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Impact of the SARS-CoV-2 pandemic on the female breast, colorectal and non-small cell lung cancer incidence, stage and healthcare pathway to diagnosis during 2020 in Wales, UK using a national cancer clinical record system

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Conflict of interest

ML has received an unrestricted educational grant from Pfizer for research unrelated to this work. ML has received honoraria from Pfizer, EMF Serono, Roche, Bayer, Novartis and Carnall Farrar unrelated to this work. DWH has received research consultancy fees from Pfizer for research unrelated to this work and his department (Welsh Cancer Intelligence and Surveillance Unit, Public Health Wales) has received analysis partnership funding from Macmillan Cancer Support for unrelated work. All other authors have declared no conflicts of interest.

Abstract (200 words exactly)

Background

COVID-19 pandemic responses impacted behaviour and health services. We estimated impact on incidence, stage and healthcare pathway to diagnosis for female breast, colorectal and non-small cell lung cancers at population-level in Wales.

Methods

Cancer e-record and hospital admission data linkage identified adult cases, stage and healthcare pathway to diagnosis (population ~2.5 million). We compared 2019 and 2020 counts, and estimated incidence rate ratios (IRR) using multivariate Poisson regressions.

Results

Cases decreased 15.2% (n=-1011) overall. Female breast annual IRR was 0.81 (95%CI:0.76-0.86,p<0.001), colorectal 0.80 (95%CI:0.79-0.81,p<0.001) and non-small cell lung 0.91 (95%CI:0.90-0.92,p<0.001). Decreases were largest in 50-69 year-olds for female breast and 80+ year-olds for all cancers. Stage I female breast cancer declined 41.6%, but unknown stage increased 55.8%. Colorectal

stages I-IV declined (range 26.6%-29.9%), whilst unknown stage increased 803.6%. Colorectal Q2-2020 GP-urgent suspected cancer diagnoses decreased 50.0%, and 53.9% for non-small cell lung cancer. Annual screen-detected female breast and colorectal cancers fell 47.8% and 13.3%, respectively. Non-small cell lung cancer emergency presentation diagnoses increased 9.5% (Q2-2020) and 16.3% (Q3-2020).

Conclusion

Significantly fewer cases of three common cancers were diagnosed in 2020. Detrimental impacts on outcomes varied between cancers. Ongoing surveillance with health service optimisation will be needed to mitigate impacts.

5000 word limit – actual 4253

Background

Responses to the COVID-19 pandemic, including mandated societal lockdowns[1], citizen behavioural change[2] and health system reconfiguration[3,4] during 2020 led to paused cancer screening programmes, altered presentation to primary care, and impacted on suspected cancer referrals, diagnostic procedures[5] and treatment modalities[6]. Several studies modelled pandemic effects on excess cancer mortality[7,8,9], but despite concern about impact on cancer services and outcomes[10], most studies reported limited data on observed cancer mortality, incidence, stage and healthcare pathways to diagnosis. These parameters have not been assessed at the population level in the UK. We undertook an analysis of clinically-ascertained: I) female breast (good prognosis and screening programme in place), II) colorectal (moderate prognosis and screening programme in place) , and III) non-small cell lung cancers (poor prognosis and no current screening programme in Wales) at a whole-population level in Wales during the pandemic's first full-year of 2020 compared to 2019, to determine the impact on cancer incidence, stage at diagnosis and healthcare pathways to diagnosis, to inform cancer service adaptation to the pandemic and subsequent recovery from it.

Methods

We conducted a retrospective observational study of the resident population of Wales aged 18+ years (n=2,539,714)[11] in the Con-COV cohort,[12]within the Secure Anonymised Information Linkage (SAIL) Databank[13].

Cases of new primary female breast (ICD-10: C50), colorectal (C18, C19, C20), and non-small cell lung cancers (C33, C34 with morphology M8041) between January 1, 2019, and December 31, 2020, inclusive, were identified from the Cancer Network Information System Cymru (CaNISC) – the national electronic clinical cancer patient record system, largely covering the population of Wales.

The exposure evaluated was the effect of the COVID-19 pandemic and pandemic mitigations[14] (Figures 1 and 2). Diagnosis from January 1, 2020, to December 31, 2020, constituted exposure. Non-exposure (as the comparator) was diagnosis from January 1, 2019, to December 31, 2019.

Outcome measures

Outcome measures included annual and monthly incident case counts, stage at diagnosis, and annual and quarterly healthcare pathway to diagnosis. Summary stage at diagnosis I-IV, including unknown stage was available from CaNISC for female breast and colorectal cancers. CaNISC is awaiting replacement, and until then it is not possible to correctly record stage at diagnosis in CaNISC for non-small cell lung cancer. The pathway to diagnosis was derived from CaNISC with person-level linkage to Patient Episode Database Wales hospital admission data (Figure S2) and categorised to one of: I) screening, II) general practitioner urgent suspected cancer referral, III) emergency presentation/admission, IV) in-patient referral V) outpatient referral VI) other or VII) not known.

Co-variates

Co-variates included sex, age (18-49, 50-59, 60-79 and 80+), and quintile of the income domain of the Welsh Index of Multiple Deprivation data[15]. All the domains of the index were not used together, as its health domain already includes registry-based cancer incidence, so its inclusion would introduce a reverse cause bias.

Analysis

We presented descriptively incident count by cancer type for 2019 and 2020, and calculated absolute and relative differences in annual counts between years for each cancer. Monthly counts and absolute and relative differences between corresponding months in 2019 and 2020 were also determined.

To test the null hypotheses that there was no difference in incident cases of female breast, colorectal and non-small-cell lung cancers in 2020 compared with 2019, we used mid-year population estimates and undertook multivariate Poisson regression analyses to estimate unadjusted incidence rate ratios (IRR) and IRRs adjusted for differences in age, sex (for colorectal and non-small cell cancers) and income deprivation quintile from the Welsh Index of Multiple Deprivation. Similarly, we also calculated the post-Poisson estimated marginal means to undertake a series of pairwise comparisons between corresponding months of 2020 and 2019. Due to the large number of comparisons, all 95% confidence intervals around the IRR and their subsequent p-values were adjusted using the Bonferroni correction (adjusted alpha = 0.05/number of comparisons).

Stage at diagnosis for female breast and colorectal cancers only was estimated as counts/percentage of the total incidence for each stage for each year. For each cancer and each stage, absolute and relative difference in counts between years was calculated. Counts of incident cases in each healthcare pathway to diagnosis category and absolute and relative differences for each pathway between years were determined.

Results

Annual and monthly incidence

A total of -1,011 (-15.2%) fewer cases of the three cancers was diagnosed during 2020 (n=5,640) compared to 2019 (n=6,651). Decreases occurred for female breast (-19.1%, n=-474), colorectal (-17.2%, n=-383) and less so for non-small cell lung cancers (-7.9%, n=-154) (Table 1 and Figure 3a).

Changes in monthly incidence differed for each cancer (Figure 3b, Table 1). For all three cancers, steep decreases in monthly incidence did not occur until April 2020. April incidence for female breast cancer was -45.3% lower in 2020 than 2019, recovering to 2019 levels by September 2020. Colorectal cancer had an even greater decrease of -59.9% in April 2020, partially recovering by June 2020 (-10.5%), but it remained below 2019 monthly incidence in to December 2020. The April 2020 decrease was less steep for non-small cell lung cancers (-27.7%, n=-41), recovering by June 2020, but decreasing to below 2019 levels at the end of 2020 (2019 vs 2020: -16.3% October, -7.4% November and -15.3% December).

Colorectal cancer cases decreased by -23.7% (n=-233) in females and -12.1% (n=-150) in males between 2019 and 2020 (Table 1), although for non-small lung cancer the relative decline was larger for males (-11.7%, n=-119) compared to females (-3.8%, n=-35).

The largest age-group decreases were amongst 50-69 year-old female breast cancer patients (-24.2%, n=-292) (Table 1). Amongst 80+ year-olds, relative incidence declines were similar for all three cancers: female breast -21.9% (n=-86); colorectal -20.2% (n=-117); and non-small cell lung cancers -20.4% (n=-110). Declines occurred in all quintiles of income area-deprivation, and were highest in the three least deprived quintiles for female breast cancer, ranging from -23.1% to -26.3%. For colorectal cancer, there was a gradient of increasing relative decline from 2019 to 2020 in the most to the least deprived quintiles. For non-small lung cancer, there was no clear gradient.

The results of the Poisson regression and unadjusted and adjusted annual and pairwise monthly IRRs for 2020 compared to 2019 are shown in Table S2. The unadjusted annual IRRs for female breast (0.81 [95%CI 0.76, 0.86; p<0.001]), colorectal (0.80 [95% CI 0.79, 0.81; p<0.001]), and non-small cell lung (0.91 [95% CI: 0.90, 0.92; p<0.001]) cancers were all largely unchanged by adjustment for age, sex (for colorectal and non-small cell cancers) and income area deprivation quintile (Table S3). The unadjusted IRRs were highly statistically significant for the pairwise comparisons of months between 2020 and 2019 that had shown large to moderate declines in the descriptive analysis for all three cancer types.

However, adjustment removed the IRR statistical significance for all 12 months in non-small cell lung cancer, and for all except April and May 2020 for colorectal cancer. For female breast cancer, the large declines in incident cases observed from March to November 2020, except for September, remained highly significant ($p<0.001$) during May, July and August 2020 when IRRs were adjusted for age and area-level income deprivation.

Stage at diagnosis

There was a large decrease in stage I female breast cancer -41.6% (n=-374) in 2020 compared to 2019 (Table 1). Relative declines in stages II and III were similar at -20.5% (n=-202) and -18.2% (n=-47), respectively. Stage IV decline was based on smaller case numbers (n=-15). Female breast cancers recorded with stage unknown increased by 55.8% (n=+164) between 2019 and 2020. The relative decrease in colorectal cancer cases was similar across the stages I-IV (ranging between 26.6% and 29.9%). There was a very large increase of 803.6% (n=+225) in colorectal cancers with stage unknown recorded in 2020, compared to 2019. Cumulative monthly case counts of female breast and colorectal cancers for 2019 and 2020 by stage at diagnosis are shown in Figures 4a and 4b.

Healthcare pathway to diagnosis

The annual decrease in screen-detected female breast cancer diagnoses was -47.8% (n=-451) (Table 1), with a large decline between Q2 (April, May, June), 2019 and Q2, 2020 (-86.7%, n=-214), followed by partial recovery to around half the 2019 diagnoses in Q4 (Figure 5). Female breast cancer diagnosis via GP urgent suspected cancer referral increased slightly (+2.2%, n=+26) over the whole of 2020, compared to 2019. After a small drop during Q2 2020, GP urgent suspected cancer referral diagnoses rebounded above 2019 levels in Q3 (+1.0%) and Q4 (+11.1%), 2020.

GP urgent suspected cancer referral colorectal cancer diagnoses declined -19.9% (n=-213) in 2020 compared to 2019, but remained the most frequent pathway to diagnosis (Table 1). Diagnoses via this pathway declined by -50.0% (n=-135) in Q2 2020 compared to Q2 2019, partially recovered in Q3 2020, surpassing 2019 by Q4 (Figure 5). Emergency presentation/admission diagnoses were maintained, and had only a small annual change (-7.8%, n=-38), but were slightly lower in Q1 and Q4 2020 than corresponding 2019 quarters, and slightly higher in Q2 and Q3 (Figure 5). Screening was the third most frequent pathway to diagnosis; it showed a -13.3% (n=-37) annual reduction in 2020, with an increase in Q1, 2020 compared to Q1 2019, a large decline in Q2 2020 (-56.7%, n=34), and recovery by Q3 to just below the Q3 2019 level. However, the Q4 diagnoses were below Q4, 2019. An annual decline of -34.3% (n-=-69) occurred in the in-patient referral route, occurring during Q2-Q4.

A decline of -18.3% (n=-135) in non-small cell lung cancer GP urgent suspected cancer diagnoses occurred over the whole of 2020, compared to 2019 (Table 1), with a large decline of -53.9% (n=-83) in Q2 2020, followed by partial recovery in Q3 that did not recover further in Q4 (Figure 5). In Q1 2020, diagnoses via this pathway were slightly higher (+7.0%, n=+14) than cases observed during the same period in 2019. In contrast, there was little annual change in emergency presentation diagnoses (-2.1%, n=-13), although diagnoses were higher in Q2 and Q3 2020, compared with 2019, then declined rapidly in Q4. Diagnosis via referral as an existing in-patient increased slightly above 2019 levels in Q1 and Q3 2020, but decreased in Q2 and Q4.

The trends in incidence, stage at diagnosis and healthcare pathway to diagnosis coincided with the timing of the pandemic and mitigation responses introduced during 2020 (Figure 1).

Discussion

To our knowledge, this is the first national population-level study using electronic cancer clinical data to quantify COVID-19 pandemic effects on cancer diagnosis, stage and healthcare pathway to diagnosis in detail for the whole of 2020. Our analyses used linked population data to compare the effects on three common cancers of contrasting prognosis and screening programme availability, facilitating consideration of differential outcomes between demographic groups over time, and against dynamic changes of the pandemic and mitigation responses to it.

We observed detrimental changes in incidence, with over a thousand fewer cases in 2020 compared with 2019 across the three cancers; in stage at diagnosis, and in healthcare pathway to diagnosis, coinciding with the timing of pandemic COVID-19 incidence and dynamic responses such as societal restrictions and health service reconfiguration. There was considerable variation between cancer types and demographic groups, with older age groups particularly affected. The pausing of screening had a major impact on early female breast cancer diagnosis, but decreased diagnoses through GP urgent suspected cancer referral had a greater impact on colorectal cancer and non-small cell lung cancers.

Our data demonstrate that impacts varied considerably between cancers and demographic groups, coinciding with dynamic changes in community COVID-19 cases and pandemic mitigation responses, and according to their pre-pandemic pattern of healthcare pathway routes to diagnosis. Other studies that examined cancer incidence during the pandemic used prediction modelling or proxy measures such as diagnostic or treatment activity[5,6,8,16,17,18]. Of the few studies that used clinical data, one study[19] examined colorectal cancer cases from a single tertiary hospital serving a regional Spanish catchment

area. Ascertainment fell by 47.7% in spring 2020 compared to spring 2019, whereas we found decreases of almost a fifth in colorectal cancer incidence during 2020 overall, and 59.9% in April 2020 compared to April 2019, greater than the Spanish study, yet of a broadly similar order of magnitude. Our results were also consistent with their finding of no change in colorectal cancer stage distribution and a greater decline amongst women than men. A south-east London clinical-data study[20] examined a smaller urban population, also including a tertiary hospital. For stage, it compared six-month periods before and after the March 2020 UK lockdowns, rather than corresponding months in 2019 and 2020. Nevertheless, our results demonstrated broadly consistent month-on-month incidence trends with the London study for female breast cancer, colorectal cancer and non-small cell lung cancers, as far as it reported to September 2020.

The main strength of our study was the deployment of clinical data from a single national system with near whole-population coverage. Rapid and confidential data linkage was possible within the SAIL Databank[13] Trusted Research Environment, enabling detailed analysis by demographic factors, area-deprivation and granular healthcare pathway to diagnosis. We studied the whole of 2019 and 2020, rather than simply before and after the first national lockdown, allowing a more precise longitudinal analysis of the impact of lockdowns, health service measures and citizen behaviour change, as well as permitting seasonal variations to be accounted for.

Limitations included the low completeness of stage data for non-small cell lung cancer, although missing stage for female breast and colorectal cancers was higher during 2020 (Table 3 and Figures 4a-b). Given health service reconfiguration to maintain largely emergency procedures and surgery during pandemic waves, and altered diagnostic and treatment modalities due to enhanced infection control measures from early 2020 onwards, whilst clinical diagnosis could still be possible, information such as from pathology samples, for example, that would allow full and final staging at diagnosis might have been less available during 2020[5,6,19]. Such healthcare restrictions are likely to have affected colorectal cancer patients more than many breast cancer cases, with surgery being required for staging, and this is reflected in the considerable increase in unknown stage for colorectal cancer during 2020. Non-small cell lung cancer staging would have also relied more on staging at surgery than breast cancer, although we were unable to obtain data on this occasion. Arguably, some breast surgery can be done in a less intensive hospital setting than for advanced colorectal and non-small cell lung cancer. Furthermore, some observed smaller changes in stage distribution may have occurred through mis-classification of stage, due to staging occurring without the usual full information sources to clinicians.

Despite preceding COVID-19 cases, certain health system changes and a brief period of societal advisory restrictions (Figure 1) in Wales during early 2020, our results did not show major impacts on

cancer incidence until April 2020, following a strict lockdown implemented March 23, 2020, and significant health system reconfiguration to prioritise COVID-19 infection control. Using sub-regional primary care data, a study in Catalonia, Spain[21] demonstrated that cancer incidence decreased from March 2020, corresponding to earlier community infections and lockdown there. Our findings of changing diagnosis patterns during summer 2020 coincided with a partial lifting of restrictions and early readjustment of health services towards managing non-COVID-19 patients. Starting October 2020 (Figure 1), another brief lockdown coincided with increased monthly declines in diagnoses, according to our analysis. Strict restrictions were re-imposed in early December 2020, when diagnoses decreased further. GP urgent suspected cancer referral diagnoses decreased during Q2, 2020, after the first lockdown when primary care access was altered.

Citizen behaviour changed in response to restrictions and instructions to stay at home or 'shield'[22], which had the unintended consequence of causing a reluctance by some to seek health care services due to concerns about SARS-Cov-2 infection, and others not wanting to burden a health system busy with COVID-19[2,23]. This behaviour change was particularly impactful for those with potential lung cancer. A persistent cough is both an early sign of disease and the main symptom of COVID-19 infection. The potential risk from SARS-Cov-2 infection became a reason to stay at home and not consult a GP. Health service data in England, Northern Ireland and Wales indicated measurable decreased cancer-related referrals[5,6,8,24,25] of similar trends to actual diagnoses via this pathway in our study. We demonstrated that screen-detected female breast cancer diagnoses fell by almost half, consistent with the temporary cessation of screening services from March 2020 (see Figure 2), although in the interim, during Q2-Q3, breast screening services diverted to support symptomatic patient diagnosis via GP urgent suspected cancer [26]. Increases in screen-detected colorectal cancer diagnoses from Q3, 2019 to Q1, 2020, likely followed the known introduction of faecal immunochemical testing in Wales at that time. During the pausing of colorectal cancer screening, faecal immunochemical testing was diverted to assist in prioritising symptomatic patients awaiting colonoscopy. Cancer screening programmes restarted in phases from the end of June to August 2020, increasing female breast cancer diagnoses. The overall impact on screen-detected colorectal cancer was less, possibly because it was easier to send a faecal immunochemical testing kit to homes, with the uptake in colorectal screen-detected diagnoses improving soon after the service restarted. Existing colorectal cancer screening patients awaiting colonoscopy were reviewed for symptoms during the paused programme and referred to the symptomatic pathway if required.

Despite attendance at emergency departments decreasing[27], colorectal cancer and non-small cell lung cancers diagnoses through emergency presentations increased in Q2-Q3, 2020. It is not clear if this was due to a shift from other less accessible pathways, or increased emergency complications of

cancer or non-cancer conditions. Multi-morbidities are common amongst colorectal cancer and non-small cell lung cancers patients[28], making them more likely to be instructed to 'shield' at home. This could partly explain their lower recovery in GP urgent suspected cancer diagnoses compared to female breast cancer, and increased emergency presentations with an incidental cancer diagnosis. Patients 80+ years old were more likely to be shielding, which might explain their similar declines of around a fifth in incidence for all three cancers. We observed an increase in non-small cell lung cancer diagnoses as an existing in-patient in Q1 2020, when COVID-19 community infections had started in Wales, which suggested they might have been incidental diagnoses.

We cannot conclude from our current study that a shift to a later stage at diagnosis occurred in the true population cancer incidence during 2020, as many cases remained undiagnosed. Instead, we observed decreases of various extents in all stages for female breast and colorectal cancers. Pausing screening disproportionately affected stage I female breast cancer detection in 50-69 year-old women. For all the cancers, some patients already at a late stage may have died without being diagnosed, as predicted by modelling studies[7,8].

With over a thousand fewer cases diagnosed across three common cancers during 2020, our study suggests large numbers of undiagnosed cancer patients more widely due to the ongoing pandemic, along with societal mitigations and health service reconfiguration in response. Although the pandemic has abated somewhat, along with societal and healthcare responses to it, our study still suggests that extensive alterations to healthcare pathways to diagnosis, increases in later-stage diagnoses and an increase in the number of undiagnosed patients with new cancers will occur. Ongoing optimisation of cancer screening programmes and the transformation of cancer services and primary care referral is urgently required. With continued research and surveillance, the accumulation of incidence, stage and healthcare pathway data will allow more accurate forecasting through stage at diagnosis and mortality prediction modelling, in order to inform effective cancer services' responses.

Additional Information

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We wish to acknowledge the collaborative partnership that enabled acquisition and access to the de-identified data, which led to this output. The collaboration was led by the Swansea University Health Data Research UK team under the direction of the Welsh Government Technical Advisory Cell (TAC) and includes the following groups and organisations: the SAIL Databank, Administrative Data Research

(ADR) Wales, Digital Health and Care Wales (DHCW), Public Health Wales, NHS Shared Services Partnership (NWSSP) and the Welsh Ambulance Service Trust (WAST).

Author contributions

GG – methodology, project administration, resources, software, supervision, validation, data curation, formal analysis, investigation, writing – original draft, RG – data curation, validation, methodology, investigation, directly accessed and verified the underlying data, writing – review & editing, AA – project administration, resources, data curation, writing – review & editing, JH – data curation, investigation, validation, writing – review & editing, MJ - investigation, supervision, methodology, writing – review & editing, JL – visualisation, investigation, writing – review & editing, ML - funding acquisition, investigation, methodology, resources, writing – review & editing, RL - funding acquisition, investigation, methodology, resources, writing – review & editing, supervision, EM- investigation, methodology, supervision, writing – review & editing, MR - methodology, resources, writing – review & editing, supervision, FT – investigation, writing – review & editing, JW – investigation, methodology, supervision, writing – review & editing, DWH – conceptualisation, writing – original draft, methodology, supervision, resources, investigation, writing – review and editing

Ethics approval and consent to participate

All research conducted has been completed under the permission and approval of the SAIL independent Information Governance Review Panel (IGRP) project number 0911. The support of DATA-CAN, the UK's Health data Research Hub for Cancer is acknowledged. The advice of the Screening Division, Public Health Wales is also acknowledged.

Consent for publication

This study makes use of anonymised data held in the Secure Anonymised Information Linkage (SAIL) Databank. This work uses data provided by patients and collected by the NHS as part of their care and support. We would also like to acknowledge all data providers who make anonymised data available for research.

Data availability

The data used in this study are available in the SAIL Databank at Swansea University, Swansea, UK, but as restrictions apply, they are not publicly available. All proposals to use SAIL data are subject to review by an independent Information Governance Review Panel (IGRP). Before any data can be accessed,

approval must be given by the IGRP. The IGRP gives careful consideration to each project to ensure the proper and appropriate use of SAIL data. When access has been granted, it is gained through a privacy-protecting safe haven and remote access system referred to as the SAIL Gateway. SAIL has established an application process to be followed by anyone who would like to access data via SAIL at https://www.saildatabank.com/application-process

Competing interests

ML has received an unrestricted educational grant from Pfizer for research unrelated to this work. ML has received honoraria from Pfizer, EMF Serono, Roche, Novartis, Bayer and Carnall Farrar unrelated to this work. DWH has received research consultancy fees from Pfizer for research unrelated to this work and his department (Welsh Cancer Intelligence and Surveillance Unit, Public Health Wales) has received analysis partnership funding from Macmillan Cancer Support for unrelated work. All other authors have declared no conflicts of interest.

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Figures and tables

Figure 1: Chronology of the SARS-Cov-2 pandemic and mitigations to it in Wales during 2020

Figure 2: Trends in numbers of confirmed incident SARS-CoV-2 infection cases and hospitalised Covid-19 cases in Wales, 2020, with overlay of the periods of societal lockdowns and the period in which cancer screening programmes were paused.

Figure 3a and b: Total annual incident case counts and monthly case counts for female breast, colorectal, and non-small cell lung cancers for 2019 and 2020.

Figure 4a-b: Cumulative monthly case counts of female breast and colorectal cancers for 2019 and 2020 by stage at diagnosis

Figure 5: Quarterly counts of incident cases for female breast, colorectal and non-small cell lung cancers by healthcare pathway to diagnosis, 2019 and 2020

Figure S1: Total numbers of patients and reason for exclusions

Figure S2: Mapping of the healthcare pathway to diagnosis from the Cancer Network Information System Cymru (CaNISC) with additional information from the in-patient Patient Episode Dataset of Wales (PEDW)

Table 1: Absolute and relative changes in annual and monthly incidence count, stage at diagnosis and healthcare pathway to diagnosis from 2019 to 2020, by sex, age group, and income area-deprivation quintile for female breast cancer, colorectal cancer and non-small cell lung cancer, Wales, UK.

Table S1: STROBE/RECORD statement

Table S2: Table S3: Unadjusted and adjusted annual and monthly pairwise Incidence Rate Ratios (IRRs) (95% Confidence intervals) comparisons of 2020 and 2019.