JMPF Vol. 12 No. 4 : 245-254
ISSN-p : 2088-8139
ISSN-e : 2443-2946

Clinical and therapeutic characteristics of hospitalized cancer patients in the Najran Region of Saudi Arabia: a cross-sectional study

Hamad S Alyami[1*], Abdallah Y Naser[2], Mohammad H. Alyami[1], Ibraheem S. Banihameem[3], Mohammad Almusabi[4], Ahlam M. Alqahtani[4], Mohammed A. Gannas[4], Hadi S. Alyami[4], Hadi J. Al Sulayyim[4], Saeed F. Alkorbi[5], Hussain M. Alsagoor[5], Abdullah M. Alyami[5], Rubiaan S. Almadi[6], Salem Hussain Alharethi[7]

[1] Department of Pharmaceutics, College of Pharmacy, Najran University, Najran, Saudi Arabia
[2] Department of Applied Pharmaceutical Sciences and Clinical Pharmacy, Faculty of Pharmacy, Isra University, Amman, Jordan
[3] General Directorate of Health Affairs Najran, Ministry of Health, Najran, Saudi Arabia
[4] King Khalid Hospital, General Directorate of Health Affairs, Najran, Ministry of Health, Saudi Arabia
[5] College of Pharmacy, Najran University, Najran, Saudi Arabia
[6] King Faisal Specialist Hospital and Research Center, Pharmaceutical Care Division, Riyadh, Saudi Arabia
[7] Department of Biological Science, College of Arts and Science, Najran University, Najran, Saudi Arabia
Submitted: 26-10-2022 *Revised: 19-12-2022* *Accepted: 27-12-2022*
Corresponding : Hamad S Alyami; Email : hsalmukalas@nu.edu.sa

ABSTRACT

There are limited studies in the Southern region of Saudi Arabia on the characteristics of hospitalised patients with cancer. The aim of this study was to explore the clinical and therapeutic characteristics of hospitalized cancer patients in the Najran Region of Saudi Arabia. A retrospective cross-sectional observational study was conducted using cancer patients' medical records at the oncology unit in the King Khalid Hospital in Najran situated in the southern region of Saudi Arabia. Hospitalized patients' records were extracted between 2014 and 2020. Logistic regression analysis was conducted to identify determinants of ICU admission among cancer patients. A total of 1,678 patients were involved in this study. The mean age was 52.5 (SD: 21.1) years. The average duration of stay was 8.7 days (SD: 13.4). The most commonly reported types of cancer were breast cancer, rectum cancer and colon cancer, accounting for 13.6%, 6.9%, and 6.7%, respectively. A total of 13.9% of the study participants required ICU admission. More than half (57.1%) of the patients were complaining of a moderate to severe case upon hospitalization. Older age (52.5 years and above) and the presence of comorbidities were risk factors that significantly increased the risk of ICU admission (*P<.001*). Patients with diabetes mellitus, hypertension, heart diseases, stroke, and kidney diseases were more likely to require ICU admissions. Patients with liver cancer were more likely to require ICU admission. Healthcare professionals should give extra care and health education for high risk cancer patients including elderly patients and those with other comorbidities to prevent complications and its associated hospitalization.
Keywords: Admission; Cancer; Hospitalized; Najran**.**

INTRODUCTION

Cancer is the world's second largest cause of death. In 2018, it was responsible for 9.6 million deaths, or one in every six deaths [1]. Neoplasm and malignant tumor are terms commonly associated with cancer [2]. Cancer is a broad term for a collection of diseases caused by the unregulated proliferation of abnormal cells in practically every organ or tissue of the body. Unlike benign tumors, malignant cells have the ability to penetrate and/or spread beyond their normal borders. This is known as metastasizing, and it is one of the leading causes of death in cancer patients.

The change in lifestyle in the Kingdom of Saudi Arabia is causing a rise in the incidence and death rates of various cancer types in all regions of the country. Despite the rapid development and expansion of the health care system, no applied national strategies exist to limit and control cancer prevalence. Additionally, the data on cancer-specific incidence rates and available data for studies to project the future cancer burden are insufficient. Individuals, families, communities, and health systems are under increasing physical, emotional, and financial pressure as the cancer burden grows [3].

Recent studies have linked the rapid rise in cancer rates to environmental and behavioral rather than biological variables, such as patients' lifestyles, dietary habits, geographic location, and industrial zones, as well as other factors particular to specific regions of the country [4-6]. Studies have also confirmed that the risk of developing cancer can vary according to age, ethnicity, sex, race and differences in dietary consumption patterns [7]. A recent comprehensive analysis of cancer incidence in Saudi Arabia stated significant variances in the rate of incidences with respect to gender, age, and region. Furthermore, wealth disparities may result in discrepancies in risk factor exposures as well as impediments to high-quality cancer prevention, early detection, and treatment.

The availability of cancer data is highly valuable; many benefits can be achieved regarding incidence rates related to constant changes in diet and lifestyle, which can help to support public health policy, improve knowledge of the most prevalent types of cancer in a region, increase people's awareness and optimize the distribution of resources, the screening programs, the use of the available facilities, in addition to the ability to direct patient awareness initiatives towards the high-risk factors [8-12]. Furthermore, cancer data collection and analysis can aid in warning the community regarding early prevention and diagnosis of cancer; accurate epidemiological data may also help in the allocation of proper funding for research on the illness and treatment.

There are limited studies in the Southern region of Saudi Arabia on the characteristics of hospitalised patients with cancer. A recent study in Asir, Saudi Arabia's southern region, found that cancer patients have survived for a median of four years with their disease, with 20.8 % of cases being metastatic, with 77.8 % being at stage four of metastasis [13]. Furthermore, the most common types of cancer were malignant neoplasms of the digestive organs, which accounted for 40.8 % of the sample, and 4.6 % of the patients required ICU admission for a median of 9 days [13]. Najran province is a big region that has seen a recent growth in cancer incidence rates registered for all types. This study aimed to explore the therapeutic and clinical characteristics of hospitalized cancer patients in the Najran Region of Saudi Arabia. Additionally, we aimed to identify predictors of Intensive Care Unit (ICU) admissions.

METHODS

Study design and sample

A retrospective cross-sectional observational study was conducted using cancer patients' medical records at the oncology unit in the King Khalid Hospital in Najran situated in the southern region of Saudi Arabia. Hospitalized patients' records were extracted between 2014 and 2020. Demographic data (age, gender, and nationality) were extracted from these records. All the data related to cancer diagnosis, type of treatment and hospitalization (including intensive care unit (ICU) admission, the duration of ICU admission, the main complaints upon presentation, status upon discharge, drug use history, laboratory findings upon presentation, and previous surgery history) were extracted from the computerized system of the cancer center.

Statistical analysis

For quantitative variables, the descriptive analysis was provided as mean (± standard deviation (SD)). The demographic information of the patients was described using descriptive statistics. Percentages and frequencies were used to report categorical data. The researchers performed logistic regression analysis to find determinants of ICU admission in cancer patients. The statistical significance of the data was represented by a confidence interval of 95% and a level of significance of 5 %. The statistical analysis was carried out using SPSS (Statistical Package for the Social Sciences) Version 27.0 software (SPSS Inc.).

RESULTS AND DISCUSSION

Table I shows the baseline characteristics of the study participants. A total of 1,678 patients were involved in this study. The mean age was 52.5 (SD: 21.1) years. More than half of them (65.0%) were Saudis. More than half of them (54.4%) were females. The mean BMI was 27.0 kg/cm^2 (SD: 13.5). Around one third (28.0%) of the study participants reported that they had had a previous surgery history (all cause surgery and not only cancer specific). The most commonly reported comorbidities were diabetes mellitus, hypertension, and thyroid disease, accounting for 20.9%, 19.0%, and 7.7%, respectively.

The most commonly reported types of cancer among the study participants were breast cancer, rectum cancer and colon cancer, accounting for 13.6%, 6.9%, and 6.7%, respectively, Figure 1.

Clinical profile of the patients

The average duration of stay was 8.7 days (SD: 13.4). The most commonly reported signs upon presentation to the hospitals were pain and fatigue, accounting for 23.5% and 14.2%, respectively. A total of 13.9% of the study participants required ICU admission. More than half (57.1%) of the patients were complaining of a moderate to severe case upon hospitalisation. Around half of the cases (53.9%) improved upon discharge, Table II.

Laboratory findings of the patients

Table III below describes the laboratory findings of the patients upon presentation to the hospitals.

Predictors of ICU admissions

We used binary logistic regression to identify predictors of ICU admission, see Table IV. Older age (52.5 years and above) and the presence of comorbidities were risk factors that significantly increased the risk of ICU admission (P<*.001*). Patients with diabetes mellitus, hypertension, heart diseases, stroke, and kidney diseases were more likely to require ICU admissions. Patients with liver cancer were more likely to require ICU admissions.

Cancers impose the largest worldwide burden [14]. This study aimed to highlight the cancer incidence rate and the associated risk factors in Najran Region in Saudi Arabia, focusing on the comorbidities diseases, the concomitant medications, types of cancer, the need for hospital admission and if intensive care was needed, the severity of the case and the percentage of improvement upon discharge.

Chronic diseases increase the risk of various types of complications and diseases including cancer [15]. The most commonly reported comorbidities among the study participants were diabetes mellitus, hypertension, and thyroid disease, accounting for 20.9%, 19.0%, and 7.7%, respectively. Diabetes mellitus and cancer were found to share in common multiple risk factors, either modifiable, non-modifiable or biological [16]. Hypertension was also linked with cancer and increased the risk of mortality [17]. This can be attributed to the fact that anti-diabetic and antihypertensive agents may be related jointly to multiple kinds of carcinomas [17]. Meanwhile, studies have shown that the coexistence of cancer and autoimmune thyroid disease can be initiated by the use of different endocrine hormones. The exact mechanism behind this association is still unclear [18].

Diabetes and hypertension are linked to certain types of cancer by medications prescribed [17,19]. This study found that the most common chronic disease medications used were calcium channel blockers (CCB), which accounted for 15.3% of the total. CCBs are a choice for the treatment of hypertension and have been found, after long-term use, to be a risk factor for breast cancer [20]. This relationship has been found following the development of molecular and genetic testing, and it requires further examination and study [21]. B-blockers counted for 12.6% of the most commonly used chronic diseases medications, being used for the treatment of hypertension. They are now believed to represent a new attractive, inexpensive and safe strategy in patients with

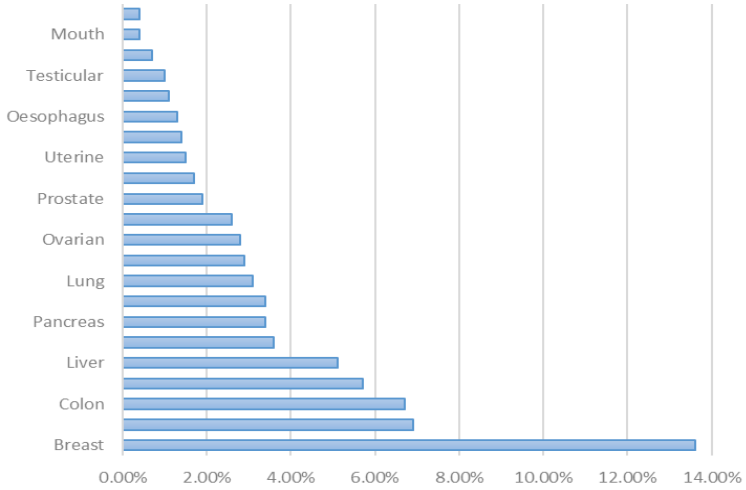

Figure 1. Epidemiology of cancer among the patients stratified by type.

Table I. The baseline characteristics of the study participants

Demographic variable	Frequency	Percentage
Age (mean (SD) years	52.5 (SD: 21.1) years	
Nationality (Saudi)	1,090	65.0%
Gender (females)	912	54.4%
Body Mass Index (mean (SD)) kg/cm^2	27.0 (SD: 13.5)	
Previous surgery history (Yes)	470	28.0%
Comorbidities		
Diabetes mellitus	350	20.9%
Hypertension	319	19.0%
Thyroid disease	130	7.7%
Heart diseases	129	7.7%
Eye problems	59	3.5%
Asthma/breathing problems	59	3.5%
Dyslipidemia	54	3.2%
Stroke	42	2.5%
Liver diseases	39	2.3%
Neuropathy	24	1.4%
Epilepsy	20	1.2%
Nephropathy	13	0.8%
Myocardial Infarction	10	0.6%
Mental health issues	8	0.5%
GERD/Acid reflux	8	0.5%
Depression/anxiety	6	0.4%
Tuberculosis	4	0.2%
Arthritis	3	0.2%

several types of cancer [22]. Otherwise, insulin counted for 11.6% of the most commonly used medications, despite the threat of hyperinsulinemia resulting from insulin and insulin analogue treatment increasing the cancer risk [23]. The use of insulin should be continued for the higher benefits of controlling diabetes mellitus over the assumed cancer

Table II. Clinical profile of the patients

Variable	Frequency	Percentage
Duration of admission (mean(sd))	8.7 days (SD:13.4)	
Main complains upon presentation (Symptoms):		
Pain	395	23.5%
Fatigue	238	14.2%
Shortness of breath	229	13.6%
Nausea/Vomiting	107	6.4%
Required ICU admission (Yes)	234	13.9%
Severity of the case:		
Mild	720	42.9%
Moderate	680	40.5%
Severe	278	16.6%
Status on discharge		
Died	179	10.7%
No change	595	35.5%
Improved	904	53.9%

Table III. Laboratory findings of the patients

Variable	Mean (SD)
HB	11.5 (4.2)
WBC	11.2 (35.5)
Platelet	238.9 (147.6)
ANC	7.0 (28.2)
BUN	11.6 (27.1)
Creatinine	98.5 (96.6)
Total bilirubin	29.6 (57.7)
PT	19.0 (53.6)
APTT	36.6 (22.5)
INR	2.7 (5.9)

risk.[10] These three chronic disease medications, CCB, B-blockers and insulin, had a high percentage of use in the cancer patients in this study. This is attributed to the increase of two comorbid chronic diseases - hypertension and diabetes mellitus – which were present in 20.9%, and 19.0% cases, respectively.

The most commonly reported types of cancer among the study participants were breast cancer, rectum cancer and colon cancer, accounting for 13.6%, 6.9% and 6.7%, respectively. After lung cancer, breast cancer is the second most frequent cancer in the world [24]. Also, breast cancer standing before colon cancer, were the fourth and fifth-highest mortality rate cancer types in the world in 2018, according to the world health organization (WHO) [25]. These types of cancer, and other types, arise from a long list of modifiable and non-modifiable factors that humans are exposed to. These differ across individuals, and this is what causes the distribution of cancer types [26].

Most cancer patients suffer from pain and fatigue, symptoms that need to be controlled [27]. These were the most commonly reported signs upon presentation at hospital, accounting for 23.5% and 14.2%, respectively. On presentation at the hospital, this pain must be identified, assessed, and managed.

Table IV. Predictors of ICU admissions

Variable	Odds ratio (95% CI)
Age	
Below 52.5 years (Reference category)	1.00
52.5 years and above	1.97 (1.46-2.65)*
Gender	
Males (Reference category)	1.00
Females	0.98 (0.73-1.30)
Body Mass Index	
Below 27.0 kg/cm^2 (Reference category)	1.00
27.0 kg/cm^2 and above	0.75 (0.53-1.05)
Previous surgery history (all cause surgery and not only cancer specific**)**	
No (Reference category)	1.00
Yes	1.00 (0.74-1.36)
Comorbidities	
No (Reference category)	1.00
Yes	3.12 (2.29-4.27)*
Diabetes mellitus (Reference group is not having the disease)	3.90 (2.89-5.26)*
Hypertension (Reference group is not having the disease)	2.29 (1.69-3.11)*
Thyroid disease (Reference group is not having the disease)	0.82 (0.49-1.36)
Heart diseases (Reference group is not having the disease)	1,98 (1.30-3.01)*)
Eye problems (Reference group is not having the disease)	-
Asthma/breathing problems (Reference group is not having the disease)	1.26 (0.67-2.37)
Dyslipidemia (Reference group is not having the disease)	1.59 (0.85-2.99)
Stroke (Reference group is not having the disease)	4.29 (2.28-8.05)*
Liver diseases (Reference group is not having the disease)	2.15 (0.95-4.84)
Neuropathy (Reference group is not having the disease)	0.40 (0.09-1.70)
Epilepsy (Reference group is not having the disease)	0.23 (0.03-1.73(
Kidney diseases (Reference group is not having the disease)	7.14 (1.69-30.10)*
Myocardial Infarction (Reference group is not having the disease)	3.42 (0.91-12.84)
Type of cancer	
Breast (Reference group is not having this type of cancer)	0.91 (0.60-1.37)
Colon (Reference group is not having this type of cancer)	1.25 (0.73-2.15)
Liver (Reference group is not having this type of cancer)	2.07 (1.24-3.45)**
Pancreas (Reference group is not having this type of cancer)	1.86 (0.98-3.53)
Lung (Reference group is not having this type of cancer)	1.87 (0.94-3.72)
Ovarian (Reference group is not having this type of cancer)	1.38 (0.64-2.95)
Prostate (Reference group is not having this type of cancer)	0.98 (0.33-2.91)
Uterine (Reference group is not having this type of cancer)	0.92 (0.31-2.74)
Oesophagus (Reference group is not having this type of cancer)	1.85 (0.65-5.31)
Testicular (Reference group is not having this type of cancer)	1.09 (0.23-5.21)
Mouth (Reference group is not having this type of cancer)	1.07 (0.12-9.78)

It should be noted that the pain might be connected to emotional, behavioral, cultural, or spiritual and factors related to the patient's environment [28,29]. Fatigue is a subjective, unpleasant symptom that is perceived as tiredness, exhaustion, and attrition, interfering with the patient's life [30]. It is also believed to develop into further severe psychological symptoms, like anxiety and depression, and can increase with the severity of the pain in cancer patients [31]. Statistics on the incidence and prevalence of cancer-related pain reveal that the majority of patients experience pain during treatment and that cancer pain degrades quality of life and function [32]. The likelihood and intensity of pain rises as the cancer progresses. Minorities, women, and the elderly may be at increased risk for inadequate cancer pain management. Even with analgesic therapy delivered in accordance with the World Health Organization's approach for cancer pain reduction, pain is typically not removed, and it may persist even after eradication of the underlying malignancy [32]. Prior to beginning chemotherapy, the prevalence of cancer-related fatigue ranged from 4 percent in breast cancer and 8 percent in prostate cancer to 91 percent in breast cancer patients following surgery, chemotherapy, and prior to bone marrow transplantation [32]. Besides, Educational interventions aimed at patients or professionals can result in a large but modest clinical benefit comparable to that produced by certain analgesics [33]. Alongside optimum oncological and analgesic care, educational interventions should be incorporated into standard therapeutic practice [33].

Patients frequently had to be admitted to the ICU, especially those needing chemotherapy, along with mechanical ventilation [34]. In this study, a total of 13.9% of the participants required ICU admission. In addition, the presence of comorbidities like diabetes mellitus, and hypertension were risk factors found to significantly increase the risk of ICU admission ($p<0.001$)[15-17]. More than half (57.1%) of the patients were considered to be moderate to severe cases upon hospitalization. Some of the laboratory findings of the patients upon presentation deviated from the reference ranges, for example, haemoglobin Hb, white blood cells WBC, and ANC, were measured as 11.5 (SD:4.2), 11.2 (SD:35.5), 7.0 (SD:28.2), respectively [35]. This deviation is believed to be expected, one that can happen at any stage of cancer during exposure to therapy [36,37]. Also, the total bilirubin, PT, APTT, INR accounted for 29.6 (SD:57.7), 19.0 (SD:53.6), 36.6 (SD:22.5), 2.7 (SD:5.9), respectively. This elevation in PT and APTT is a predictor for a poor outcome in colon and rectal cancer, which was confirming the findings of previous study on 250 patients with colorectal cancer [37].

Around half of the cases of the patients (53.9%) improved upon discharge, and this improvement may be the result of multiple factors, including the duration of the hospitalization and the ease of the discharge process [38].

In conclusion, breast cancer, rectum cancer and colon cancer were the most common types of cancer in Najran, Saudi Arabia. Patients with diabetes mellitus, hypertension, heart diseases, stroke, and kidney diseases were more likely to require ICU admissions. Patients with liver cancer were more likely to require ICU admissions. Healthcare professionals should give extra care and health education for high risk cancer patients including elderly patients and those with other comorbidities to prevent complications and its associated hospitalization.

Data Sharing Statement

All data generated or analysed during this study are reflected in the present published article

Ethics Statement

The study protocol was reviewed, and ethical approval was granted by the Research Ethics Committee of the Directorate of Najran Health Affairs – Najran Region in Saudi Arabia (REC) H-11-N-081. Written informed

consent was obtained from all subjects involved in the study upon their admission to the hospital.

Author contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

ACKNOWLEDGMENTS

Authors would like to express their gratitude to Najran Cancer Foundation for funding this project, represented by its president Gannas Ahmad Al Swar. The authors acknowledge that all acknowledged individuals have no role in the study analysis, writing or interpretation.

Funding

None declared.

Disclosure

The authors declare no conflict of interest.

REFERENCES

1. Alattas M. Cancer Control Priorities and Challenges in Saudi Arabia: A Preliminary projection of Cancer Burden. *Gulf J Oncolog.* 2019;1(29):22-30.
2. World Health Organization. Health topics/Cancer. 2020; https://www.who.int/health-topics/cancer#tab=tab1. Accessed October 09, 2021.
3. M Alqarni SS. A Review of Prevalence of Obesity in Saudi Arabia. *Journal of Obesity & Eating Disorders.* 2016;02(02).
4. Grosso G, Bella F, Godos J, et al. Possible role of diet in cancer: systematic review and multiple meta-analyses of dietary patterns, lifestyle factors, and cancer risk. *Nutr Rev.* 2017;75(6):405-419.
5. National Cancer Institute. Risk Factors for Cancer. 2020; https://www.cancer.gov/ about-cancer/ causes-prevention/ risk. Accessed October 09, 2021.
6. Adnan Hameed H, Naser AY, Mudheher Talib N. Clinical and therapeutic characteristics and medical cost of managing cancer patients in Al-Anbar, Iraq: A cross-sectional study. *Saudi Pharmaceutical Journal.* 2022.
7. Bazarbashi S, Al Eid H, Minguet J. Cancer Incidence in Saudi Arabia: 2012 Data from the Saudi Cancer Registry. *Asian Pac J Cancer Prev.* 2017;18(9):2437-2444.
8. El Bcheraoui C, Basulaiman M, Wilson S, et al. Breast cancer screening in Saudi Arabia: free but almost no takers. *PLoS One.* 2015;10(3):e0119051.
9. Hewitson P, Glasziou P, Watson E, Towler B, Irwig L. Cochrane systematic review of colorectal cancer screening using the fecal occult blood test (hemoccult): an update. *Am J Gastroenterol.* 2008;103(6):1541-1549.
10. lmadi M, Mosli M, Bohlega M, et al. Effect of public knowledge, attitudes, and behavior on willingness to undergo colorectal cancer screening using the health belief model. *Saudi J Gastroenterol.* 2015;21(2):71-77.
11. Nelson H, Fu R, Cantor A, Pappas M, Daeges M, Humphrey L. Effectiveness of Breast Cancer Screening: Systematic Review and Meta-analysis to Update the 2009 U.S. Preventive Services Task Force Recommendation. *Ann Intern Med.* 2016;164(4):244-255.
12. Sankaranarayanan R. Screening for cancer in low- and middle-income countries. *Ann Glob Health.* 2014;80(5):412-417.
13. Alyami HS, Naser AY, Dahmash EZ, et al. Clinical and Therapeutic Characteristics of Cancer Patients in the Southern Region of Saudi Arabia: A Cross-Sectional Study. *Int J Environ Res Public Health.* 2021;18(12).

14. World Health Organization. Global Health Estimates 2016: dis-ease burden by cause, age, sex, by country and by region, 2000–2016. 2016; https://www.who.int/healthinfo/global_burden_disease/esti-mates/en/index1.html Accessed October 09, 2021.
15. Tu H, Wen C, Tsai S, et al. Cancer risk associated with chronic diseases and disease markers: prospective cohort study. *BMJ.* 2018;360(134).
16. Wojciechowska J, Krajewski W, Bolanowski M, Kręcicki T, Zatoński T. Diabetes and Cancer: a Review of Current Knowledge. *Exp Clin Endocrinol Diabetes.* 2016;124(5):263-275.
17. Grossman E, Messerli F, Boyko V, Goldbourt U. Is there an association between hypertension and cancer mortality? *Am J Med.* 2002;112(6):479-486.
18. Felicetti F, Catalano M, Fortunati N. Thyroid Autoimmunity and Cancer. *Front Horm Res.* 2017;48:97-109.
19. Maatela J, Aromaa A, Salmi T, Pohja M, Vuento M, Grönroos M. The risk of endometrial cancer in diabetic and hypertensive patients: a nationwide record-linkage study in Finland. *Ann Chir Gynaecol Suppl.* 1994;208:20-24.
20. Raspa R, Wilson C. Calcium channel blockers in the treatment of hypertension. Am Fam Physician. *48.* 1993;3(461-70).
21. Thakur A, Wang X, Garcia-Betancourt M, Forse R. Calcium channel blockers and the incidence of breast and prostate cancer: A meta-analysis. *J Clin Pharm Ther.* 2018;43(4):519-529.
22. Fumagalli C, Maurizi N, Marchionni N, Fornasari D. β-blockers: Their new life from hypertension to cancer and migraine. *Pharmacol Res.* 2020;151(104587).
23. Onitilo A, Engel J, Glurich I, Stankowski R, Williams G, Doi S. Diabetes and cancer II: role of diabetes medications and influence of shared risk factors. *Cancer Causes Control.* 2012;23(7):991-1008.
24. Mattiuzzi C, Lippi G. Current Cancer Epidemiology. *J Epidemiol Glob Health.* 2019;9(4):217-222.
25. International Agency for Research on Cancer. Global cancer observatory - cancer fact sheets. 2020; http://gco.iarc.fr/today/fact-sheets-cancers Accessed October 09, 2021.
26. Whiteman D, Wilson L. The fractions of cancer attributable to modifiable factors: A global review. *Cancer Epidemiol.* 2016;44(203-21).
27. Henson L, Maddocks M, Evans C, Davidson M, Hicks S, Higginson I. Palliative Care and the Management of Common Distressing Symptoms in Advanced Cancer: Pain, Breathlessness, Nausea and Vomiting, and Fatigue. *J Clin Oncol.* 2020;38(9):905-914.
28. Greco M, Roberto A, Corli O, et al. Quality of cancer pain management: an update of a systematic review of undertreatment of patients with cancer. *J Clin Oncol.* 2014;32(36):4149-4154.
29. Naser AY, Hameed AN, Mustafa N, et al. Depression and Anxiety in Patients With Cancer: A Cross-Sectional Study. *Front Psychol.* 2021;12:585534.
30. Ream E, Richardson A. Fatigue: a concept analysis. *Int J Nurs Stud.* 1996;33(5):519-529.
31. Stone P, Richards M, A'Hern R, Hardy J. A study to investigate the prevalence, severity and correlates of fatigue among patients with cancer in comparison with a control group of volunteers without cancer. *Ann Oncol.* 2000;11(5):561-567.
32. Carr D GL, Lawrence D, et al. . Management of Cancer Symptoms: Pain, Depression, and Fatigue : Summary. In: AHRQ Evidence Report Summaries. 2002; https://www.ncbi.nlm.nih.gov/books/NBK11961/. Accessed December 18, 2022.
33. Bennett MI, Flemming, K., & Closs, S. J. Education in cancer pain management.

Current opinion in supportive and palliative care. 2011;5(1):20-24.

34. Azoulay E, Afessa B. The intensive care support of patients with malignancy: do everything that can be done. *Intensive Care Med.* 2006;32(1):3-5.
35. Downey R. Complete Blood Count Reference Ranges from a Rural Haitian Ambulatory Care Clinic. *Lab Med.* 2017;48(2):e24-29.
36. Rojko L, Megyesfalvi Z, Czibula E, et al. Longitudinal analysis of complete blood count parameters in advanced-stage lung cancer patients. *Thorac Cancer.* 2020;11(11):3193-3204.
37. Zhang L, Ye J, Luo Q, et al. Prediction of Poor Outcomes in Patients with Colorectal Cancer: Elevated Preoperative Prothrombin Time (PT) and Activated Partial Thromboplastin Time (APTT). *Cancer Manag Res.* 2020;12:5373-5384.
38. Nowak M, Lee S, Karbach U, Pfaff H, Groß S. Short length of stay and the discharge process: Preparing breast cancer patients appropriately. *Patient Educ Couns.* 2019;102(12):2318-2324.