber, A., et al., *Prevalence of depression in cancer patients: a meta-analysis of diagnostic interviews and self-report instruments*. *Psycho-Oncology*, 2014. **23**(2): p. 121-130.
37. Massie, M.J., *Prevalence of depression in patients with cancer*. JNCI Monographs, 2004. **2004**(32): p. 57-71.
38. Ganguli, M., et al., *Depressive symptoms, cognitive impairment and functional impairment in a rural elderly population in India: a Hindi version of the geriatric depression scale (GDS-H)*. *International Journal of Geriatric Psychiatry*, 1999. **14**(10): p. 807-820.
39. Harpole, L.H., et al., *Improving depression outcomes in older adults with comorbid medical illness*. *General hospital psychiatry*, 2005. **27**(1): p. 4-12.

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