The impact of the COVID-19 pandemic on cancer deaths due to delays in diagnosis in England, UK: a national, population-based, modelling study

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Summary

Background Since a national lockdown was introduced across the UK in March, 2020, in response to the COVID-19 pandemic, cancer screening has been suspended, routine diagnostic work deferred, and only urgent symptomatic cases prioritised for diagnostic intervention. In this study, we estimated the impact of delays in diagnosis on cancer survival outcomes in four major tumour types.

Methods In this national population-based modelling study, we used linked English National Health Service (NHS) cancer registration and hospital administrative datasets for patients aged 15–84 years, diagnosed with breast, colorectal, and oesophageal cancer between Jan 1, 2010, and Dec 31, 2010, with follow-up data until Dec 31, 2014, and diagnosed with lung cancer between Jan 1, 2012, and Dec 31, 2012, with follow-up data until Dec 31, 2015. We use a routes-to-diagnosis framework to estimate the impact of diagnostic delays over a 12-month period from the commencement of physical distancing measures, on March 16, 2020, up to 1, 3, and 5 years after diagnosis. To model the subsequent impact of diagnostic delays on survival, we reallocated patients who were on screening and routine referral pathways to urgent and emergency pathways that are associated with more advanced stage of disease at diagnosis. We considered three reallocation scenarios representing the best to worst case scenarios and reflect actual changes in the diagnostic pathway being seen in the NHS, as of March 16, 2020, and estimated the impact on net survival at 1, 3, and 5 years after diagnosis to calculate the additional deaths that can be attributed to cancer, and the total years of life lost (YLLs) compared with pre-pandemic data.

Findings We collected data for 32 583 patients with breast cancer, 24 975 with colorectal cancer, 6744 with oesophageal cancer, and 29 305 with lung cancer. Across the three different scenarios, compared with pre-pandemic figures, we estimate a 7·9–9·6% increase in the number of deaths due to breast cancer up to year 5 after diagnosis, corresponding to between 281 (95% CI 266–295) and 344 (329–358) additional deaths. For colorectal cancer, we estimate 1445 (1392–1591) to 1563 (1534–1592) additional deaths, a 15·3–16·6% increase; for lung cancer, 1235 (1220–1254) to 1372 (1343–1401) additional deaths, a 4·8–5·3% increase; and for oesophageal cancer, 330 (324–335) to 342 (336–348) additional deaths, 5·8–6·0% increase up to 5 years after diagnosis. For these four tumour types, these data correspond with 3291–3621 additional deaths across the scenarios within 5 years. The total additional YLLs across these cancers is estimated to be 59 204–63 229 years.

Interpretation 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. Urgent policy interventions are necessary, particularly the need to manage the backlog within routine diagnostic services to mitigate the expected impact of the COVID-19 pandemic on patients with cancer.

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See Comment page 1000

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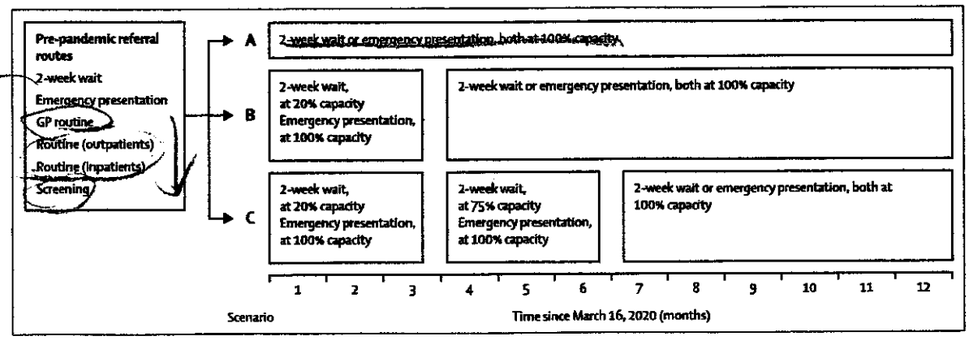

Figure 1: **Conceptual framework for reallocation of pre-pandemic referral routes in three modelling scenarios (A, B, and C)**
For breast cancer, in addition to patients on routine pathways, only 25% of patients diagnosed through screening (ie, the proportion of patients with tumour stage III or IV, node-positive, or metastatic disease) were reallocated to 2-week wait or emergency presentation in the pandemic scenarios. GP=general practitioner.

	Patients	Stage III–IV*	Net survival		
			1 year	3 years	5 years
Breast cancer					
Pre-pandemic period					
Emergency presentation	930 (2·9%)	245/356 (68·8%)	56·3% (53·9–58·6)	39·0% (37·0–41·0)	33·4% (31·8–35·1)
GP referral	5136 (15·8%)	566/2836 (20·0%)	96·3% (96·2–96·3)	90·0% (89·9–90·1)	86·2% (86·2–86·3)
Other routine†	887 (2·7%)	93/418 (22·2%)	94·0% (93·8–94·2)	85·8% (85·5–86·1)	81·3% (81·0–81·7)
Screening	10 795 (33·1%)	406/6789 (6·0%)	100·0% (100–100)	99·6% (99·6–99·6)	98·8% (98·8–98·8)
2-week wait	14 835 (45·5%)	1821/8934 (20·4%)	97·9% (97·9–97·9)	91·3% (91·3–91·4)	86·3% (86·2–86·3)
Overall	32 583 (100%)	..	**97·0%** (97·0–97·1)	92·2% (92·2–92·3)	88·8% (88·7–88·8)
Pandemic period					
Scenario A	..	..	**96·0%** (95·9–96·1)	89·0% (88·9–89·1)	83·9% (83·9–84·0)
Emergency presentation	1149 (4·7%)	..	..	..	..
2-week wait	23 357 (95·3%)	..	..	..	..
Scenario B	..	..	**95·9%** (95·9–96·0)	88·8% (88·7–88·9)	83·6% (83·6–83·7)
Emergency presentation	1225 (5·0%)	..	..	..	..
2-week wait	23 286 (95·0%)	..	..	..	..
Scenario C	..	..	**95·9%** (95·8–96·0)	88·7% (88·6–88·8)	83·6% (83·5–83·6)
Emergency presentation	1249 (5·1%)	..	..	..	..
2-week wait	23 240 (94·9%)	..	..	..	..
Colorectal cancer‡					
Pre-pandemic period					
Emergency presentation	..	..	54·8% (54·6–55·1)	40·3% (40·1–40·4)	35·1% (34·9–35·2)
Colon	4143 (26·1%)	1753/2263 (77·5%)	..	..	..
Rectum	1040 (11·4%)	459/584 (78·6%)	..	..	..
GP referral	..	..	83·5% (83·4–83·5)	70·6% (70·5–70·7)	64·4% (64·3–64·4)
Colon	3769 (23·8%)	1262/2082 (60·6%)	..	..	..
Rectum	2538 (27·9%)	903/1531 (59·0%)	..	..	..
Other routine†	..	..	83·7% (83·6–83·8)	71·3% (71·2–71·4)	65·4% (65·3–65·5)
Colon	2063 (13·0%)	666/1112 (59·9%)	..	..	..
Rectum	1001 (11·0%)	365/587 (62·2%)	..	..	..
Screening	..	..	97·5% (97·5–97·5)	92·9% (92·9–93·0)	89·6% (89·6–89·7)
Colon	1922 (12·1%)	431/985 (43·8%)	..	..	..
Rectum	1102 (12·1%)	307/677 (45·3%)	..	..	..
2-week wait	..	..	85·0% (85·0–85·1)	71·2% (71·2–71·3)	64·2% (64·1–64·2)
Colon	3970 (25·0%)	1493/2444 (61·1%)	..	..	..
Rectum	3427 (37·6%)	1449/2344 (61·8%)	..	..	..
Overall	..	..	79·7% (79·7–79·8)	67·3% (67·2–67·3)	61·4% (61·4–61·5)
Colon	15 867 (100%)	..	..	..	..
Rectum	9108 (100%)	..	..	..	..
Pandemic period	..	..	..	..	..
Scenario A	..	..	76·0% (75·9–76·0)	61·9% (61·8–61·9)	55·3% (55·3–55·3)
Emergency presentation					
Colon	6166 (38·9%)	..	..	..	..
Rectum	1570 (17·2%)	..	..	..	..
2-week wait					
Colon	9700 (61·1%)	..	..	..	..
Rectum	7538 (82·8%)	..	..	..	..
Scenario B					
Emergency presentation	..	..	75·7% (75·6–75·7)	61·6% (61·6–61·7)	55·1% (55·1–55·2)
Colon	6384 (40·2%)	..	..	..	..
Rectum	1654 (18·2%)	..	..	..	..

(Table 1 continues on next page)