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The impact of the COVID-19 pandemic on tertiary care cancer center: Analyzing administrative data

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ABSTRACT

Introduction: Patients with cancer need to receive their proper treatment and often cannot wait for their treatment, despite delays due to the COVID-19 pandemic. As a result, many cancer centers have had challenges maintaining their oncological activities.
Objectives: To compare the average hospital management data and indicators in two different periods, with and without the peak of COVID-19 cases, from an important tertiary cancer center in the northeast region of Brazil.
Methods: A retrospective and observational study was performed comparing average hospital administrative data and indicators, between January to March *v* April to June, 2020 exclusively at the Hospital de Câncer de Pernambuco, Brazil.
Results: There were on average a 13% reduction in the chemotherapy administered ($P = .131$), 17% fewer radiotherapy treatments carried out ($P = .043$) and 41% as many oncologic surgeries undertaken ($P = .002$). There was a reduction in the number of sessions of out-patient chemotherapy of 8•6% ($P = .271$) and chemotherapy inpatients of 33% ($P = .038$). Admission of new cases of patients with cancer was reduced by 44% ($P = .007$) during the period analyzed. Ambulatory appointments also decreased by 55% ($P = .004$) and emergency room appointments fell by 7•9% ($P = .495$). The number of hospitalizations was reduced by 36% ($P = .005$) and the occupancy rate decreased by 23•6% ($P = .003$), while the length of individual hospital stays (in days) increased 10•5% ($P = .116$).
Conclusion: We report a reduction in the number of radiotherapy treatments and surgeries performed cancer carried out, ambulatory and emergency appointments, hospitalization and admission of new cases of cancer during peak of COVID-19 in an important public tertiary cancer center in the northeast region of Brazil.

Introduction

The emergence of coronavirus disease 2019 (COVID-19) caused an unprecedented public health challenge worldwide beginning in December 2019 [1]. Globally, as of 1 October 2021, 233,503,524 confirmed cases of COVID-19, including 4,777,503 deaths, had been reported to WHO [2]. In Brazil, from January 3, 2020 to October 1, 2021, 21,399,546 confirmed cases of COVID-19 and 596,122 deaths, had been reported to WHO with Pernambuco, a federation state of Brazil located in the northeast region, a major source of cases [3].

Cancer also remains a serious public health threat worldwide [4], and patients with cancer are considered a high-risk popula-

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tion to acquire infectious diseases, including COVID-19 [5]. Moreover, cancer patients usually develop severe disease when infected with SARS-CoV-2 [6], although it is unclear if cytotoxic chemotherapy worsens the prognosis of cancer patients to coronavirus [7]. Oncologic operations have been reduced during the outbreak of COVID-19 [8], even though patients with cancer often need to receive proper treatment and cannot wait or delay treatment despite the COVID-19 pandemic [9]. Furthermore, during oncologic treatment, patients may require more hospitalization, ambulatory, or emergency appointments, exams, or other procedures [10]. As a consequence, cancer centers have had to carefully structure or organize their capacity to minimize the reduction in new cancer diagnoses and to continue oncologic treatment during the coronavirus pandemic [10].

For cancer centers, maintaining oncologic activities has been challenging [11]. Issues that have arisen during the COVID-19 pandemic have included resource allocation, medication shortage, separation of patients that have tested positive or negative for COVID, establishing clear communication between staff, patients, and their relatives, giving medical and psychological support for many health professionals that are infected or ill, and quickly hiring new professionals [10,12]. It has thus not been surprising that the capacity of oncologic care in cancer centers has been considerably affected during the pandemic [12].

The aim of this study was to evaluate routine services for new cases admitted, ambulatory and emergency visits, hospitalizations and the kind of oncologic treatment offered between January 1 to June 30, 2020, through as difficult period in a tertiary cancer center in the northeast region of Brazil.

Methods

A retrospective and observational study was performed evaluating hospital management data and indicators, between January 1, up to June 30, 2020, exclusively at the Hospital de Câncer de Pernambuco (HCP). HCP is in Recife city, Brazil and is a reference institution for the prevention, diagnosis and treatment of cancer. HCP receives patients from different cities from the state of Pernambuco.

HCP is a non-profit oncologic health institution, founded 74 years ago, whose hospital care is only provided free of charge within Brazil's Unified Public Health System, to patients who are not insured. It has 250 beds, and during the study period, this hospital was not considered for referrals for diagnosis and treatment of COVID-19, albeit it diagnosed and treated patients with cancer and COVID-19. The hospital has an emergency room, critical care units, operating room, image (ultrasound, X-ray and tomography) service, radiotherapy sector, chemotherapy sector, clinical laboratory, pharmacy sector, wards, ambulatory sector and teaching and research departments.

The first two cases of COVID-19 in Pernambuco were reported on the same day March 12, 2020, by both the state and municipal health department of Pernambuco. The peak of cases in the state was reported between April to June and was evaluated in this study. Thus, hospital management data from January to March - considered a period of normal assistance for cancer patients - was used as a comparison period.

To evaluate the impact of COVID-19 at HCP the following variables were collected: the average number of new cases admitted to HCP, the number of general ambulatory appointments, the number of emergency visits, the number of hospitalizations, the length of stay, occupancy rate, number of surgeries performed and chemotherapy and radiotherapy sessions. These variables were harvested for each month between January to March (comparison period) and compared to the average of each variable from April to June (pandemic period).

Statistical analysis

The Statistical Package for the Social Sciences, version 23.0, was used in the statistical analysis. A descriptive analysis was performed using mean and standard deviation (± SD) for each numeric variable analyzed. The student *t* test was used to identify differences between groups for continuous data. Differences were considered statistically significant when *P*-values were <.05. A relative percentage change was calculated by dividing the change from the first to the second trimester by the figure in the first trimester x 100.

Ethics

Ethical committee approval was not required, because only hospital management data and indicators were used, as stipulated in resolution 466/2012 of the Brazilian National Health Council. Patients' data were not evaluated.

Results

During January 1 to June 30, 2020, no beds, wards, sectors or departments were closed. One critical care unit with ten beds and one COVID-19 ward with 14 beds were adapted for patients with a diagnosis of cancer suspected or confirmed to have COVID-19. If this ward and/or critical care unit was full, patients suspected or confirmed could be transported to another COVID-19 reference hospital. Our oncology team created restricted access to caregivers and relatives of inpatients in the hospital and banned gatherings. Personal protective equipment was available for all health professionals who were working in COVID-19 sectors, including hydroalcoholic hand wash solutions, proper scrubs, or gowns, N95 masks, gloves and eye protection.

Oncologic treatment

Priority was given to avoid interruptions or delay to start chemotherapy and radiotherapy. Medical staff could decide together with the patient to carry out, postpone or cancel their surgical treatment. Comparing the period of April-June with January-March the chemotherapy administered was reduced on average 13% ($P=.131$), 17% fewer radiotherapy sessions were undertaken ($P=.043$), and 41% less oncologic surgeries performed ($P=.002$). Analyzing data of ambulatory chemotherapy also showed a reduction in the number of sessions by 8.6%, but this was not statistically significant ($P=.271$), albeit the number of chemotherapy inpatients decreased by 33% ($P=.038$) (Table 1).

Oncological triage

New patients admitted with a diagnosis of cancer fell by 44% ($P=.007$) during the period analyzed. Ambulatory appointments also decreased by 55%, and this was statistically significant ($P=.004$). Emergency room appointments also fell by 7•9% ($P=.495$) (Table 1).

Hospital indicators

The number of hospitalizations was also evaluated and found to be reduced by 36% ($P=.005$), while occupancy rate decreased by 23.6% ($P=.003$) between April to June compared to January to March. The length of hospital stays (in days) increased 10.5% ($P=.116$) (Table 1).

Table 1
Administrative data between January to June 2020 from the hospital de Câncer de Pernambuco, Brazil.

	2020 – Comparison period			*Average*	2020 – Peak COVID–19			*Average*	RPC* (%)	*P* value**
	January	February	March		April	May	June			
Oncologic treatment										
Total chemotherapy	3,718	3,071	3,512	3,433.7	3,217	2,736	3,005	2,986.0	−13	.131
Ambulatory chemotherapy	3,008	2,498	2,920	2,808.7	2,695	2,360	2,648	2,567.7	−8.6	.271
Inpatient chemotherapy	710	573	592	6,250	522	376	357	4,183	−33.1	.038
Radiotherapy	164	138	165	1,557	125	129	133	1,290	−17.1	.043
Surgery	642	607	586	6,117	339	317	418	3,580	−41.5	.002
Oncologic triage										
New cases admitted	679	609	545	6,110	300	314	410	3,413	−44.1	.007
Ambulatory appointments	9,270	8,644	8,032	86,487	4,772	4,298	2,447	38,390	−55.6	.004
Emergency room appointments	1,445	1,208	1,239	12,973	1355	1,256	975	11,953	−7.9	.495
Hospital indicators										
Number of hospitalizations	1,084	926	932	9,807	634	558	688	6,267	−36.1	**.005**
Occupation rate (%)	7,384	7,104	7,064	718	5,726	5,011	5,761	550	−23.6	**.003**
Length of hospital stay (in days)	616	591	657	62	711	669	674	68	+10.5	.116

* RPC = relative percentage change.
** Differences were considered statistically significant when *P*-values were <0.05.

Discussion

By comparing data of different oncologic treatments administered at HCP from January-March with that of April–June 2020, we found a significant reduction in the demand for oncology care. From the patient's perspective, this study showed that chemotherapy sessions were maintained during the peak of COVID-19, but the number of surgeries and radiotherapy sessions were reduced significantly. Moreover, there was a significant decrease in the number of ambulatory appointments and the number of admissions of patients with a new or established diagnosis of cancer. From the perspective of the hospital, there was an important reduction in oncologic procedures with an obvious impact on the indicators that generate revenue for the institution.

During the COVID-19 pandemic, oncologic treatment could be offered or postponed [10]. This has become an important dilemma for oncologists. The risk of developing COVID-19 during treatment or progression of cancer could happen if the treatment is delayed. In this study, the number of radiotherapy treatments and surgeries performed for cancer were reduced significantly, but this was not the case for chemotherapy. Chang et al. also reported a decreased number of oncologic surgeries [8]. A cohort of patients with cancer and COVID-19 were identified, and amongst these increased age, male gender, smoking status, low performance status and active cancer were negative prognostic factors. However, the type of anticancer therapy and recent surgery were not associated with mortality [5,7]. Delaying treatment of cancer also could reduce survival and quality of life [9], including for patients needing surgical interventions [13]. Thus, keeping ongoing anticancer therapy for advanced stages and/or curative intentions benefits patients [14].

Oncologic surgery often gives patients with a diagnosis of cancer the best chance of cure, but elective surgical procedures in stable cancers should be postponed [11]. Kutikov et al. has suggested recommendations which can be used to guide the best moment to delay cancer treatment, or not. Especially for surgery, non-melanoma skin cancer, low or intermediate risk prostate cancer, type 1 endometrial cancer, most thyroid cancer, stage IA1 cervical cancer, low grade urothelial cancer, HER-2 negative breast cancer and others can be delayed [15]. In HCP, surgical procedures involving thyroid cancer, non-melanoma skin cancer and gynecologic are very common, and were one of reasons for the reductions in the number of elective surgeries during the COVID-19 pandemic. Moreover, intensive care beds reserved for assisting complex surgeries of patients with cancer were transformed into COVID-19 beds for patients with associated critical illness. Third, the operating room team was reduced because many health professionals were away from work due to illness or were of an age and/or had comorbidities considered high-risk to develop COVID-19. Finally, many patients treated in HCP are from the rural areas of Pernambuco, whose travel or mobility was dramatically reduced during the outbreak.

HCP had hoped to avoid suspensions or delays in the administration of radiotherapy and chemotherapy however this study showed a reduction in the number of radiotherapy and chemotherapy sessions. This occurred despite the institution of new radiotherapy strategies to reduce the risk of patients with cancer becoming infected [9,10]. Shorter treatments courses and avoidance of twice-daily radiotherapy was done to minimize ambulatory appointments. Cytotoxic chemotherapy was not included because it was feared patients would be more susceptible to die of coronavirus infections [7]. Additionally, educational calls and guidance campaigns were offered to patients and family members to encourage patients to continue oncologic treatment during the pandemic. Vacations by health professionals were postponed and new health professionals were hired. There was no drop in the availability of cytotoxic drugs used by oncologists during this period. Despite this, ambulatory consultations fell by 55%, while the number of hospitalizations fell by 36% and the number of chemotherapy inpatients decreased by 33%.

The fall in the number of hospitalizations was driven in part by 44% fewer admissions to HCP for new cases of cancer during the outbreak, meaning fewer patients were diagnosed and treated in this period. Similar difficulties have been reported worldwide (Table 2) We anticipate that in the ensuing months after the outbreak, we will likely see an increased number of appointments or hospitalizations of patients with new diagnoses of cancer, but with histories of symptoms of longer duration.

From the hospital's perspective, the financial management and stability of the cancer center was very difficult during the COVID-19 pandemic. As an institution, the financial situation of a hospital requires maintaining the production of oncologic services. Furthermore, many hospitals with limited financial capacity and flexibility, needed to divert resources to address the increased number of COVID-19 cases [34]. This study demonstrates that many of the interventions that generate revenue were significantly reduced possibly affecting the quantity and quality of oncologic assistance in this pandemic period, a possibly in the future. This will likely require robust and sustained financial support by the government to avoid further delays or cancellation of oncologic assistance.

This study has some limitations. First, the analysis was retrospective. Second, data was from just one Cancer Center, which cannot be generally representative. Finally, the cancelled or de-

Table 2
Impact of COVID-19 pandemic on the diagnosis of cancer across the world.

Author, Publication Month / [Country]	Summary of study and results	Author conclusions
Asai et al, [16] MAR2020 [Ontario, Canada]	• Examined skin biopsies performed in Ontario from January 6, to September 27, 2020, compared to same period for 2019 • Total skin biopsies, and biopsies for keratinocyte carcinoma (KC) and melanoma were 15%, 18% and 27% of expected, respectively, with the onset of COVID-19 cases ($P < .01$). • In adjusted analysis, those >80 yr age, females and residents of certain regions were less likely to be biopsied during the pandemic. • Despite substantial improvements in biopsy rates, compared to 2019, 28 weeks after lockdown there remained a large backlog of expected cases - 45,710 all biopsy, 9,104 KC, 595 melanomas.	"This will have implications for downstream care of skin cancer"
Gurney et al, [17] MAY20 [New Zealand]	• Compared to 2018–2019, 40% decline in cancer registrations during New Zealand's national shutdown in March-April 2020 • Numbers increased to pre-shutdown levels over subsequent months • Minimal impact on cancer surgery and medical oncology, but 8% decrease in radiation therapy attendances	"The impact of COVID-19 on cancer care in New Zealand has been largely mitigated".
Dinmohamed et al, [18] JUN2020 [Netherlands]	• Data for February 24-April 12, 2020, obtained from the nationwide Netherlands Cancer Registry based on initial case ascertainment through pathological cancer notifications from the Nationwide Network of Histopathology and Cytopathology • Analysis found notable decrease in cancer diagnoses compared with period before COVID-19 outbreak.	"Collectively, fewer cancer diagnoses in the COVID-19 era will result from patient, doctor, and system factors"
Kristiansen et al, [19] JUL2020 Faroe Islands [Denmark]	• The Faroe Islands are a self-governing nation under the external sovereignty of the Kingdom of Denmark, population 52,500 • During 2020, there were 547 cases diagnosed with COVID-19 in the Faroe Islands, no other impact	"The main reason for our findings is likely to be the timely and reactive handling of the COVID-19 epidemic in the Faroe Islands"
Maringe et al, [20] JUL2020 [United Kingdom]	National population-based modelling study, using linked English National Health Service (NHS) cancer registration and hospital administrative datasets for patients aged 15–84 yr, diagnosed with breast, colorectal, and esophageal cancer Number of patients: Breast cancer, 32,583; Colorectal cancer, 24,975; Esophageal cancer, 6,744; Lung cancer, 29,305 Estimated additional deaths in5yrdue to delay in diagnosis: Breast, 7.9%–9.6%; Colorectal cancer, 15.3%–16.6%; Lung cancer, 4.8%–5.3%; Esophageal cancer, 5.8%–6.0% Estimated total additional YLLs across these cancers = 59,204–63,229 yr	"Substantial increases in the number of avoidable cancer deaths in England are to be expected as a result of diagnostic delays due to the COVID-19 pandemic in the UK"
London et al, [21] JUL2020 [Global]	TriNetX platform to analyze 20 health care institutions with relevant, up-to-date encounter data. Compared cancer cohorts from January-April 2019 and January-April 2020. Data from a UK institution similarly analyzed. Significant decline in cancer encounters in all cohorts explored Largest decrease in the number of encounters in April 2020 Melanoma, -51.8%; Prostate cancer, -49.1%; Breast cancer, -47.7%; Hematologic cancer, -39.1%; Colorectal cancer, 39.9%; Lung cancer, -39.1%. Cancer screenings declined drastically: Breast cancer, -89.2% and Colorectal cancer, -84.5%	"Significant decrease in all cancer-related patient encounters because of the pandemic. The steep decreases in cancer screening and patients with a new incidence of cancer suggest the possibility of a future increase in patients with later-stage cancer being seen initially"
Park et al, [22] OCT2020 [Korea]	• During pandemic, number of pulmonary consultations fell 16% from previous year • Adaptations made to minimize delays in lung cancer diagnosis resulted in comparable number of lung cancers diagnosed • Despite this, the proportion of patients with stage III-IV non-small-cell lung cancer (NSCLC) increased significantly from 57.9%, 66.7%, and 62.7%, in 2017, 2018 and 2019, respectively to 74.7% in 2020 ($p = 0.011$).	"The proportion of patients with advanced NSCLC increased during the COVID-19 pandemic"
Patt et al, [23] NOV2020 [United States]	Large medical claims clearinghouse database representing 5%–7% of the Medicare fee-for-service population Substantial ↓ in cancer screenings visits, therapy, and surgeries during March-July 2020, in comparison with baseline period March-July 2019 At peak of pandemic in April, screenings for breast, colon, prostate, and lung cancers were ↓ by 85%, 75%, 74%, and 56%, respectively. Hospital outpatient evaluation/management visits -74% in April 2020 New patient evaluation/management visits -70% in April 2020 Established patient evaluation/management visits -60% in April 2020 Mastectomies ↓ in April-July 2020 Colectomies ↓ in April-May 2020 Prostatectomies ↓ April and July 2020	"The current impact of the COVID-19 pandemic on cancer care in the United States has resulted in decreases and delays in identifying new cancers and delivery of treatment. These problems, if unmitigated, will increase cancer morbidity and mortality for years to come"
Suárez, [24] JAN2021 [Spain]	Evaluated impact of COVID-epidemic in colorectal cancer (CRC) diagnosis during Spain's state of emergency by comparing newly diagnosed patients with patients diagnosed in same period of 2019. • New CRC diagnosis ↓ 48% with a higher rate of patients diagnosed in the emergency setting (12.1% *v* 3.6%; $P = .048$) and a lower rate diagnosed in the screening program (5.2% *v* 33.3%; $P = .000$).	"Fewer patients have been diagnosed with CRC, with a higher rate of patients diagnosed in an emergency setting".

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Table 2 (*continued*)

Author, Publication Month / [Country]	Summary of study and results	Author conclusions
Jacob et al, [25] JAN2021 [Germany]	• Retrospective study investigating the impact of COVID-19 pandemic on cancer diagnosis in general and specialized practices in Germany • The number of new cancer diagnoses per general practice ↓ significantly between March-May 2020 compared with March-May 2019 (-12.0%, -27.6%, and -23.4% in March, April, and May, respectively) • Similar trend observed in specialized practices, and more pronounced in April 2020 (dermatology: -44.4%, gynecology: -32.0%, and ENT: -28.2%) • Significant ↓ found in almost all sex and age groups • ↓ in new cancer diagnoses particularly pronounced among cancers of the skin, respiratory and intrathoracic organs	"The COVID-19 pandemic had a significant negative impact on cancer diagnosis in Germany"
Marques et al, [26] JAN2021 [Brazil]	• The study aimed to examine cancer diagnosis in Brazil regulated by the National Cancer Prevention and Control Policy, provided by Brazilian Unified Health Care System (SUS) • Average number of cancer diagnoses ↓considerably in all Brazilian Regions • The number of new cancer cases fell in all regions, from −24.3% in the North to −42.7% in Northeast region • The overall Brazilian average deficit reached 35.5%, corresponding to about 15,000 undiagnosed cases of cancer monthly	"The pandemic period dramatically reduced the diagnosis of new cases of cancer in Brazil, since consultations in public health services were compromised by restrictive measures"
De Vincentiis et al, [27] MAR2021 [Italy]	Evaluated impact of COVID-19 pandemic-related delay in the diagnosis of major cancers at a Pathology Unit of a Secondary Care Hospital Network in Italy by comparing number of first cellular pathological diagnoses of malignancy made from the 11th to 20th week of the years 2018–2020.Cancer diagnoses fell in 2020 by 39% compared with 2018 and 2019 averages. • ↓of 75%, 66% and 62% were seen in prostate, bladder, and colorectal cancers, respectively with the latter identified as carrying a potentially important diagnostic delay	Advise "CRC corrective procedures including continuing mass screening tests; patient triage by family physicians; diagnostic procedures alternative to colonoscopy; predictive evaluation on biopsy samples
Bakouny et al, [28] MAR2021 [United States]	• Study comprised four 3-mo periods: March 2-June 2, 2020 (peak pandemic), and 3 control periods including December 1, 2019-March 2, 2020; March 2-June 2, 2019, and June 3-September 3, 2020). • Screening procedures: Low-dose computed tomography, Papanicolaou test, colonoscopy, prostate-specific antigen screening, or mammography Screening and ensuing diagnoses ↓ during pandemic periodPeak pandemic period: 15,453 patients (1,985 ensuing diagnoses); Control periods: 51,944 patients (3,190 ensuing diagnoses), 64,269 patients (3,423 diagnoses) and 60,344 patients (2,961 ensuing diagnoses)Percentage of positivity of screening tests appeared higher during the peak pandemic period compared with the 3 control periods for mammography (4.1% *v* 1.9%–2.3%), prostate-specific antigen (22.7% *v* 9.9%–13.2%), colonoscopies (1.3% *v* 0.7%–0.9%), and Papanicolaou tests (11.6% *v* 6.5%–10.0%), but not for low-dose computed tomography scans (0.8% *v* 0.7%–0.8%).Percentage decreases in diagnoses also ↓−19% to −78%	"This study reports a significant decrease in the number of patients undergoing screening tests for cancer and in the number of ensuing diagnoses of cancerous and precancerous lesions during the COVID-19 pandemic in 1 health care system in the Northeastern United States. Importantly, the number of potential "missed" diagnoses during the peak pandemic period were likely lower than would have been expected because the percentage of screening tests leading to a diagnosis of a cancerous or precancerous lesion was higher"
Eijkelboom et al, [29] APR2021' [Netherlands]	Women included in the Netherlands Cancer Registry and diagnosed during four periods in weeks 2–17 of 2020 were compared with reference data from 2018/2019 (averaged). Comparing 2020 to 2018/2019 incidence of breast cancer declined across all age groups and tumor stages (except stage IV) Treatment was likewise impaired: DCIS less likely to be treated within 3 mo (OR, 2.04–2.18) Invasive tumors less likely to be treated initially by mastectomy with immediate reconstruction (OR, 0.52) or by breast conserving surgery (OR, 0.75) Chemotherapy less likely if diagnosed in beginning of study period (OR, 0.59–0.66), but more likely if diagnosed at end (OR, 1.31) Primary hormonal treatment more common (OR, 1.23–3.01). Only women diagnosed in weeks 2–8 of 2020 experienced treatment delays.	**"**The incidence of breast cancer fell in early 2020, and treatment approaches adapted rapidly. Clarification is needed on how this has affected stage migration and outcomes"
Yabroff et al, [30] JUN2021 [United States]	• Examined changes in patterns of cancer diagnosis and surgical treatment between January 1-December 31, 2020 and 2019 using electronic pathology report data from Surveillance, Epidemiology, and End Results (SEER) population-based cancer registries from Georgia and Louisiana. • 29,905 fewer pathology reports were found in 2020 than in 2019, representing a 10.2% decline. • Declines similar by cancer site and observed in all age groups, including children and adolescents <18 yr. • Patterns of declines like those reported elsewhere with the greatest differences being 42.8 fewer report in April 2020 relative to April 2019, the first peak in COVID-19 mortality rates with declines in August, November, and December coinciding with later peaks in COVID-19 mortality rates • Numbers of reports through December 2020 never consistently exceeded those in 2019 after first declines	"Findings suggest substantial delays in diagnosis and treatment services for cancers during the pandemic"

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Table 2 (*continued*)

Author, Publication Month / [Country]	Summary of study and results	Author conclusions
Kempf et al, [31] JUN2021 [Paris, France]	• Prospectively collected clinical data of 11.4 million patients referred to the Assistance Publique Hôpitaux de Paris Hospital • Identified new cancer cases and compared indicators for 2018 and 2019 to 2020 with a focus on French lockdown (March 17 to May 11, 2020) across cancer types and patient age classes. In Paris, new cancer cases:33% lower in March–May 2020 than in 2018–2019.19% lower in June–September 2020 than in 2018–2019. — Had median of 1949/mo (IQR 1586; 2045) from. January–September 2020 — ↓consistent across all tumor types: −30% and −9% for colon cancer, −27% and −6% for lung cancer, −29% and −14% for breast cancer, −33% and −12% for prostate cancer. — For patients <70 yr, the ↓ of new colorectal and breast cancers in 2020 reached 41% and 39%, respectively compared to April 2018 and 2019 averages	The SARS-Cov2 pandemic led to a substantial decrease in new cancer cases. Delays in cancer diagnoses may affect clinical outcomes in the coming years.
Vrdoljak et al, [32] JUL2021 [Croatia]	Retrospective, population- and registry-based study comparing the number of patients newly diagnosed with breast cancer in Croatia in 2020 to those diagnosed in 2017, 2018, and 2019. The outcome was the change in number of newly diagnosed breast cancer cases. Average monthly percent change after initial lockdown measures introduced was -11.0% (95%CI -22.0% to 1.5%), resulting in a 24% reduction of newly diagnosed breast cancer cases in Croatia during April-June 2020 compared with same period of 2019. However, only 1% fewer new cases were detected during all of 2020, than in 2019, or 6% fewer than expected based on the linear 2017-2019 trend	"National health care system measures for controlling the spread of COVID-19 had a detrimental effect on the number of newly diagnosed breast cancer cases in Croatia during the first lockdown. However, the effect weakened after the first lockdown and COVID-19 control measures were relaxed, and it has not reoccurred during the second COVID-19 wave" … with the oncology health care system compensating by the end of 2020.
Kaufman et al, [33] AUG 2021 [United States]	Cross-sectional study included patients across the United States tested at Quest Diagnostics for any cause from January 2018-March 2021, and whose ordering physicians assigned *International Statistical Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM)* diagnosis codes associated with any of 8 cancer typesStudy included 799,496 patients (45% women) Mean monthly number of patients with newly identifiedcancer • Pre-pandemic[January 2019–February 2020]: All eight cancers (32,407); Prostate (13,214); Breast (9,583); Colorectal (4,101); Lung (3,015); Pancreatic (1,177); Cervical (493); Gastric (415); Esophageal (409) • First pandemic period [March–May 2020]: All eight cancers (22,748. -29.8%); Pancreatic (927, -21.2%); Breast 6,122, (-36.1%) Second pandemic period [June–October 2020]: All eight cancer: 29,304 (-9.6%) and statistically the same level as in pre-pandemic for all cancers exceptThird pandemic period [November 2020–March 2021]: All eight cancers 26,204 (-19.1%) remained significantly lower compared with pre-pandemic period for all cancers; however, magnitude of declines lower than during the first period	Significant decline in newly identified patients with 8 common types of cancer in the first and third pandemic periods (winter months) but not in the second period (summer months). Because the number of newly identified patients with cancer in the third pandemic period did not exceed the pre-pandemic value, many cancers may remain undiagnosed.
Costa et al, 2021 (This Study) [Brazil]	• 44% fewer admissions to Hospital de Câncer de Pernambuco, Brazil (HCP) for new cases of cancer during the outbreak	Anticipate in the ensuing months after the outbreak, an increased number of appointments or hospitalizations with new diagnoses of cancer, but with histories of symptoms of longer duration

HR = hazard ratio; CI = confidence interval; CRC = colorectal cancer; IQR = inter-quartile range; OR = odds ratio; YLL = years of life lost.

layed oncologic treatments of each patient were not individually assessed, preventing a more reliable analysis. However, the study was based on hospital management data and indicators from an important tertiary cancer center responsible for the majority of oncology cases in the state of Pernambuco in Brazil.

The information obtained in this study can be valuable for understanding and coping with the current impact of the pandemic for both the patient and oncology institutions in Brazil. Consequently, the information can be used for planning and implementation of public health policies and to ensure financial support guarantees prevention, diagnosis and appropriate oncologic treatment during a pandemic. Finally, this data also could support oncologic management in a future epidemic or pandemic.

In conclusion, this study showed a reduction in the quantity of oncologic radiotherapy and surgeries performed, ambulatory and emergency appointments, and hospitalizations and admission of new cases of cancer in an important tertiary cancer center during the peak of cases of COVID-19 in the northeast region of Brazil, despite instituting measures to avoid a fall in the quantity and quality of cancer care and in the billing of the health institution.

Conflicts of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. The authors declare no conflict of interest regarding this subject.

CRediT authorship contribution statement

Guilherme Jorge Costa: Conceptualization, Methodology, Formal analysis, Software, Project administration. **Hélio de Araújo Fonseca Júnior:** Investigation, Data curation, Writing – original draft. **Fábio Costa Malta:** Visualization, Investigation. **Felipe Costa Leandro Bitu:** Supervision, Software, Data curation. **Claudia Barbosa:** Software, Validation. **Josenildo de Sá:**

Software, Validation, Investigation. **André Amarante:** Visualization, Investigation. **Luiz Claudio Santos Thuler:** Methodology, Formal analysis, Writing – review & editing.

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