Evaluation of the Impact of the COVID-19 Pandemic on the Incidence of Cancer: A Comparative Analysis between the Years 2018 and 2022

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ABSTRACT
Background: The SARS-CoV-2 pandemic has caused unprecedented medical, social, and economic challenges, resulting in lockdowns, travel restrictions, social isolation, and distancing measures. Some research studies have shed some light on how this pandemic has influenced cancer screening and treatment services, highlighting the urgent need to continue to assess incidence rates during this period. Objective: To evaluate the incidence of cancer pre and post-COVID-19 Pandemic in a highly specialized hospital. Methods: Descriptive, Cross-sectional, Retrospective Study. We studied all biopsy reports of cancer from the highly specialized hospital Pathology Department between 2018 and 2022. Results: The results of 8804 biopsies were analyzed. In 2018, 4379 were examined, of which 1622 were benign specimens, and 2757 (62.95%) were diagnosed with malignancy. In 2022, 4425 were studied, of which 1209 were diagnosed with benignity and 3216

(72.68%) were malignant. <u>Conclusion</u>: Compared to the pre-pandemic year and the post-pandemic year, reports of biopsies with malignancy diagnoses increased.

Keywords: Pandemic (D058873), Covid-19 (D000086382), Cancer (D009369).

INTRODUCTION

Cancer is a disease that has affected humanity throughout history, being one of the leading causes of morbidity and mortality worldwide. This disease is characterized by the uncontrolled growth and spread of abnormal cells in different tissues and organs of the body. (1–3)

"Cancer is the second cause of death in the world; in 2018, it caused 9.6 million deaths, or one in six" (2)

As these cancer cells multiply and accumulate, they can form masses of tissue called tumors, which interfere with the body's normal functions.

It is important to understand that its origin is multifactorial and can be influenced by genetic, environmental, and lifestyle factors. Cancer can manifest itself in various types, each with specific characteristics. (4) Today, despite advances in cancer research, significant questions remain about the underlying causes that trigger the carcinogenic process in normal cells, as well as the frequency of the appearance of the various oncological presentations. The incidence of cancer is a highly relevant phenomenon in the field of global health, (5) since its study not only provides essential information on the burden of the disease but also reveals the changing patterns in its detection and diagnosis. (2)

However, events of unimaginable magnitude, such as the COVID-19 pandemic, have introduced enormous challenges in healthcare, leaving a significant mark on the detection and treatment patterns of cancer patients. (6-9)

COVID-19, also known as coronavirus disease 2019, has caused a global pandemic affecting millions worldwide. The virus responsible for this disease SARS-CoV-2, which belongs to the coronavirus family. This virus was identified in December 2019 in the city of Wuhan, located in the Chinese province of Hubei. (10)

The SARS-CoV-2 pandemic has caused unprecedented medical, social, and economic challenges. Governments and healthcare systems have struggled to contain the spread of the virus, resulting in lockdowns, travel restrictions, and social distancing measures. These measures have significantly impacted the global economy, with businesses closing and millions of people losing their jobs. (8,9,11)

Although it is relatively recent, some research studies have shed a dim light on how this pandemic has influenced cancer detection and treatment services, highlighting the urgent need to continue to evaluate incidence rates during this period. (11,12)

In addition, the convergence of diseases such as cancer and public health events such as the SARS-COV-2 pandemic underlines the urgent need to thoroughly analyze their interaction and their implications for healthcare planning and delivery. (9,10)

Over the past few years, hospitals and healthcare facilities have had to prioritize patients infected with COVID-19 and allocate resources to combat the virus, putting other diseases, including cancer, in second or even third place. (13–17)

As a result, cancer patients have faced significant delays in diagnosis and eventually also in treatment, which may ultimately lead to worse outcomes and higher mortality rates. (7,18–20) Furthermore, it is documented that the pandemic has also caused a significant increase in fear and anxiety among cancer patients, who are at higher risk of developing severe COVID-19 disease. This fear has caused patients to delay or avoid visits to medical facilities, further exacerbating delays in cancer diagnosis and treatment. (9,12) For example, studies in Italy have shown a significant decrease in colorectal cancer diagnoses throughout the pandemic. (21)

In addition, the temporary suspension of organized cancer screening programs has been a recurring concern. (6)

However, the pandemic has also catalyzed innovation in cancer care. Telemedicine and remote monitoring had become widespread, allowing patients to receive cancer care without leaving home, especially when many healthcare centers were overwhelmed and understaffed; telemedicine emerged as a key tool to provide cancer patients with remote consultations and follow-up. (8,22)

However, the effectiveness and accessibility of telemedicine services vary significantly between different regions and health systems, and there is a large volume of patients in our country with limited access to such services. It is, therefore, essential to assess the impact of the pandemic on all aspects of cancer and thus improve the accessibility and effectiveness of health services to ensure that cancer patients receive adequate care. (23,24)

To fully understand the impact of the pandemic on cancer incidence, it is essential to examine trends in cancer diagnosis before the pandemic. (2,25,26)

Annual cancer statistical reports provide an in-depth view of the burden of this disease in different regions and periods. (14–17,25) These reports also serve as essential reference points to assess possible deviations in cancer incidence due to extraordinary events such as the COVID-19 pandemic.

The health emergency has also brought to light existing disparities in cancer care, especially in vulnerable populations such as ethnic minorities and economically disadvantaged people. These populations may face barriers to accessing cancer screening and treatment services even in the absence of a pandemic. The pandemic has exacerbated these barriers, leading to further delays in cancer diagnosis and treatment.

In summary, the COVID-19 pandemic has had a significant impact on cancer care worldwide. While it has posed challenges and highlighted disparities, it has also stimulated innovation in cancer care. Studies by Terashima et al. in 2022 and Kuzuu et al. (19,20) have shed light on the challenges cancer patients face during the pandemic and the importance of adapting cancer care services to meet their needs.

The annual cancer statistics reports from WHO and other health agencies provide a comprehensive view of cancer incidence, prevalence, and mortality patterns globally and by specific regions. By delving deeper into these trends, we hope to contribute to a better understanding of how public health events can influence the dynamics of a disease as important as cancer.

OBJECTIVES

To assess the incidence of cancer pre and post-Covid-19 pandemic in a Tertiary Hospital. To identify the incidence of the most common types of cancer by comparing 2018 with 2022 in the same hospital.

MATERIAL AND METHODS

This is a descriptive, retrospective, cross-sectional study of biopsies results during 2018 and 2022. The data evaluated were taken from the pathology service's Excel databases at a University Hospital. The total biopsy records of the years in question from a Tertiary Hospital were examined. This database is composed of patient identification data, file number, date, age, and sex of the patient, type of tissue, organ from which the biopsy comes, laterality, type of biopsy, histopathological diagnosis, clinical stage, and immunohistochemical markers.

For the present study, only sex, organ, and histopathological diagnoses of the aforementioned years were examined.

Selection Criteria

Inclusion: Records of patients diagnosed with cancer of any type by biopsy and/or anatomopathological study, men and women of any age, carried out from January to December 2018 and in the same period in 2022, were chosen.

Exclusion

- Records with benign disease.
- Patient samples were evaluated in other years.
- "Ambiguous" records (pre-malignant).
- Samples reported as insufficient, damaged, or indeterminate.

Elimination

- Samples from the same patient were carried out in a different month.

Sample Size

- Census sample

The data was captured, processed, and analyzed using SPSS version 25 for Windows. Descriptive statistics were used with relative frequency and percentages as appropriate to demographic variables such as sex, age, and diagnosis, and subsequently, the results of 2018 and 2022 were compared.

For the analysis, descriptive statistics, frequency values, percentages, and contingency tables, as well as chi-square (Ch2) and odds ratio (OR) tests, were used.

Regarding ethical guidelines, the Bioethics and Research Committee: MF23-00003 UANL University Hospital evaluated and accepted this research.

DATA COLLECTION INSTRUMENT
An Excel Database designed ad hoc for this research will be used:
- Sociodemographic data of the population (Registry, age, sex)
- Type of Biopsy
- Type of Tissue Evaluated
- Type of Neoplasia Found and Current Stage.

RESULTS
A total of 8,804 biopsy results from the two years studied met the inclusion criteria. In 2018, 4,379 results were examined, representing 100% of the biopsy results from that year. Of these, 1,622 were benign specimens, and 2,757 were diagnosed with malignancy.

In 2022, 4,425 were studied (the total for that year), of which 1,209 were diagnosed with benignity and 3,216 were diagnosed with malignancy. The overall results by type of tissue most frequently affected were:

In 2018
Skin was in first place with 556 records or 20.16%, followed by Breast with 284 cases or 10.3%. In third place is Cervix, with 165 cases and 5.98%. In fourth place was the Lymph Node with 162 cases for 5.87%, in fifth place was the Colon with 164 cases for 5.94%, and in sixth place was the Prostate with 119 cases for 4.31%

Regarding 2022
The most affected tissues were: Skin in first place with 544 records or 16.91%, followed by Breast with 230 cases or 7.15%, in third place Cervix with 202 cases for 6.28%, in fourth place Colon with 139 cases for 4.32%, in Fifth place was the Prostate with 124 cases for 3.85%, and in sixth place was the Lymph Node with 110 cases for 4.41% In the Sex Section, a trend towards female sex was observed in both years, with 1616 and 1748 frequencies in contrast to the 1141 and 1468 cases of male sex, respectively.

In 2018, for the Female Sex, the six tissues most frequently affected were: Skin with 286 (17.69%) cases, Breast with 284 (17.57%) cases, Cervix with 165 (10.21%) cases, Uterus with 135 (8.35%) cases, Lymph Node with 84 (5.19%) cases and Colon with 69 (4.27%) cases

In the same period for the Male Sex, the six most frequent issues were:
Skin with 274 (24.01%) cases, Prostate with 119 (10.42%) cases, Colon with 95 (8.32%) cases, Lymph Node with 81 (7.09%) cases, Soft Tissues with 57 (4.99%) cases and Lung with 54 (4.73%) cases

In 2022
For the Female Sex, the most reported tissues were Skin with 276 (15.78%) cases, Breast with 119 (10.42%) cases, Colon with 95 (8.32%) cases, Lymph Node with 81 (7.09%) cases, Soft Tissues with 57 (4.99%) cases and Lung with 54 (4.73%) cases

230 (13.15%) cases, Cervix with 202 (11.55%) cases, Uterus with 86 (4.86%) cases, Thyroid with 71 (4.06%) cases, and Colon with 64 (3.66%) cases.

In this same year, for the Male Sex, the most affected tissues were:
Skin with 268 (18.25%) cases, Prostate with 124 (8.44%) cases, Colon with 75 (5.10%) cases, Lung with 52 (3.54%) cases, Lymph Node with 47 (3.20%) cases and Kidney with 41 (2.79%) cases.

Among the reports, a significant increase in cases of Pancreatic cancer is also highlighted, with a difference of 72% between 2018 (25 cases) compared to 2022 with 43 cases.

The percentage of malignancy between the years compared was 62.95% in 2018 and 72.68% in 2022 (Table 1)

Table 1: Comparative data pre and post-pandemic

YEAR	2018	2022
Biopsies performed	4379	4425
Benign tumors	1622	1209
Malignant tumors	2757	3216
Percentage of malignancy	62.95	72.68
Female malignancy	1616	1748
Male malignancy	1141	1468

The statistical analysis shows a ch2 of 0.001 comparing the incidence of all types of cancer before and after the pandemic, with an Odds Ratio of 1.56 (95% CI of 1.43-1.71) and a Pearson correlation of 95.28 (Table 2). For pancreatic cancer, which had the most significant increase after the pandemic, a ch2 of 0.001 and Odds Ratio of 2.3 (95% CI of 1.40-1.79) were obtained. And for other types of cancer, similar results are observed (Table 2)

Table 2: Statistical correlation of cancer by frequency

CANCER TYPE	Chi2	Odds Ratio	95% CI
All cancer types	0.001	1.56	1.43-1.711
Cervical cancer	0.001	1.64	1.319-2.044
Prostate cancer	0.014	1.39	1.074-2.615
Ovarian cancer	0.028	1.67	1.075-2.615
Brain cancer	0.011	1.69	1.14-2.508
Bone marrow cancer	0.022	1.77	1.106-2.84
Larynx cancer	0.009	2.18	1.23-3.895
Pancreas cancer	0.003	2.11	1.304-3.537

Table 3 shows the results of the most frequent biopsies comparing the year 2018 and 2022

Table 3: Comparative results 2018 – 2022 The most frequent

2018			2022	
ADENOCARCINOMA	635		ADENOCARCINOMA	629
SKIN CANCER	556		SKIN CANCER	544
LYMPHOMA	194		LYMPHOMA	91

BREAST	284		BREAST	230
METASTATIC CARCINOMA	213		METASTATIC CARCINOMA	218
CERVIX	165		CERVIX	202
COLON	164		COLON	139
LYMPH NODE	162		LYMPH NODE	110
UTERUS	135		UTERUS	86
PROSTATE	119		PROSTATE	124
SOFT TISSUE	111		SOFT TISSUE	64
LUNG	99		LUNG	85
THYROID	86		THYROID	83
STOMACH	75		STOMACH	43
LIVER	63		LIVER	61
KIDNEY	63		KIDNEY	61
ASCITES	47		ASCITES	34
UROTHELIUM	47		UROTHELIUM	46
TESTICLE	46		TESTICLE	34
TONGUES	21		TONGUES	21
PENIS	11		PENIS	4
PLEURA	65		PLEURA	39
OVARY	36		OVARY	45
BRAIN	46		BRAIN	58
BONE MARROW	31		BONE MARROW	41
PANCREAS	25		PANCREAS	43
LARYNX	19		LARYNX	31
LEUKEMIA	2		LEUKEMIA	17
Total positive biopsies	2757		Total positive biopsies	3216

DISCUSSION

Although it is relatively recent, some research studies have shed a dim light on how this pandemic has influenced cancer detection and treatment services, highlighting the urgent need to continue evaluating incidence rates during this period. (11,12)

Furthermore, the convergence of diseases such as cancer and public health events such as the SARS-COV-2 pandemic underscores the need to thoroughly analyze their interaction and its implications for healthcare planning and delivery. (9,10)

Over the past few years, hospitals and healthcare facilities have had to prioritize patients infected with COVID-19 and allocate resources to combat this virus, leaving other diseases, including cancer, in second or even third place. (13–17) As a result, cancer patients have faced significant delays in diagnosis and eventually also in their treatment, which may ultimately lead to worse outcomes and higher mortality rates. (7,18–20)

Concerning Leukemias and Lymphomas, the studies in most cases go directly to Hematology, which is why they do not appear in a comparative form in this study. However, a report from this hospital showed an increase in these two pathologies post-pandemic. (27)

CONCLUSIONS

There is an increase in reports of biopsies with malignancy diagnoses comparing a year pre-pandemic with a year post-pandemic.

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Conflict of Interest
The authors declare that they have no conflict of interest.

References

1. Ledford H. Metabolic quirks yield tumor hope. Nature. 2014;508(7495):158–9.

2. Organizacion Mundial de la Salud. Sitio web mundial. Cáncer [Internet]. 2022. Disponible en: https://www.who.int/es/health-topics/cancer#tab=tab_1

3. Jones PA, Baylin SB. The Epigenomics of Cancer. Cell. 2007;128(4):683–92.

4. Gilbertson RJ. Mapping Cancer Origins. Cell. 2011;145(1):25–9.

5. Brau-Figueroa H, Palafox-Parrilla EA, Mohar-Betancourt A. El Registro Nacional de Cáncer en México, una realidad. Gac Mex Oncol. 2020;19(3):107-111.

6. Mazidimoradi A, Tiznobaik A, Salehiniya H. Impact of the COVID-19 Pandemic on Colorectal Cancer Screening: a Systematic Review. J Gastrointest Cancer. 2022;53(3):730-744.

7. Suárez J, Mata E, Guerra A, Jiménez G, Montes M, Arias F, et al. Impact of the COVID-19 pandemic during Spain's state of emergency on the diagnosis of colorectal cancer. J Surg Oncol. 2021;123(1):32–6.

8. Seo SH, Cho S, Yoo SH, Keam B, Shin A. Changes in the Utilization of Health Care Services by Cancer Patients during the COVID-19 Pandemic. Yonsei Med J. 2023;64(7):463.

9. Masroor S. Collateral damage of COVID-19 pandemic: Delayed medical care. J Card Surg. 2020;35(6):1345–7.

10. Zhu H, Wei L, Niu P. The novel coronavirus outbreak in Wuhan, China. Glob Health Res Policy. 2020;5(1):6.

11. Boettcher AN, Hammoud DA, Weinberg JB, Agarwal P, Mendiratta-Lala M, Luker GD. Cancer Imaging and Patient Care during the COVID-19 Pandemic. Radiol Imaging Cancer. 2020;2(6):e200058.

12. Walker MJ, Meggetto O, Gao J, Espino-Hernández G, Jembere N, Bravo C, et al. Measuring the impact of the COVID-19 pandemic on organized cancer screening and diagnostic follow-up care in Ontario, Canada: A provincial, population-based study. Prev Med. 2021;151:106586.

13. Chen RC, Haynes K, Du S, Barron J, Katz AJ. Association of Cancer Screening Deficit in the United States With the COVID-19 Pandemic. JAMA Oncol. 2021;7(6):878.

14. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2019. CA Cancer J Clin. 2019;69(1):7–34.

15. Siegel RL, Wagle NS, Cercek A, Smith RA, Jemal A. Colorectal Cancer statistics, 2023. CA Cancer J Clin. 2023;73: 233–54.

16.	Siegel RL, Miller KD, Fuchs HE, Jemal A. Cancer Statistics, 2021. CA Cancer J Clin. 2021;71(1):7–33.

17.	Siegel RL, Miller KD, Fuchs HE, Jemal A. Cancer statistics, 2022. CA Cancer J Clin. 2022;72(1):7–33.

18.	Jikihara S, Hoshino N, Hida K, Inamoto S, Tanaka E, Matsusue R, et al. Impact of the coronavirus disease 2019 pandemic on gastric and colorectal cancer surgeries: a multicenter epidemiologic study from the Kinki region of Japan. Surg Today. 2024; 54: 86–9

19.	Terashima T, Konishi H, Sato Y, Igarashi M, Yanagibashi T, Konno R, et al. Impact of coronavirus disease 2019 on the number of newly diagnosed cancer patients and examinations and surgeries performed for cancer in Japan: a nationwide study. BMC Cancer. 2022; 22(1):1303.

20.	Kuzuu K, Misawa N, Ashikari K, Kessoku T, Kato S, Hosono K, et al. Gastrointestinal Cancer Stage at Diagnosis Before and During the COVID-19 Pandemic in Japan. JAMA Netw Open. 2021; 4(9):e2126334.

21.	Rottoli M, Gori A, Pellino G, Flacco ME, Martellucci C, Spinelli A, et al. Colorectal Cancer Stage at Diagnosis Before vs During the COVID-19 Pandemic in Italy. JAMA Netw Open. 2022;5(11):e2243119.

22.	Aboueshia M, Hussein MH, Attia AS, Swinford A, Miller P, Omar M, et al. Cancer and COVID-19: analysis of patient outcomes. Future Oncology. 2021;17(26):3499–510.

23.	Padilla-Raygoza N, Monroy-Torres R, Sandoval-Salazar C, Vera-Becerra LE, Patiño-López ME, García-Campos M, et al. Cancer prevention programmes in Mexico: are we doing enough? Ecancer. 2020;14:1-21.

24.	Ignacio-Ibarra G, Espinoza-Zamora JR, Ramírez-Alvarado AG, Ceballos-López AA. Mieloma múltiple en tiempos de SARS-CoV-2 (COVID-19) en México. Gac Med Mex. 2021;157(Supl 3):S141-S147.

25.	Siegel RL, Miller KD, Jemal A. Cancer statistics, 2018. CA Cancer J Clin. 2018;68(1):7–30.

26.	Zhang Y, Guo Y, Zhang C. A bibliometric study of the top 100 most cited papers on aging and cancer. Medicine. 2023;102:32(e34428).

27.	Riquelme-Heras H, Ramirez-Aranda J, Gutierrez-Herrera R, Sierra-Ayala I, Saenz-Saucedo I, Nielsen-Fonseca S, et al. Comparison of pre and post-pandemic general morbidity in primary care. Am J Med Surg. 2024; 15 (1):31-6.