Review of the Impact of COVID-19 First Wave Restrictions on Cancer Care

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Summary

The COVID-19 pandemic led to wide-scale global disruption of cancer care across a broad range of cancers. Sixty-nine studies from 23 countries report changes in the patterns of screenings, diagnoses, waiting lists and treatments for cancer related to restrictions during the COVID-19 pandemic in 2020. Fourteen studies report an increase in later-stage cancer presentations. Future restrictions should consider the disruptions to cancer care pathways and plan to prevent the unnecessary harms.

Introduction

The COVID-19 pandemic created widespread global disruption to health, education, and economies - both directly due to the illness and indirectly due to government interventions. The interventions comprise various restrictions that aimed to contain the effects of the virus.[1] There have been concerns that such restrictions that affect healthcare may adversely affect non-COVID care.

Cancer is a leading cause of deaths worldwide, accounting for nearly ten million deaths in 2020.[2] Up to half of cancers could be prevented by effective prevention strategies, particularly through avoiding risk factors, better early detection and use of appropriate evidence-based treatments.[2] We, therefore, sought to synthesise the evidence that assessed the effects of restrictions on cancer care that were applied in 2020 compared to pre-pandemic levels.

Methods

For this search, we restricted the results to peer-reviewed articles using the LitCovid database. LitCovid is a curated literature hub for tracking up-to-date scientific information about SARS-CoV-2. We searched for cancer and various terms/phrases associated with cancer care, e.g. delayed diagnosis, screening, waiting lists. We screened the title and abstract for inclusion, then extracted data on the country, the type of cancer, the study type, the methods, and the main results. We formally assessed quality as all studies involved a retrospective review of records, an active lockdown phase and a historical pre-pandemic control period for comparison. We did not formally assess the quality of the observational studies included in the review.

Results

We found 69 published studies that compared changes in the patterns of screenings, diagnoses, waiting lists and treatments for cancer during the pandemic period in 2020 with pre-pandemic levels. Studies were conducted in 23 countries: Austria, Cameroon, Canada, Croatia, Denmark, Hong Kong, Korea, Japan, Poland and Slovenia (n=1 study each); France, Germany, India, Portugal and Taiwan (n=2 studies each); Brazil, China, The Netherlands and Spain (n=3 studies each); Turkey (n=4); UK (n=9); Italy (n=10); and US (n=14).

We found analyses for the following types of cancer: eye, gynaecological, liver, lung, maxillofacial, radiotherapy and surgical cancer delay (n=1 study each); cervical, screening programmes and urology (n=2 studies each); head & Neck and lung (n=3 studies each); skin and oral (n=4 studies each); breast (n=7) that include breast & colorectal and breast/gynaecological studies cancer diagnosis (n=7); colorectal (n=9) and 14 studies that analysed all cancer types. We found three studies specifically done in paediatric populations, including solid tumours and leukaemia. Fourteen studies report an increase in

later-stage cancer presentations (See the table of included studies).

All Cancers

Reductions were reported in screening attendance, diagnostics, treatments, and deaths across various cancers during the pandemic's first wave in 2020 (individual study periods are reported in the table) and in some cases after the lifting of restrictions. In the US, large reductions in cancer registrations were observed for breast (-48%); prostate (-49%); melanoma (-48%); lung (-39%); colorectal (-40%), and hematologic cancers (-39%) across twenty health care institutions covering more than 28 million patients[London JW 2020]. Weekly numbers of ICD codes for six cancers combined (breast, colorectal, lung, pancreatic, gastric, and oesophagal) fell by 46% (4310 to 2310). In a further US study, significant decreases were seen for all cancers, ranging from 25% for pancreatic cancer to 52% for breast cancer[Kaufman 2020]. At the largest cancer centre in southern Brazil, a 42% reduction in first-time appointments was reported during the pandemic (from the onset of the outbreak to the end of June) compared to the same period in the previous year[Nabhen JJ 2020]. In the Netherlands, after six weeks (between 24 Feb 2020, and 12 Apr 2020), there was a 26% reduction in all cancers registered. The effect was seen across all ages, all geographical regions and almost all cancer sites[Dinmohamed AG 2020]. Incident-first cancer diagnoses ascertained from Danish national registries estimated a reduction in 2020 of approximately 800 incident cancers in March, 900 in April, and 1,200 incident cancers in May [Skovlund CV 2020]. In India, the number of radiotherapy treatments dropped by almost 40% in the first month of the lockdown and operations by 80%. Cancer incidence rose after the containment period in France as the number of newly diagnosed and referred patients increased by 11% during containment (from 16 Mar to 10 May 2020) and 50% just after [Penel N 2021]. The Portuguese Oncology Institute of Porto reported that during follow-up to 31 October, higher adjusted hazards of death were seen for Stage III cancer and for those undergoing surgery or receiving radiotherapy[Morais S 2021].

Cancer Diagnosis

In Italy, cancer diagnoses the 11th to the 20th week of 2020 by 39% compared with the average in 2018 and 2019. Prostate cancer (75%), bladder cancer (66%) and colorectal cancer (62%) had the most significant decreases [De Vincentiis L 2020]. Similar results were reported in seven pathology units in northern-central Italy, where cancer diagnoses fell by 45% compared with 2018 and 2019 [Ferrara G 2020]. Data from the Netherlands reported a decrease of 20% to 40% in the number of registered cancer diagnoses, including falls in lung cancer by 23%, head-neck cancer by 36%, and haematological cancers by 26% [Uyl-de Groot CA 2020]. In the UK, national, regional, and procedure-specific analyses reported activity during the COVID restrictions reduced to 12% of pre-COVID levels, a drop of 88%. At the low point, activity was 5% of the normal, and the weekly number of cancers detected decreased by 58%[Rutter MD 2020]. In Germany, new cancers diagnosed per general practice decreased by 12% in March, 28% in April, and 23% in May compared with the previous year[Jacob L 2021}. US Data from a medical claims database representing 5 to 7% of the Medicare fee-for-service population reported that at the pandemic peak in April, screenings for breast, colon, prostate, and lung cancers were lower by 85%, 75%, 74%, and 56%, respectively. Billing for top physician-administered oncology products decreased by 26% in April and 31% in Jul y[Patt D 2020].

Breast Cancer

NHS England Cancer Waiting Time data showed suspected breast cancer referrals were 28% lower in the first six months of 2020 compared to 2019. The number receiving their first treatment for a breast cancer diagnosis was 16% lower in the first wave of restrictions[Gathani T 2021]. Community breast imaging facilities in North Carolina reported maximum reductions in March for screening and diagnostic

mammography and in May for biopsies. This deficit decreased gradually, with no significant difference observed by July for diagnostic mammography and August for screening mammography and biopsy[Nyante SJ 2021]. In Taiwan, a national screening database compared screenings and recall rates for January to April with the same period in 2019 and reported screenings decreased by 22%[Tsai H-Y 2020]. Waiting times between biopsy/cytological examinations were found to be shorter during the pre-pandemic period in Italy [Vanni G 2020]. Furthermore, mammography and colonoscopy rates among commercially insured US adults declined by approximately 95% in April and took till July to rebound to normal levels[Tsai H-Y 2020]. Breast cancer surgery was also reported to be decreased in the Hubei province in China during the lockdown phase[Li J 2020].

Cervical Cancer

From mid-March until the end of April 2020, the screening unit of Dschang cervical cancer primary screening programme in Cameroon was closed. The number screened dropped by almost 80% compared with 2019. Electronic medical records of women enrolled in Kaiser Permanente in the US showed screening rates in women aged 21 to 29 were 78% lower during and 29% lower after the stay-at-home order. For women aged 30-65, screening rates were 82% lower during and 24% lower after the stay-at-home order was lifted. Decreases were found to be similar across all racial and ethnic groups.

Colorectal Cancer (CRC)

In Spain, new diagnoses of CRC decreased by 48%[Suárez J 2021]. Data extracted from four NHS England population-based datasets reported a 63% reduction (from 36 274 to 13 440) in monthly 2-week referrals for suspected cancer and a 92% reduction in colonoscopies (46 441 to 3484) in April compared with the corresponding month in 2019. Numbers just recovered by October 2020[Morris EJA 2021]. In Japan, an analysis of colorectal patients showed no changes in the numbers who underwent surgery at a regional cancer treatment centre. However, the incidence of complete obstruction more than doubled, and the number of patients with advanced pathological stages tended to increase compared with before the emergency[Mizuno R 2020]. Screening uptake in the National Taiwan University Hospital was reduced by 89% compared with the corresponding period of the past three years. The colonoscopy rate was 66% lower during the emergency[Cheng S-Y 2020]. The Italian Society for Study of Esophageal Diseases (SISME) conducted a national survey to evaluate changes in oesophageal cancer management. Overall the number of resections did not decrease; however, a higher rate of open resections was observed, and surgery was delayed in one-third of patients primarily due to shortage of anesthesiologists and use of intensive care beds for COVID-19 patients[Rebecchi F 2020].

Head & Neck Cancer

A comparison of head and neck cancer diagnoses in Florence, Italy, between April and May, reported a three-fold increase in advanced cancer stages diagnoses compared with last year (64% vs 22%). Non-surgical treatment indications almost doubled for same stage cases[Mannelli G 2020]. A review of patients presenting at a multidisciplinary tumour conference in the US reported a 25% reduction in newly diagnosed malignancies. The primary tumour size was significantly larger, and the T stage was more advanced for mucosal subsites in the COVID-19 group[Kiong KL 2021]. Medical records of 61 patients diagnosed and scheduled for surgery in a tertiary care centre in Turkey compared with 64 patients treated in the same institution at the same time of 2019 reported the rate of advanced tumours (T3-4) increased in 2020[Tevetoğlu F 2021].

Lung Cancer

Data from a single centre in China reported hospitalisations and lung cancer-related operations steadily increased from 2015 to 2019

but reduced by an average of 27% and 57% in 2020[Fu R 2020]. In the US, a prospective institutional Low Dose CAT Scan screening database reported reduced lung cancer screening rates. New patient monthly LDCTs remained low despite resuming entire operations, and the proportion of lung nodules suspicious for malignancy increased after screenings continued (8% vs 29%; $p < 0.01$)[Van Haren RM 2020]. Three university-affiliated hospitals in Korea reported the number of lung cancer patients who sought consultation dropped by 16% from the previous year. While overall, the number of cancers diagnosed remained the same, the proportion with stage Ill-IV non-small-cell lung cancer significantly increased (2020: 75% vs 2017: 58%, 2018: 67%, 2019: 63%, p=0.011) [Young Park J 2020].

Oral Cancer

The hospitalisation rate in Brazil for oral and oropharyngeal cancer declined between 2019 and 2020 by 49%, reaching 60% in the North [Ramos da Cunha A 2021]. Furthermore, pathology reports of oral cancer in the south-eastern region of Brazil during the first six months of the COVID-19 pandemic reported cases decreased by 52% compared to the same period in 2019. The malignancy rate increased from 10.5% in 2019 to 14.7% in 2020[Abrantes TC 2020]. In India, there was a significant drop in patients presenting to a tertiary care hospital with oral cancers in the early three months of COVID-19 compared with the pre-COVID-19 era. Among the operated during the Early COVID Era, 80% had significantly more advanced tumour stage, and of those discussed in multidisciplinary meetings, 39% were deemed inoperable - double the number compared with Pre COVID[Riju J 2021]. In Italy, oral squamous cell carcinoma diagnosed in a research Dental School of the University of Turin reported significant drops in the number of cases identified: in 2019, 40 cases were identified. But in the last 45 working days, when around seven new cancer cases were expected, only one case was diagnosed[Arduino PG 2020].

Paediatric Cancer

A major Paediatric Oncology Department in Turkey reported reduced outpatient visits and a drop in the average number of patients undergoing daily chemotherapy, radiotherapy, surgery, and imaging during the 'COVID-19 period' (10 Mar to 31 Oct 2020). A negative trend was observed for new paediatric cancer diagnosis, with 128 new cancer cases during the COVID period compared with 212 in the prior year [Kutluk MT 2021]. An analysis in Italy of patients presenting to the Pediatric Oncology Unit of the Istituto Nazionale Tumori, Milan, a referral centre for solid paediatric tumours for the whole of Italy, reported only 46% of the expected cases were seen in the period during which restrictions were applied[Chiaravalli S 2020]. A US study reported five cases of critically ill children in two US tertiary care referral centres in April 2020. Despite a five-year historical mean of three days between new leukaemia patients, no patients were seen at the Children's Hospital of Philadelphia with a new leukaemia diagnosis for 35 days (22 Mar, to 6 Apr 2020). The longest gap observed from 2015 to 2019 was 18 days. In April, 75% of new leukaemia/lymphoma diagnoses required intensive care compared with a monthly average of 12% in 2018-2019[Ding 2020].

COVID-19 Fear and Anxiety

In the National Taiwan University study, the rescheduling or cancellation rate was up to 11%; half of the cancellations were put down to individuals' fear of being infected[Cheng S-Y 2020]. In Turkey, records at a healthcare centre with chemotherapy appointments between 17 Jan and 10 May 2020 revealed 220 of 1549 (14.2%) patients in the 60 days following the first COVID-19 case had their CT appointment postponed. The three most common reasons for delaying were neutropenia (23%), thrombocytopenia (21%), and COVID-19 fear and anxiety (14%). The introduction of telemedicine mitigated some of the fears and anxieties[Karacin C 2020]. Finally, a comparison with the same period of the four previous years in an outpatient clinic at

Pavia (Lombardy) of those accessing the hospital for anticancer drug infusion from February to the end of April reported a significant reduction in therapy access compared with 2019. In 2020, 63 patients delayed treatment: 38% for "pandemic fear" [Quaquarini E 2020].

Discussion

The evidence in this review comes from a wide range of countries. We could not identify published studies that showed little or no change in care. It is unclear if publication bias affects the results and whether restrictive measures lead to a homogeneous effect in decreasing care. Delays in several studies meant patients presented with later-stage disease, even when care pathways were relatively unaffected. Reasons for delays include increased patient COVID-19 fear and anxiety, a lack of public transport in some restricted areas, and reductions in surgical capacity used to create extra intensive care capacity. Some of these issues may be rectified by policy measures such as teleconsulting, better transport, and increasing intensive care capacity to prevent cancellations of life-saving surgery. A systematic review on the impact of strategies for mitigating delays and disruptions in cancer care due to COVID-19 that included nine low to moderate quality studies highlighted the lack of high-quality evidence to direct mitigation strategies due to disruptions.[4] A second systematic review, including 62 studies reporting and measuring at least one delay or disruption in cancer care because of the pandemic, found 38 different categories of delays and/or disruptions that could impact treatment, diagnosis, or health services.[5]

Delaying surgery by three months has been shown to decrease survival in breast, lung, and colon cancers and worsen survival in stage I and II breast cancers.[3] The evidence presented in this review reports evident reductions in care for the majority of cancers. However, the impact on overall mortality remains to be determined and should be the subject of future research.

Furthermore, the evidence on paediatric cancer is currently limited. The reduction reported in paediatric tumour presentations and late-stage leukaemias are, however, concerning. Analysis across 4,667 global studies and 186,807 study-site reports a 60% decrease in enrolment of new patients in oncology clinical trials in April 2020 compared with the same month in 2019.[6]

The majority of the evidence is from high-income countries, yet evidence suggests that those in low and middle-income countries were just as affected. A survey focusing on barriers to paediatric oncology management in oncology departments of the Pediatric Oncology East and Mediterranean (POEM) collaborative group from the Middle East, North Africa, and West Asia, reports essential treatments (e.g., chemotherapy, surgery, and radiation therapy) were delayed in 29% to 44% of centres and about one in four centres restricted new patient access. More than 70% of the participating centres reported shortages in blood products, interruptions to surgery, radiation therapy, and medications shortages.[7] Updates to this review will seek to refine the search and ensure that as the evidence evolves, relevant studies that may have been missed are retrieved.

Limitations of this review are linked to the inevitable observational nature of included studies and the possibility of publication bias (only those studies that report differences end up being published) which we cannot discount. We did not assess the quality of individual studies. However, clinical audit studies remain a valuable tool for improving care as they require data analysis and changes, or as in the case of restrictive measures, restoring care to normal levels efficiently. We plan to update this review.

Conclusions

Restrictive measures in the first wave of the COVID-19 pandemic in 2019-20 led to wide-scale, global disruption of cancer care. Future restrictions should consider disruptions to the cancer care pathways and plan to prevent unnecessary harms.

Table of included studies (n=69): Comparing the effects of early-phase COVID-19 restrictions on cancer and related services

Study ID	Country	Cancer Type	Methods	Results
London JW 2020	US	All	Twenty health care institutions (>28 million patients) in the COVID and Cancer Research Network across the US compared pre-COVID 2019 to Jan-Apr 2020.	Percentage reductions in cancer registrations: Breast cancer 48%; Prostate cancer 49%; Melanoma 48%; Lung 39%; colorectal 40% and Hematologic cancers 39%. Breast cancer screenings 89%; Colorectal cancer screenings 85%.
Morais S 2020	Portugal	All	Identified cancer cases from the Portuguese Oncology Institute of Porto (IPO-Porto) diagnosed between 2 Mar and 1 Jul of 2019 and 2020 (after COVID-19).	During follow-up to 31 Oct, there were 154 (11.8%) deaths before COVID-19 and 131 (17.2%) after: crude and adjusted HRs of 1.51 (95% CI, 1.20-1.91) and 1.10 (0.86-1.40), respectively. Higher adjusted hazards of death were observed for Stage III cancer and those undergoing surgical treatment or receiving radiotherapy.
Nabhen JJ 2020	Brazil	All	Analysis of the cancer tracking database of the largest cancer centre in southern Brazil comparing first-time appointments from the onset of the outbreak to the end of June to the equivalent period in 2019.	A 42% reduction in first-time appointments during the pandemic compared to the same period in the previous year was seen (P <0.001).
Dinmohamed AG 2020	Netherlands	All	Data from the nationwide Netherlands Cancer Registry between 24 Feb 2020, and 12 Apr 2020, were compared with the period before the outbreak.	There was a 26% reduction in all cancers after six weeks and 60% in skin cancers diagnosed. The effect was most pronounced for skin cancers and observed across all age groups, geographical regions, and almost all cancer sites.
Skovlund CV 2020	Denmark	All	Incident first cancer diagnoses were ascertained from Danish national registries covering all Danish citizens for 2015-2018 and the National Patient Register for 2019 and 2020.	In 2020 compared to previous 5 years, incident cancers reduced by approximately 800 in March (24%; 95% CI: 2-4 1); 900 in April; (34%;: 26-42); to 1,200 in May (42%: 37-46). The combined reduction for March to May was 33%, a total reduction of approximately 2800 undetected cancers.
Karacin C 2020	Turkey	All	Records of 3661 patients at a healthcare centre with chemotherapy appointments between 17 January and 10 May 2020 were reviewed.	In the 60 days preceding the 1st COVID-19 case (10 Mar), 245 (11.6%) had their CT appointment postponed; of 1549 patients in the 60 days following, 220 (14.2%) had their C T appointment postponed. The three most common reasons for delaying were neutropenia (23%), thrombocytopenia (1%) and COVID-19 fear and anxiety 14% before the introduction of the telemedicine practice.

Kaufman 2020	US	All	US patients who received testing for any cause by Quest Diagnostics and whose physician assigned them ICD-10 codes associated with six cancer types (breast, colorectal, lung, pancreatic, gastric, and oesophagal). Weekly numbers of newly diagnosed patients were compared between the baseline period (Jan 2019, to Feb 2020) and the COVID-19 period.	During the pandemic, the weekly number fell by 46% (4310 to 2310) for the six cancers combined, with significant declines in all cancer types, ranging from 25% for pancreatic cancer (271 to 204; P = . 01) to 52% for breast cancer (2208 to 1064; P< .001).
Penel N 2021	France	All	Key indicators in a cancer centre located in Northern France for three successive eight-week periods: directly before, during, and after containment from 16 Mar to10 May 2020.	The number of newly diagnosed and referred cancer patients increased by 1027; 1135 and then 1704 (+11% during containment and +50% just after). Teleconsulting activity increased by 5, 2025, and 2351, but surgical procedures decreased (448; 330 and 288; -26% during containment and -13% just after). A 31% increase in patients admitted to palliative care after containment and a reduction in clinical trial enrollment occurred.
Deshmukh S 2020	India	All	Comparison of the lockdown period in all three departments of a dedicated cancer hospital in India with the previous year's data in the same corresponding period.	The number of RT patients taking treatment dropped by almost 40% in the first month of the lockdown in surgery, the decrease was roughly 80%. The number of CT patients also dropped significantly, only to recover in the 4th week of the lockdown.
Quaquarini E 2020	Italy	All	A comparison with the same period of the four previous years in an outpatient clinic at Pavia (Lombardy) accessing the hospital for anticancer drug infusion from 24 Feb to 30 Apr 2020.	A significant reduction in therapy access was seen compared with 2019 (2590 versus 2974). In 2020, 63 patients delayed treatment: 38% for "pandemic fear", 18% for travel restrictions, 13% for quarantine, 18% for flu syndrome other than COVID-19, and 13% for worsening clinical conditions and death. A significant reduction in radiological exams was found in 202, P< 0.001).
Purushotham A 2021	UK	All	Cancer diagnoses in The South East London Cancer Alliance network encompass three NHS trusts during the first wave of the COVID-19 pandemic compared with the stage of diagnosis of cancer patients presenting before the pandemic across several tumour types.	An 18% reduction in new cancer diagnoses compared with 2019. Fall in prostate (51%), gynaecological (30%), breast (30%) and lung (23%) cancers. An overall 3.9% increase in advanced stage presentation (Stages 3 and 4), and 6.8% increase in Stage 4 cancers during this period: Lung cancer (increase 6.3%, 11.2% increase in Stage 4 cancer). For prostate cancer, an increase in 3.8% in Stage 4 disease. For breast, an 8% reduction in patients diagnosed with Stage 1 cancer with commensurate increases in proportion with Stage 2 disease.

Yildirim OA 2021	Turkey	All	A comparative evaluation of cancer patients before and during the pandemic using the Beck Depression Inventory and Beck Anxiety Inventory to detect the impact on treatment delays.	Depression and anxiety levels in cancer patients increased during the pandemic, positively correlated with treatment disruption (r = 0.81). Depression and anxiety and treatment delays were higher in elderly patients, and anxiety was more pronounced in female patients. Treatment delays were more common in patients using public transportation (p = 0.038).
Rogado J 2021	Spain	All	Analysis of the flow of patients during the first two waves of COVID-19 and the previous year in the city of Madrid	A decrease of 31% of new oncology referrals was seen (almost 1 in 3 patients was diagnosed later than usual). There was also a decrease of 28% in successive visits after referral (a large number were remote visits).
Maluchnik M 2020	Poland	All	Data from the central payer's system - National Health Fund in Poland covers 2015 to 25 May 2020. The DiLO card eliminates the limit of services related to oncological treatment	Compared to the same period of the previous year, the number of DiLO cards issued decreased by 33% (34,755 vs 41,594). Preliminary diagnoses decreased by 31% compared to 2019, while extended diagnostic procedures decreased by 25%.
Vanni G 2020	Italy	Breast	Patients in two University Hospitals in Rome who underwent breast surgery from 11 Mar to 30 May 2020 were compared with similar patients during the same period of the previous year.	Among the lockdown group, preoperative diagnosis assessment was performed in 32 cases by cytological examination (15.7%) and in 187 by biopsy (92%). In the Pre-Lockdown group, 24 (13.9%) patients underwent cytological examination and 159 (92%) were biopsied (p=0.066 and 1.00, respectively). Waiting time on the list, the time between biopsy/cytological examination and surgery, was shorter in the Pre-Lockdown group.
Li J 2020	China	Breast	Multicentre study at 97 cancer centres in China of Early Breast Cancer patients who received treatment regardless of preoperative therapy, surgery or postoperative therapy during the first quarter of 2020.	The proportion of surgery decreased from 16·4% in Dec 2019 to 2·6% in Feb in Hubei. Compared with before quarantine restrictions, the average time from diagnosis to treatment increased from 3·5 to 7·7 days in Hubei and 5·7 to 7·7 days in other provinces (p< 0·001). There were also 18·5 and 7·2 days delay in Hubei and other areas, from surgery to postoperative therapy.
Gathani T 2021	UK	Breast	Routinely collected NHS England Cancer Waiting Time data were analysed for breast cancer in the in the first 6 months of 2020 compared to the same time in 2019.	Referrals for suspected breast cancer was 28% lower (231,765 versus 322,994), and the number of patients who received their first treatment for a breast cancer diagnosis was 16% lower (19,965 versus 23,881).
Nyante SJ 2021	US	Breast	Community breast imaging facilities in North Carolina after 3 March 2020, were evaluated and compared with expected numbers based on trends between 11 January 2019, and 22 March 2020.	Maximum reductions occurred in March 2020 for screening mammography (- 85%; 95% CI , - 100.0%, - 70.0%) and diagnostic mammography (- 49%; 95% CI , - 72%, -26%) and in May 2020 for biopsies (- 41%; 95% CI, - 58%, - 24%). The deficit decreased gradually, with no significant difference between observed and expected numbers by July 2020 (diagnostic mammography) and

				August 2020 (screening mammography and biopsy).
Tsai H-Y 2020	Taiwan	Breast	A national screening database comparing the numbers of screenings and recall rates for January-April 2020, compared to the same period in 2019.	Screenings decreased by 22%, which was more pronounced for in-hospital examinations (- 37%), while outreach showed a 13% decrease.
McBain RK 2021	US	Breast & Colorectal	Mammography and colonoscopy rates among commercially insured American adults before and after 13 March 2020	Before 13 Mar 2020, the median weekly screening mammography was 87.8 women per 10,000 beneficiaries, which declined to 6.9 in April (96% decline). By the end of July, 88.2 screenings per 10,000 were reported. Colonoscopy screenings fell from 15.1 per 10,000 to 0.9 (95% decline and rebounded to 12.6 per 10,000 beneficiaries by the end of July.
Gosset M 2020	France	Breast & Gynaecological	Comparison of patients in a single centre for the first consultation for breast or gynaecological tumour between the confinement period and a control period.	During confinement, 91 patients were seen compared with 159 during the control period (decrease of 44%). The tumour stage was not changed. Among the 51 patients with an indication for surgery during confinement, 16 (31%) were postponed after the confinement was lifted.
De Vincentiis L 2020	Italy	Cancer Diagnosis	A comparison of first cellular pathological diagnosis of malignancy from 11th to the 20th week of 2018-2020 at a Pathology Unit of a Secondary Care Hospital Network in Italy.	Cancer diagnoses fell in 2020 by 39% compared with the average number recorded in 2018 and 2019. Prostate cancer (75%), bladder cancer (66%) and colorectal cancer (62%) had the most significant decrease.
Uyl-de Groot CA 2020	Netherlands	Cancer Diagnosis	Data from the Netherlands Cancer Registry and the Dutch registry of histo- and cytopathology (PALGA). From the week of the first COVID-19 diagnosis in the Netherlands.	A decrease of 20-40% in the number of cancer diagnoses was noticed, including lung cancer (average 23%), head-neck cancer (average 36%) and haematology (average 26%).
Ferrara G 2020	Italy	Cancer Diagnosis	The first pathologic diagnosis of malignancy was made from weeks 11 to 20 of 2018, 2019, and 2020 at seven anatomic pathology units in northern-central Italy.	Cancer diagnoses fell in 2020 by 45% compared with 2018 and 2019. Melanoma and nonmelanoma skin cancer represented 57% of all missing diagnoses. The diagnostic decrease in colorectal (-4 7%), prostate (-4 5%), and bladder (-44%) cancer were the most common among internal malignancies; for prostate, high-grade tumours were moderately affected (- 22%).
Rutter MD 2020	UK	Cancer Diagnosis	National, regional and procedure-specific analyses were performed pre-COVID (6 Jan 2020 to 15 Mar), transition (16-22 Mar) and COVID-impacted (23 Mar to 31 May).	A weekly average of 35,478 endoscopy procedures was performed in the pre-COVID period. Activity in the COVID-impacted period reduced to 12% of pre-COVID levels; at its low point, activity was 5%, recovering to 20% of pre-COVID activity by study end. The weekly number of cancers detected decreased by 58%, and the proportion of missing cancers ranged from 19% (pancreatobiliary) to 72% (colorectal).

Jacob L 2021	Germany	Cancer Diagnosis	A total of 102,009 patients newly diagnosed with cancer in 1660 practices in Germany from January to May 2019 and from January to May 2020.	New cancer diagnosed per general practice decreased from 2020 to 2019 by (March: -12%, April: - 28%, and May: - 23%).
Zadnik V 2020	Slovenia	Cancer Diagnosis	Analysis of routine data for Nov 2019 through May 2020 from three sources: (1) Slovenian Cancer Registry from Ljubljana and Maribor; (2) e-referral system in Slovenia; and (3) administrative data of the Institute of Oncology Ljubljana.	The decrease in April 2020 was about 43% and 29% for pathohistological and clinical cancer notifications; 33%, 46% and 85% for first, control and genetic counselling referrals. The number of CT and MRI scans performed was not affected.
Patt D 2020	US	Cancer Diagnosis	An extensive medical claims clearinghouse database representing 5%-7% of the Medicare fee-for-service population. March-July 2020 was compared with the baseline period of March-July 2019.	At the pandemic peak (April), screenings for breast, colon, prostate, and lung cancers were lower by 85%, 75%, 74%, and 56%, respectively. In April, hospital outpatient evaluation and management (E&M) visits (-74%), new patient E&M visits (- 70%), and established patient E&M visits (-60%) were all lower. A decrease in billing frequency was observed for the top physician-administered oncology products, dropping in April (- 26%) and July (- 31%).
Sormani J 2021	Cameroon	Cervical	From mid-March until the end of April 2020, the screening unit of Dschang cervical cancer primary screening programme was closed. Screening rates were compared pre- and post-closure.	The number of women screened in 2020 dropped by almost 80% compared with 2019. Three actions were identified: (1) coverage of transportation costs for women accepting screening, (2) improvement of pandemic related health literacy, and (3) introduction of home-based HPV self-sampling.
Miller MJ 2021	US	Cervical	Cervical cancer screening rates before, during and after the stay-at-home order, compared with same periods during 2019. Electronic medical records of women aged 21-65 years who were enrolled Kaiser Permanente members for one day during this period were examined.	Among women aged 21 to 29 years, screening rates in 2020 were 8% lower before the stay-at-home order, 78% lower during, and 29% lower after the stay-at-home order was lifted compared with 2019. For women aged 30- 65, screening rates in 2020 were 3% lower before, 82% lower during, and 24% lower after the stay-at-home order was lifted. The decreases were similar across all racial and ethnic groups.
Lai 2020	UK	Chemotherapy	Multi-center, weekly cancer diagnostic referrals and chemotherapy treatments until April 2020 in England and Northern Ireland. Analysed population-based health records from 3,862,012 adults in	Weekly data until April 2020 demonstrated significant falls in admissions for chemotherapy (45-66% reduction) and urgent referrals for early cancer diagnosis (70-89% reduction) compared to pre-emergency levels.

			England to estimate 1-year mortality.	
Suarez J 2021	Spain	Colorectal	Impact of COVID-epidemic in colorectal cancer (CRC) diagnosis during Spain's state of emergency comparing newly diagnosed patients with patients diagnosed in the same period of 2019.	New diagnosis of CRC decreased 48% with a higher rate of patients diagnosed in the emergency setting (12.1% vs 3.6%; p = .0 48) and a lower rate diagnosed in the screening program (5.2% vs 33.3%; p = . 000).
Cui J 2021	China	Colorectal	The medical records of patients with colorectal cancer who underwent elective surgery in one department from 11 Feb to 31 May 2020 were compared with the same period in 2018 and 2019.	Sixty-seven patients with CRC underwent elective surgery during the COVID-19 pandemic: a 66% reduction compared with 2018 and 2019.
Morris EJA 2021	UK	Colorectal	Data extracted from four population-based datasets spanning NHS England for all referrals, colonoscopies, surgical procedures, and courses of rectal radiotherapy from 11 Jan 2019, to 31 Oct 2020, related to colorectal cancer in England.	As compared to 2019, in April 2020, there was a 63% reduction (from 36 274 to 13 440) in monthly 2-week referrals for suspected cancer and a 92% reduction in colonoscopies (from 46 441 to 3484). Numbers just recovered by October 2020. A 22% (95% CI 8-34) relative reduction in cases referred for treatment (monthly average 2781 in 2019 to 2158 in April 2020). By October 2020, the monthly rate had returned to 2019 levels but did not exceed it. From April to October 2020, over 3500 fewer people had been diagnosed and treated for colorectal cancer in England than expected. There was a 31% (95% CI 19-42) relative reduction in the numbers receiving surgery in April 2020, with a lower proportion of laparoscopic and a more significant proportion of stoma-forming procedures. There was a 44% relative increase in neoadjuvant radiotherapy for rectal cancer relative to 2019 due to greater use of short-course regimens.
Mizuno R 2020	Japan	Colorectal	Analysed the cases of all of the Colorectal patients (n = 123) who underwent surgery at a regional cancer treatment centre and tertiary emergency hospital in Japan during 120 days ranging from before to after the state of emergency.	No significant change was observed in the number of patients who underwent surgery. The incidence of complete obstruction was roughly 15% before the state of emergency and increased significantly to 39% during the pandemic ($p < 0.05$). The number of patients with advanced pathological stages tended to increase compared with before the state of emergency.
Patel S 2021	US	Colorectal	Analysis of San Francisco Health Network serves 90,000 individuals through multi-site clinics and a specialist referral centre between Feb and May 2020.	Total adult primary care in-person visits decreased by 70% (from 6,800 to 2,000 visits/wk). Telehealth visits increased from 1.2% of adult primary care visits in the first week of March to 60% by April (from 40 to 3,000 visits/wk).

Cheng S-Y 2020	Taiwan	Colorectal	Prospective observational study of screening uptake and diagnostic colonoscopy in faecal immunochemical test-positive subjects in the National Taiwan University Hospital screening hub since the outbreak **of** COVID-19 and compared with corresponding periods in the past three years.	Screening uptake during Dec 2019 to Apr 2020 was 89%, significantly lower than the corresponding period of the past three years (P for trend < 0.0001). Colonoscopy rate was 66% lower (P < 0.0001). The rescheduling or cancellation rate was up to 11%, which was significantly higher than the past three years (P = 0.023); half were due to the fear of being infected.
D'Ovidio V 2021	Italy	Colorectal	A retrospective controlled cohort study in our "COVID-free" hospital to compare data of the CRCS colonoscopies of the lockdown period (9 Mar to 4 May 2020) with those of the same period of 2019.	In the lockdown group, 60/137 invited patients underwent colonoscopy, in the control group, 238 (3.9-fold more) were performed. During the lockdown, more colorectal cancers (5 cases; 8% vs 3 cases; 1%; P = .002) were found. The "high-risk" adenomas detection rate was also significantly higher in the "lockdown group" than in controls (47% vs 25%; P =. 001).
Wang H 2021	UK	Eye	Four adults, Ocular Oncology centres, compared uveal melanoma referral patterns and treatments in 4 months during the national lockdown and first wave of the COVID-19 pandemic in 2020 with corresponding periods in the previous two years.	Referral numbers and confirmed uveal melanoma cases reduced to -120 fewer diagnosed uveal melanoma cases than the previous two years. A reduction in referral numbers by 42% and confirmed uveal melanoma cases declined by 43%. There was more advanced disease presenting to the services in the four months following lockdown.
Lui TKL 2020	Hong Kong	Gastric & Colorectal	The total numbers of upper and lower endoscopies performed in all public hospitals in Hong Kong between 11 Oct 2019, and 31 Mar 2020. The same period in the preceding three years was retrieved from the Clinical Data Analysis and Reporting System of the Hong Kong Hospital Authority.	From the week of the first COVID diagnosis, the mean number of upper and lower endoscopies performed per week dropped by 51% (from 1813 to 887; P < .001) and 59% (from 1190 to 491; P <.001), respectively. The mean gastric cancer and colorectal cancer diagnosed per week also fell by 46% (from 23 to 12.3; P < .001) and 37% (from 92 to 58; P < .001), respectively. The positive rates (per 1000 endoscopies) for gastric cancer remained static throughout these periods (11.8 to 13.9; P =. 14) but increased for colorectal cancer (76 to 118; P < .001).
Tsibulak I 2020	Austria	Gynaecology	Data of 2077 patients from 18 centres in Austria with newly diagnosed gynaecological or breast cancer between January and May 2019 and the exact dates in 2020 were collected and compared.	A slight increase of newly diagnosed cancers in January and February 2020 compared with 2019 (+2 and +35%, respectively) and a decline in newly diagnosed tumours since lockdown: -24% in March, -49% in April, -49% in May versus corresponding 2019 months. Two-thirds of patients during the pandemic period presented with tumour-specific symptoms compared with less than 50% before the pandemic (p<0.001).

Mannelli G 2020	Italy	Head & Neck	Compared cancer diagnoses in Firenze (Italy) between April and May 2020 with the same period of the last year.	Three-fold increase in advanced cancer stages diagnoses between April and May 2020 compared with last year (64% vs 22%). Non-surgical treatment indications almost doubled for same stage cases (21.2% vs 16.6%).
Kiong KL 2021	US	Head & Neck	A review of patients presenting at a multidisciplinary tumour conference from 14 May 2020, to 18 Jun 2020 was performed compared to a similar 6-week period a year before.	There was a 25% reduction in newly diagnosed malignancies. Median primary tumour size was significantly larger (p = 0.042) and T stage more advanced for mucosal subsites (p = 0.025) in the COVID-19 group.
Tevetoglu F 2021	Turkey	Head & Neck	Medical records of 61 patients from 15 Mar 2020 to 15 Sep 2020 (Group 1) diagnosed and scheduled for surgery in a tertiary care centre compared with 64 patients treated in the same institution in the same time of 2019 (Group 2).	The rate of T3-4 tumours increased in 2020 (p = 0.049). In oral cavity cancer patients, the N stage was significantly increased in Group 1 (p = 0.024). The need for reconstruction with regional or free flaps was significantly increased in oral cavity cancer patients (p = 0.022).
Larrea 2020	Spain	Hypo-fractionation	Between 16 March and 16 April 2020, analysed the first 100 consecutive patients who began treatment in a single department and analysed the number of fractions or sessions per patient and treatment during this period. This was defined as 'Fractionation Index' (FI) and calculated the FI for 2018 and 2019.	In 100 patients in 2020, the FI was 12.1 lower than in previous years.
Veiga J 2021	Portugal	Liver	Single-Centre Retrospective Analysis in an interventional radiology unit in Portugal from 18 March to 2 May 2020. Descriptive statistical analyses were used to compare 2019 (non-COVID) and 2020 (COVID) data.	The number of procedures was reduced by 55%. There was a significant difference in urgent procedures with 33% (n = 57) in 2019 versus 48% (n = 37) in 2020 (p = 0.012).
Fu R 2020	China	Lung	Data from 397 inpatients from a single centre during four weeks of the pandemic (2020 group) compared with 2504 inpatients during the same period (4 wk) in the past five years (2015-2019 group).	The number of hospitalisations and lung cancer-related operations steadily increased from 2015 to 2019 but reduced by an average of 27% and 57% in 2020. Hospital capacity decreased by 28% (35 inpatient beds). Patients were concerned about long waiting times for outpatient services, inpatient beds, physical examinations, or operations (51%); the possibility of COVID infection (45%); and difficulties in getting to a hospital owing to transportation outages (35%).

Van Haren RM 2020	US	Lung	A prospective institutional Low Dose CAT scan (LDCT) screening database, which began in 2012 of 2,153 patients. The monthly mean number of screens were compared between baseline (Jan 2017 to Feb 2020) and COVID-19 periods (March 2020 to July 2020).	Total monthly mean LDCTs and new patient monthly LDCTs were significantly decreased during the COVID-19 period. New patient monthly LDCTs remained low despite resuming full operations. The "no-show" rate was significantly increased from baseline (15% vs 40%; p < 0.04). The percentage with lung nodules suspicious for malignancy (Lung-RADS 4) were significantly increased after screenings resumed (8% vs 29%; p < 0.01).
Henderson LM 2021	US	Lung	Analysis of low-dose CT (LDCT) lung screening examinations at two academic and two community imaging sites affiliated with the University of North Carolina Healthcare System from 11 January 2019, to 30 September 2020.	The most significant reductions in predicted Lung cancer Screening volumes were seen in March 2020 (change 34%). By June, predicted LCS volumes returned to expected pre-COVID-19 levels and from June to Sep 2020 remained similar to pre-COVID-19 levels.
Young Park J 2020	Korea	Lung	The number of newly diagnosed lung cancer cases in three university-affiliated hospitals during the pandemic and their clinical features were compared with lung cancer cases diagnosed during the same period in the past three years.	During the pandemic, the number of patients who sought consultation dropped by 16% from the previous year. The number of cancers diagnosed remained the same. The proportion of patients with stage III-IV non-small-cell lung cancer (NSCLC) significantly increased.
Pavic AK 2021	Croatia	Maxillofacial	The workload at the Maxillofacial and Oral Surgery Department (Department), Osijek University Hospital, during the COVID-19 pandemic (March-May 2020) and four subsequent months. The same period of 2019 was a control.	From March to May 2020, the number of hospitalisations (306 vs 138), surgical procedures (306 vs 157), and scheduled outpatient visits (2009 vs 804), dropped significantly compared with 2019. The number of skin tumour removals halved (from 155 in 2019 to 58 in 2019) (p<0.001). The number of emergency patients was unchanged in the three months. A significant decrease in outpatient visits and hospital admissions continued after lockdown (p<0.001).
Rebecchi F 2020	Italy	Oesophageal	The Italian Society for Study of Esophageal Diseases (SISME) conducted a national survey to evaluate changes in oesophagal cancer management. Short-term outcomes of oesophagal resections during lockdown were compared with those achieved in the same period of 2019.	Overall the number of resections did not decrease. A higher rate of open oesophagal resections was observed. Surgery was delayed in 24 (37%) patients in 6 (50%) centres, primarily due to a shortage of anesthesiologists and intensive care unit beds from intubated COVID-19 patients. Clinical strategies differed considerably among the 12 centres.

Ramos da Cunha A 2021	Brazil	Oral	The number of hospitalisations during the first periods of the pandemic-and between the same period of 2016 to 2019 was retrieved from the SUS Hospital Information System in Brazil.	The hospitalisation rate for oral and oropharyngeal cancer declined between 2019 and 2020 was 49%, reaching 60% in the North.
Riju J 2021	India	Oral	Patients presenting to a tertiary care hospital with oral cancers in the early three months of COVID-19 with pre-COVID-19 era.	There was a significant drop in the number of presenting patients. Among the operated during the Early COVID Era (ECE), 80% had a significantly advanced tumour stage ($P < 0.034$) and advanced composite stage (p-value < 0.049). Among patients discussed in MDT during ECE, 39% were deemed inoperable - double the number compared with Pre CE ($P < 0.009$).
Arduino PG 2020	Italy	Oral	Oral squamous cell carcinoma diagnosed in The Inter - departmental Research Center (CIR) Dental School, a research centre of the University of Turin, during the first wave compared to the previous year.	In 2019, 40 cases of OSCC were identified. In the last 45 working days (usually expected around seven new cancer cases), only one case of OSCC was diagnosed. General dentists had referred no other case in that period.
Abrantes TC 2020	Brazil	Oral	Pathology reports of oral cancer in the south-eastern region of Brazil on oral cancer diagnoses during the first six months of the COVID-19 pandemic were compared with the same period in 2019.	Cases decreased by 52% in comparison with the same period in 2019, when 1 121 cases were diagnosed, of which 118 were malignant tumours (95 cases of squamous cell carcinoma, five cases of basal cell carcinoma, 12 cases of adenocarcinoma, five cases of lymphomas, and one case of sarcoma). The malignancy rate increased from 10.5% in 2019 to 14.7% in 2020.
Kutluk MT 2021	Turkey	Paediatric	A major Paediatric Oncology Department in Turkey compared the number of daily paediatric cancer patients, diagnostic and treatment procedures for the 'COVID-19 period' (10 March to 31 October 2020) with the corresponding 'prior year control period' in 2019.	The mean 35 outpatients per day during the 'COVID-19 period' was lower than the 'prior year. There were 18 inpatients per day during the 'COVID-19 period' lower than 24 inpatients during the 'prior control period'. A significant reduction in the daily mean number of patients undergoing chemotherapy, radiotherapy, surgery and imaging studies during the 'COVID-19 period' was seen. A negative trend in diagnosing new paediatric cancers was evident with 128 new cancer cases during the COVID period, whereas the number was 212 for the prior year. The presentation delay (median 31 days) remained unchanged during the 'COVID period'.

Ding 2020	US	Paediatric Leukaemia	Report of five cases of children who presented critically ill to two US tertiary referral centres in April 2020 and report data comparisons from before the pandemic.	Despite a five-year historical mean of 3 days between new leukaemia patients, the Children's Hospital of Philadelphia referral centre did not see any patients with a new leukaemia diagnosis for 35 days (22 Mar 2020, to 6 Apr 2020). Comparatively, the longest gap from 2015 to 2019 was 18 days. In April 2020, 75% of new leukaemia/lymphoma diagnosis required PICU care, compared with a historical monthly average of 12% during 2018-2019 (previous maximum 40%).
Chiaravalli S 2020	Italy	Paediatric Solid Tumours	Patients presenting to the Paediatric Oncology Unit of the Istituto Nazionale Tumori, Milan, a referral centre for solid paediatric tumours for the whole of Italy. Data were analysed during lockdown (9 March to 3 May 2020) and compared with corresponding periods of 2017 to 2019.	Sixteen newly diagnosed patients were registered. During the same period in the years 2017, 2018, and 2019, 34, 35, and 36 cases were registered. Under lockdown, only 46% of the expected cases were seen (P = . 042).
Roberge D 2021	Canada	Radiotherapy	Data on each patient treated from 13 March 2020, to 10 August 2020, in a radiation oncology department of the largest academic centre in the hardest-hit city in Canada were compared to patients treated during the same period in 2019.	During the pandemic, the caseload was reduced by 12%. The average number of fractions per patient was reduced from 12.3 to 10.9. Physicians reported 17% of treatment plans deviated from usual practice. At its worst, the waitlist contained 27% of patients who had a delay in radiotherapy of more than 28 days.
Bakouny Z 2021	US	Screening programmes	Comparison of the first peak of the pandemic in New England (22 March to 22 June 2020) with three control periods before and after the main study period. The percentage decrease in screening tests and diagnoses during the pandemic period was compared with each control period.	Overall, 15453 patients (with 1985 ensuing diagnoses) had undergone 1 of 5 cancer screening examinations (low-dose CT, Papanicolaou test, colonoscopy, PSA screening, or mammography) during the 3-month pandemic study period compared with 51 944 (3190 diagnoses) during the subsequent three months; 64 269 (3423 diagnoses) in the preceding three months, and 60 344 patients (2961 diagnoses) during the same three months of the preceding year (2019). The percentage decreases in screening were pronounced across all screening tests, compared with all three control periods, and ranged from -60% to - 82%. Compared with all three control periods, the percentage decreases in diagnoses resulting from the cancer screening tests were also pronounced (-19% to - 78%).

Dinmohamed AG 2020	Netherlands	Screening programmes	Selected patients diagnosed between 6 Jan and 4 Oct 2020 from the National Cancer Registry that relies on pathological cancer notifications via the Nationwide Histopathology and Cytopathology Data Network and Archive were compared with weekly trends 2010-2019.	Breast cancer diagnoses among women aged < 50 or> 74 yrs (not invited for mammography screening) as of early May reached and remained at the level of the expected values. The number of breast cancers in women aged 50-74 years (invited for screening) showed a steep decline in early April (2 weeks after the suspension of screening). The number remained lower than expected until mid-late June. The number of colorectal cancer diagnoses among aged< 55 or> 75 years (not invited for faecal immunochemical testing) was lower than expected in April; it reached and remained at the desired level. The number of colorectal cancer diagnoses in individuals aged 55-75 years (invited for testing) remained slightly lower than expected. The observed number of diagnoses reached expected values in late June.
Valenti M 2021	Italy	Skin	Incidence of excised advanced melanoma and keratinocyte cancers in a dermato-surgery division on 18 May to November 18, 2020, compared to the same time of 2019.	From May to November 2019, 265 surgical excisions were performed, while during the pandemic, 280 surgeries were completed. The number of advanced skin cancers excised between 18 May and 18 November 2020, was significantly higher compared with the same period in 2019 (54 vs 22: P = 0.0003). Significant differences were also observed for a number of surgically removed advanced BCCs and advance SCCs.
Andrew TW 2020	UK	Skin	Analysis of data from the UK Northern Cancer Network from 23 March 2020 to 23 June 2020 and compared it with the same period in 2019 (pre-COVID).	In the COVID period, there was a decrease of 69% in skin cancer diagnoses (3619 to 113, P < 0.01). Skin cancer waiting times were also reduced compared to the pre-COVID period (median of 8 and 12 days, respectively; P < 0.001). Findings suggest continued capacity in skin cancer services , potentially due to cancer referrals' prioritisation and an overall decrease in skin cancer referrals from primary care. Adoption of telemedicine allowed appropriate triage of those lesions requiring face-to-face assessment by a specialist.
Rich H 2021	UK	Skin	Predicted numbers of referrals in Wales based on previous four years of data compared against the actual number of urgent skin cancer referrals for the COVID-19 period	During the COVID-19 pandemic, service received 27% (95% CI [16%,36%]) less than predicted urgent skin cancer referrals for the first five months of 2020.
Earnshaw CH 2020	UK	Skin	Reduction in urgent cancer referrals is known in England as the two-week wait (TWW) pathway - and subsequent diagnosis of skin cancer in our dermatology service from February to April 2020	Identified a 34% reduction in referrals from February to April 2020 compared with the same period in 2019.

			with the same period in 2019.	
Zheng NS 2020	US	Surgical Delay	EHR data from Vanderbilt University Medical Center's (VUMC) Research and Synthetic Derivatives. Elective procedures and non-urgent visits were suspended at VUMC between 18 March 2020, and 24 April 2020, compared to a similar time frame in 2019.	Unique patients with inpatient stays during the 2018, 2019, and 2020 timeframes were 20,798, 23,463, and 11,665, respectively. In historical patients diagnosed with colorectal cancer, delay of colonoscopy before diagnosis was associated with increased 5-year mortality (Hazard ratio [HR] = 1.05; 95% CI = 1.01 to 1.09). Similarly, delay of CT for lung cancer (HR = 1.04; 95% CI = 1.01 to 1.07) or delay of prostate-specific antigen tests (HR = 1.05; 95% CI = 1.01 to 1.09) were associated with increased 5-year mortality. Delayed lung CT was associated with more advanced stage of lung cancer at diagnosis. The delay of mammography was associated with having a more advanced stage of breast cancer at diagnosis
Bolenz 2021	Germany	Urology	Registration of urologic cancer care during the first wave of the COVID-19 pandemic in Germany was compared to 2019 using InEk data (Institute for the Hospital Remuneration System).	The data showed a decrease in the surgical treatment of renal cell and bladder carcinoma during the first wave of the pandemic (the number of radical prostatectomies was hardly different from previous years).
Maganty A 2020	US	Urology	A retrospective review of EMR of pre-COVID-19 and COVID-19 patient characteristics presenting with a possible new cancer diagnosis to a urologic oncology clinic.	During the three months before the COVID-19 pandemic began, 585 new patients were seen in one urologic oncology practice. In the following 3-month period, during the COVID-19 pandemic, 362 patients were seen, corresponding to a 38% decline.

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Jon Brassey is a major shareholder in the Trip Database search engine (www.tripdatabase.com) as well as being an employee. In 20+ years Trip has worked with a large number of organisations over the years, none have any links with this work. Examples include the NHS in England, Wales and Scotland, MSD, AXA and a large number of universities.

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