ORIGINAL ARTICLE

Impact of Different Types of Cancer on Health-Related Quality of Life

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ABSTRACT

Aim: Cancer is known as a condition that some cells in the body can uncontrollably proliferate and spread to other body's parts. Although various studies have shown a link between cancer and patient quality of life, this cross-sectional study has investigated the impact of different types of cancer along with treatment status on HRQoL including physical and mental health, in adult cancer patients.

Methods: The impact of cancer on HRQoL in adult patients in this cross-sectional study used data provided from Behavioral Risk Factor Surveillance System, 2020 in the United States. BRFSS is a health, behaviors, and social life questionnaires of people in the United States provided by Centers for Disease Control and Prevention (CDC). There were 401,958 participants in this questionnaire. To achieve the study's purpose, the Statistical Analysis System (version 9.4) was used to conduct several statistical approaches, including descriptive, inferential, and predictive methods.

Results: Of the 401,958 participants in the BRFSS 2020, 22,551 were adult patients with cancer with different status of treatment. This study showed that cancer with different treatment status has a statistically significant impact on HRQoL in adult patients.

Conclusion: Cancer has a significant impact on physical and mental health in adult patients. Different status of treatment can increase the impact on physical health problems to be increased by 70.08% and mental health problems to be increased by 74.02%.

Keywords: Cancer; Physical Health; HRQoL; Mental Health; BRFSS; Health Informatics

INTRODUCTION

Cancer is known as a condition that some cells in the body can uncontrollably proliferate and spread to other body's parts [1,2]. Although specific causes of cancer remain unknown, scientists believe that cancer may be caused by an interaction of different factors including: genetic and environmental factors [3]. However, there are different risk factors of cancer including: tobacco, family history, inheritance, genetic disorders, high-fat diet, exposures to some viruses, exposures to chemicals, high doses of chemotherapy, and radiation [1,3].

According to the American Cancer Society, one out of every three persons is diagnosed with cancer in the United States [4]. There are many different types of cancer including: skin, colon, bladder, stomach, oral, breast, blood, renal, head & neck, pancreatic, prostate, throat, bone, rectal, esophageal, ovarian, lung, liver, brain cancer [5].

There are different signs and symptoms based on the type of cancer. However, general signs and symptoms include unusual breast changes, unexplained pain or ache, heavy night sweats, unusual lump or swelling anywhere, fatigue, sores, difficulty swallowing, unusual heartburn or indigestion, unexplained weight loss, appetite loss, hoarseness, persistent cough, breathlessness, mouth ulcer, persistent bloating, and unexplained bleeding [6]. In addition to these different signs and symptoms, cancer can be diagnosed by different tests and exams including: radiology tests, endoscopy procedures, biopsies and cytology tests [4]. Finally, treatment of cancer include surgery, chemotherapy, radiation therapy, targeted therapy, immunotherapy, stem cell or bone marrow transplant, and hormone therapy [4].

Statistically, according to world health organization (WHO), in 2020, an estimated 19.3 million people were diagnosed with cancer and nearly 10.0 million deaths of cancer [7,8]. In 2002, new cases of cancer were 10.9 million and deaths were 6.7 million [9]. However, these numbers have been increased in 2012 to be 14.1 million new cases of cancer and 8.2 million deaths [10]. Also, in 2018, the number increased to be 18.1 million new cases of cancer and 9.6 million deaths [11]. Finally, there is a huge increasing of the new cases and deaths of cancer in the period between 2002 and 2020 [8,9] (Table 1).

Therefore, measuring health-related quality of life (HRQoL) is very important patients' health and care management general, quantifying the impact of a specific disease, condition, or other factors on the functions and health of the human body is referred to as HRQoL. The purpose of HRQoL measurement is to examine a patient's health and quality of life from their perspective [12,13].

There are some studies showed that there are association between some types of cancer and HRQoL. These studies showed that these types of cancer have a negative impact on patients' health including physical and mental health [14-20].

Although various studies have shown a link between cancer and patient quality of life, this cross-sectional study has shown the impact of different types of cancer, as well as treatment status, on HRQoL, including physical and mental health, in adult cancer patients.

Table 1: Comparing the rate of new cancer cases and deaths between 2002 and 2020 [8,9]:

Types of Cancer	New Cases		Deaths	
	2002	2020	2002	2020
Lung Cancer	1,352,132	⬆ 2,206,771	1,178,918	⬆ 1,796,144
Breast Cancer	1,151,298	⬆ 2,261,419	410,712	⬆ 684,996
Colon / Rectal Cancer	1,023,152	⬆ 1,931,590	528,978	⬆ 953,173
Prostate / Testis Cancer	727,636	⬆ 1,488,717	229,880	⬆ 384,638
Ovarian Cancer	896,525	⬆ 1,398,601	448,692	⬆ 671,875
Blood Cancer	663,422	⬆ 1,101,958	417,138	⬆ 594,763
Stomach Cancer	933,937	⬆ 1,089,103	700,349	⬆ 768,793
Throat / Larynx Cancer	510,593	⬆ 1,086,837	259,656	⬆ 310,236
Liver Cancer	626,162	⬆ 905,677	598,321	⬆ 830,180
Esophageal Cancer	462,117	⬆ 604,100	385,892	⬆ 544,076
Bladder Cancer	356,557	⬆ 573,278	145,009	⬆ 212,536
Oral Cancer	274,289	⬆ 431,296	127,459	⬆ 200,535
Renal Cancer	208,480	⬆ 431,288	101,895	⬆ 179,368
Pancreatic Cancer	232,306	⬆ 495,773	227,023	⬆ 466,003
Brain Cancer	189,485	⬆ 308,102	141,650	⬆ 251,329
Skin Cancer	160,177	⬆ 324,635	40,781	⬆ 57,043
Other Types	85,740	⬆ 393,561	62,535	⬆ 256,347

PATIENTS AND METHODS

The impact of cancer on health-related quality of life in adult patients was investigated using data from the 2020 Behavioral Risk Factor Surveillance System (BRFSS) from the Centers for Disease Control and Prevention (CDC). The BRFSS data has been provided for public access, according to the CDC [21]. This research author also holds a bioethics certificate with the number 10014263.

The BRFSS was created by the CDC to be the first national faculty of health questionnaire collected from US people by telephone interview in regard to their health and various diseases, as well as their habits and social lives [21]. The participants in this study were adult cancer patients in various conditions of treatment from across the United States.

Variables of this cross-sectional study were based on presence of which type of cancer (CNCRTYP1) and status of treatment (CSRVTRT3) as predictor variables (Figure 1). On the other hand, the indicator variables include physical health (PHYSHLTH) and of mental health (MENTHLTH).
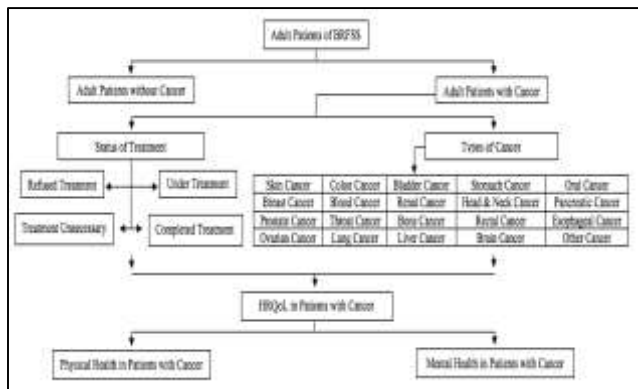

Figure 1: Flowchart of this cross-sectional study.

The Statistical Analysis System (SAS) was used in this to cross-sectional study through different methods including descriptive, inferential, and predictive methods to examine the impact of cancer, as well as different treatment statuses, on HRQoL in adult cancer patients, including physical and mental health.

After purification of the massive data, the next step was to use frequency distribution methods to define the study variables.

The investigation's second phase was to use inferential analysis methods like the chi-square test to assess the relationship between these variables at a significance level of P-value 0.05. Finally, using a predictive analysis method such as logistic regression, we confirmed the association between these factors and calculated the percentage differences.

RESULTS

401,958 adult patients participated in the BRFSS 2020. 22,551 of them were adult patients with cancer. However, the number of these patients came from different types of cancer (Figure 2).

13,589 of adult cancer patients have completed their treatment while 2,824 adult cancer patients are still under treatment. Also, 176 of adult cancer patients refused to get the treatment while the treatment is not necessary for 5,962 adult cancer patients (Table 1). Moreover, 19,657 of adult patients with cancer had physical health problems while 2,894 of adult patients with cancer had no signs of physical health problems. Also, 20,342 of adult patients with cancer had mental health problems while 2,209 of adult patients with cancer had no signs of mental health problems (Table 2).

Chi-square test was used to investigate the relationship between the study variables, which included cancer and treatment status as predictor variables, as well as physical and mental health problems as indicator variables (Table 3).

The association between the study variables was confirmed using logistic regression, which included cancer and treatment status as predictor variables and physical and mental health problems as indicator variables (Table 4).
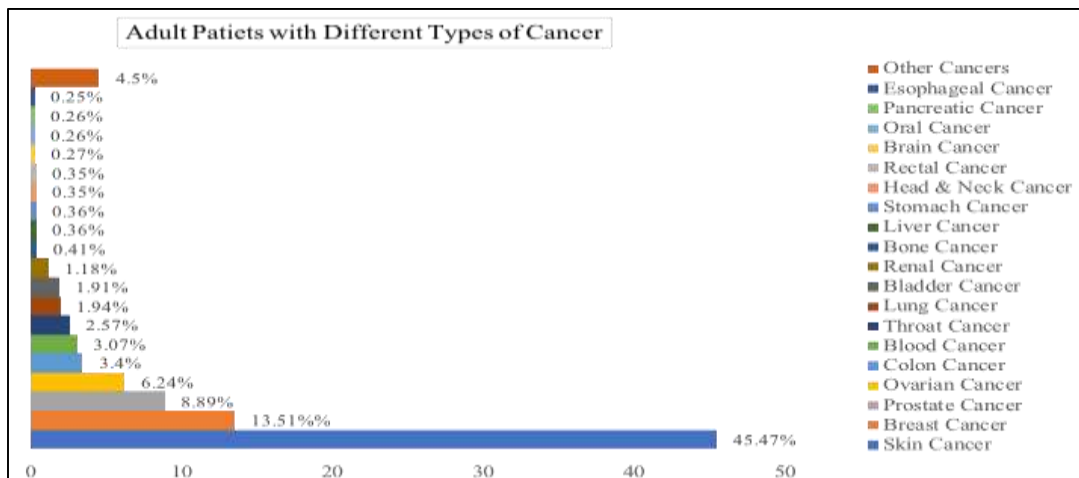

Figure 2. Distribution of adult patients with different types of cancer.

Table 2. Distribution of adult patients with cancer by status of treatment and physical and mental health problems.

HRQoL		Status of treatment for adult patients with cancer				
		Completed treatment	Under treatment	Refused treatment	Treatment unnecessary	Total
Physical health problems	Yes	12,283 [54.5%]	2,463 [10.9%]	145 [0.6%]	4,766 [21.2%]	19,657 [87.2%]
	No	1,306 [5.8%]	361 [1.6%]	31 [0.1%]	1,196 [5.3%]	2,894 [12.8%]
	Total	13,589 [60.3%]	2,824 [12.5%]	176 [0.7%]	5,962 [26.5%]	22,551 [100%]
Mental health problems	Yes	12,633 [56.1%]	2,578 [11.4%]	152 [0.6%]	4,979 [22.1%]	20,342 [90.2%]
	No	956 [4.2%]	246 [1.1%]	24 [0.1%]	983 [4.4%]	2,209 [9.8%]
	Total	13,589 [60.3%]	2,824 [12.5%]	176 [0.7%]	5,962 [26.5%]	22,551 [100%]

Table 3. P-values in chi-square test that was used to examine the association between predictor and indicator variables.

HRQoL	Adult patients with cancer				Adult patients without cancer
	Completed treatment	Under treatment	Refused treatment	Treatment unnecessary	
Physical health problems	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Mental health problems	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001

Table 4. P-value and odds ratio of logistic regression to confirm the relationship between predictor and indicator variables and calculate the percentage differences.

Adult Patients			HRQoL	
			Physical health problems	Mental health problems
Adult Patients with cancer	Completed treatment	Pr > chi-Sq	< 0.0001	< 0.0001
		Odds ratio	0.683	0.719
	Under treatment	Pr > chi-Sq	< 0.0001	< 0.0001
		Odds ratio	0.764	0.797
	Refused treatment	Pr > chi-Sq	< 0.0001	< 0.0001
		Odds ratio	0.921	0.981
	Treatment unnecessary	Pr > chi-Sq	< 0.0001	< 0.0001
		Odds ratio	0.539	0.572
Adult patients without cancer		Pr > chi-Sq	< 0.0001	< 0.0001
		Odds ratio	0.443	0.451

The odds ratio (OR) must be calculated using logistic regression to assess the percentage differences in the impact of cancer and treatment status on HRQoL including: physical and mental health (Table 4).

DISCUSSION

Measurement of health utilizing accurate and sensitive scales to obtain significant and interpretable results for a specific population is one of the finest approaches for assessing that population. Because several studies have shown that various types of cancer can worsen HRQoL, but these studies have not looked into the impact of treatment status on physical and mental health in adult cancer patients, this study aimed to look into that impact by measuring physical and mental health problems in adult cancer patients.

The BRFSS 2020, which included 401,958 participants, was used to confirm the impact of cancer and treatment status on the physical and mental health of adult cancer patients. Through the Statistical Analysis System (SAS version 9.4), this study used a variety of statistical methods, including descriptive, inferential, and predictive methods.

In descriptive analysis of this cross-sectional study of 401,958 participants in BRFSS 2020, there were 22,551 adult patients with different types of cancer (Figure 2). 60.3% of those patients completed their treatment while 12.5% of them were still under treatment. Also, 26.5% of those patients thought treatment is not necessary while 0.7% of them refused to get treatment. Moreover, 87.2% of those adult patients with cancer had physical health problems while 90.2% had mental health problems (Table 2).

The chi-square test was employed in the inferential analysis of this cross-sectional study to assess the associations between study variables, predictor variables including cancer and treatment status and indicator variables including physical and mental health problems. All inferential analysis results had P-values of 0.0001 when a significance level of P-value 0.05 was used, showing that there are significant associations between cancer, treatment status, as well as physical and mental health concerns (Table 3).

The logistic regression was used in the predictive analysis of this cross-sectional study to confirm the relationship between study variables, predictor variables including cancer and treatment status and indicator variables including physical and mental health problems. All predictive analysis results had Pr > chi-Sq. < 0.0001, showing that there are relationships between cancer, treatment status, as well as physical and mental health concerns (Table 4).

Moreover, the odds ratio (OR) were obtained by logistic regression (Table 4) to calculate the percentage differences of the impact of cancer with different status of treatments on physical and mental health problems comparing to these physical and mental health problems in patients without cancer based on the following equation:

Percentage differences = (VI-V2) / ((V1+V2)/2)*100   [22]

where:
V1 = number of exposed cases
V2 = number of non-exposed cases

So, adult patients of cancer were divided into four groups based on their treatment status including: patients with no need of treatment, patients with completed treatment, patients are under treatment, and patients refused treatment. The obtained odds ratio from logistic regression would be used to indicate the differences of the impact of these different groups on physical and mental health problems comparing to without cancer (Table 5).

Table 5. Odds ratio of different groups of adult patients of cancer and the differences of the impact on HRQoL.

Adult Patients		HRQoL			
		Physical health problems		Mental health problems	
		Odds ratio	Difference	Odds ratio	Difference
Adult patients without cancer		0.443		0.451	
Groups of adult patients with cancer	Completed treatment	0.683	42.62%	0.719	45.81%
	Under treatment	0.764	53.18%	0.797	55.44%
	Refused treatment	0.921	70.08%	0.981	74.02%
	Treatment unnecessary	0.539	19.55%	0.572	23.65%

The impact of cancer on physical health in adult patients who completed their treatment increased by 42.62% while in adult patients who are still under treatment increased by 53.18%. Also, the impact of cancer on physical health in adult patients who refused treatment increased by 70.08% while in adult patients who their treatment is unnecessary increased by 19.55% (Table 5). Also, the impact of cancer on mental health in adult patients who completed their treatment increased by 45.81% while in adult patients who are still under treatment increased by 55.44%. Also, the impact of cancer on mental health in adult patients who refused treatment increased by 74.02% while in adult patients who their treatment is unnecessary increased by 23.65% (Table 5). Finally, that would indicate the great impact of cancer on HRQoL including physical and mental health with different treatment status on adult patients increasing the knowledge of the importance of health management and treatment.

CONCLUSION

The goal of this cross-sectional study was to look into the impact of cancer on adult patients' physical and mental health. The data of this study was obtained from CDC's BRFSS 2020. The findings of this study were based on 22,551 adult cancer patients. 60.3% of these patients completed their treatment, 12.5% were under treatment, 26.5% of adult patients of cancer believe treatment was unnecessary, and 0.7% have refused the treatment. The Statistical Analysis System (SAS version 9.4) was utilized to conduct this

investigation, which included descriptive, inferential, and predictive statistical approaches. The study showed that cancer can increase physical health problems in adult patients whether refused treatment patients, under treatment patients, completed treatment patients, or treatment unnecessary patients by 70.08%, 53.18%, 42.62%, and 19.55% respectively. Also, this study showed that cancer can increase mental health problems in adult patients whether refused treatment patients, under treatment patients, completed treatment patients, or treatment unnecessary patients by 74.02%, 55.44%, 45.81%, and 23.65% respectively. However, although this study showed the impact of cancer on physical and mental health in adult patients, a limitation of this study is that it remains unknow of specific type of cancer treatment that helps in improvement of health-related quality of life of adult patients as well as management of this disease.

Authors' contributions: The work was done by only one author.
Funding: There was no source of funding.
Availability of data and materials: All data are available on reasonable request.
Ethics approval and consent to participate: Not applicable. The data is publicly available, and no approval is required.
Consent for publication: Not applicable. The paper does not involve the use of any individual person's data.
Competing interests: The author declares that there are no competing interests.
Conflict of interest: There is not any conflict of interest.

REFERENCES

1. National Cancer Institute (NCI). National Institutes of Health (NIH). 2021. What Is Cancer? Retrieved on Sep 2021 from www.cancer.gov
2. World Health Organization (WHO). 2021. Cancer. Retrieved on Sep 2021 from www.who.int
3. Stanford Health Care. 2021. What Causes Cancer? Retrieved on Oct 2021 from www.stanfordhealthcare.org
4. American Cancer Society. 2021. What Is Cancer? Retrieved on Oct 2021 from www.cancer.org
5. Centers for Disease Control and Prevention (CDC). 2021. Kind of Cancer. Retrieved on Oct 2021 from www.cdc.gov
6. Cancer Research UK. 2020. Signs and symptoms of cancer. Retrieved on Oct 2021 from www.cancerresearchuk.org
7. World Health Organization (WHO). 2021. Cancer Key Facts. Retrieved on Nov 2021 from www.who.int
8. Sung, H., Ferlay, J., Siegel, R. L., Laversanne, M., Soerjomataram, I., Jemal, A., Bray, F. 2021. Global cancer statistics 2020: Globocan estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA: A Cancer Journal for Clinicians, 71(3), 209–249. doi.org/10.3322/caac.21660
9. Parkin, D. M., Bray, F., Ferlay, J., Pisani, P. 2005. Global cancer statistics, 2002. CA: A Cancer Journal for Clinicians, 55(2), 74–108. doi.org/10.3322/canjclin.55.2.74
10. Torre, L. A., Bray, F., Siegel, R. L., Ferlay, J., Lortet-Tieulent, J., Jemal, A. 2015. Global cancer statistics, 2012. CA: A Cancer Journal for Clinicians, 65(2), 87–108. doi.org/10.3322/caac.21262
11. Bray, F., Ferlay, J., Soerjomataram, I., Siegel, R. L., Torre, L. A., Jemal, A. 2018. Global cancer statistics 2018: Globocan estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA: A Cancer Journal for Clinicians, 68(6), 394–424. doi.org/10.3322/caac.21492
12. F, Kevin. Arthritis and Health-related Quality of Life. 2019. Retrieved on Nov 2021from www.hopkinsarthritis.org
13. Sitlinger, A., & Zafar, S. Y. 2018. Health-Related Quality of Life: The Impact on Morbidity and Mortality. Surgical oncology clinics of North America, 27(4), 675–684. doi.org/10.1016/j.soc.2018.05.008
14. Abegaz, T. M., Ayele, A. A., Gebresillassie, B. M. 2018. Health related quality of life of cancer patients in Ethiopia. Journal of Oncology, 2018, 1–8. doi.org/10.1155/2018/1467595
15. Chen, Q., Li, S., Wang, M., Liu, L., Chen, G. 2018. Health-related quality of life among women breast cancer patients in eastern China. BioMed Research International, 2018, 1–12. doi.org/10.1155/2018/1452635
16. Jacob, J., Palat, G., Verghese, N., Chandran, P., Rapelli, V., Kumari, S., Malhotra, C., Teo, I., Finkelstein, E., Ozdemir, S. 2019. Health-related quality of life and its socio-economic and cultural predictors among advanced cancer patients: Evidence from the approach cross-sectional survey in Hyderabad-India. BMC Palliative Care, 18(1). doi.org/10.1186/s12904-019-0465-y
17. Mokhatri-Hesari, P., & Montazeri, A. 2020. Health-related quality of life in breast cancer patients: Review of reviews from 2008 to 2018. Health and Quality of Life Outcomes, 18(1). doi.org/10.1186/s12955-020-01591-x
18. Freire, M. E., Sawada, N. O., França, I. S., Costa, S. F., Oliveira, C. D. 2014. Health-related quality of life among patients with Advanced cancer: An integrative review. Revista Da Escola De Enfermagem Da USP, 48(2), 357–367. doi.org/10.1590/s0080-6234201400002000022
19. De Cicco, D., Tartaro, G., Ciardiello, F., Fasano, M., Rauso, R., Fiore, F., Spuntarelli, C., Troiano, A., Lo Giudice, G., Colella, G. 2021. Health-related quality of life in Oral cancer patients: Scoping review and critical appraisal of investigated determinants. Cancers, 13(17), 4398. doi.org/10.3390/cancers13174398
20. Kokkonen, K. R. I. S. T. I. I. N. A., Tasmuth, T. I. I. N. A., Lehto, J. U. H. O. T., Kautiainen, H. A. N. N. U., Elme, A. N. N. E. L. I., Jääskeläinen, A. N. N. A.-S. T. I. N. A., Saarto, T. I. I. N. A. 2018. Cancer patients' symptom burden and health-related quality of life (hrqol) at Tertiary Cancer Center from 2006 to 2013: A cross-sectional study. Anticancer Research, 39(1), 271–277. doi.org/10.21873/anticanres.13107
21. Behavioral Risk Factor Surveillance System (BRFSS). 2021. 2020 BRFSS Survey Data and Documentation. Retrieved on Sep2021 from https://www.cdc.gov/brfss/
22. Clemson University. Physics Tutorial: % Error & % Difference. 2006. Retrieved on Nov 2021 from http://www.clemson.edu/ces/phoenix/tutorials/error/