Prevalence of BMI ≥30 kg/m^2 in cancer patients receiving systemic therapy: a population-based study in 69,898 patients across 11 cancer types

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BACKGROUND & AIM

- A higher body mass index (BMI) increases the risk of multiple cancers, including of the breast, bowel, pancreas, liver, and oesophagus.[1] However, it is not fully known if having a BMI≥30 (within the obese range) impacts upon cancer treatments and outcomes.[2]
- Longitudinal BMI measurements from population-based electronic health records (EHR) can be used for research into higher BMI and the link with cancer, systemic anticancer therapy (SACT) and survival. [3]
- In a new study linking five population-based EHR data sources in England,[4-8] our aim was to estimate observed and age-standardised prevalence of BMI≥30 in cancer patients at time of receiving first SACT overall and across cancer types in England over 2013-2023.

METHODS

Data Sources

- Data were linked from five EHR sources in England:
  1) QResearch primary care records
  2) Hospital episode statistics (HES)
  3) National cancer registrations & analysis service (NCRAS)
  4) SACT data set
  5) Civil Registrations of Death

Study eligibility and follow-up

- Eligible patients were adults registered (followed-up) at a QResearch practice for at least 1-year, who had a first diagnosis of one of 11 cancer types recorded in QResearch, HES and/or NCRAS and a first systemic treatment recorded in SACT during the study period 1-Jan-2013 and 31-Dec-2023.
- Patients were censored on the earliest of follow-up end date in QResearch or death registration date.

Prevalence estimation

- BMI was derived from complete and plausible weight (kilograms, Kg) and height (metres, m) values recorded for the first SACT start date using formula: BMI = Kg/m^2
- Observed prevalence of BMI≥30 was estimated as the number of patients with BMI ≥30 kg/m^2 divided by the total number of patients with a BMI value and reported as a percentage with 95% confidence interval (% [95%CI]) overall and separately for each cancer type.
- Age-standardised prevalence rates were calculated by direct method (age groups 20 to 44, 45 to 54, 55 to 64, 65 to 74 and 75 years and over) using the mid-year 2022 population statistics for England for both males and females separately and combined.[9]
- Prevalence rates by calendar year were plotted against Health Survey for England annual estimates of adult obesity in England.[10]
- Analyses were carried out per the study protocol, which was independently peer-reviewed and approved by the QResearch Scientific Board (OX183).

RESULTS

Study sample characteristics

- As shown in **Table 1**, 346,954 patients had a first record of cancer in 2013-2023, and 69,898 patients had a SACT record. Breast cancer was the most frequent cancer in the sample, and hepatocellular cancer the least frequent.
- For SACT patients overall, the median age at regimen start was 67.8 years, and ranged from 58 years (breast) to 73 years (prostate, bladder) across cancer types.
- While 52.4% patients overall were female, the majority of patients with non-sex specific cancers were male.
- At diagnosis, 33.1% SACT patients had stage IV disease, ranging from 9.0% (breast) to 57.3% (prostate).
- A BMI measurement was available for 88.8% patients overall, ranging across cancer types from 69.4% patients (prostate) to 97.3% patients (bowel, pancreas).

Table 1. Study sample characteristics

	Cancer patients	SACT patients	Female	Age at first SACT (years)	Stage at diagnosis:					BMI value
						I	II	III	IV	
	N	N	n (%)	median (Q1, Q3)	N	n (%)	n (%)	n (%)	n (%)	n (%)
Breast	64111	17435	17304 (99.2)	58.2 (49.5, 68.7)	11615	2588 (22.3)	5878 (50.6)	2099 (18.1)	1050 (9.0)	15631 (89.7)
Prostate	62300	7680	0 (0.0)	73.1 (67.4, 78.3)	5799	765 (13.2)	490 (8.4)	1221 (21.1)	3323 (57.3)	5332 (69.4)
Lung	55949	11573	5488 (47.4)	70.0 (62.8, 75.7)	7951	603 (7.6)	634 (8.0)	2537 (31.9)	4177 (52.5)	10740 (92.8)
Bowel	53510	13368	5589 (41.8)	67.4 (58.9, 74.7)	8710	462 (5.3)	1398 (16.1)	4139 (47.5)	2711 (31.1)	13001 (97.3)
Melanoma	21418	2362	960 (40.6)	69.7 (58.9, 77.5)	1541	387 (25.1)	515 (33.4)	458 (29.7)	181 (11.7)	1786 (75.6)
Kidney	16876	2372	738 (31.1)	69.0 (60.2, 75.6)	1508	276 (18.3)	88 (5.8)	405 (26.9)	739 (49.0)	1784 (75.2)
Pancreas	13851	2794	1279 (45.8)	69.3 (61.1, 75.3)	1565	148 (9.5)	384 (24.5)	315 (20.1)	718 (45.9)	2719 (97.3)
Bladder	24624	3321	768 (23.1)	73.2 (66.0, 78.7)	1460	540 (37.0)	509 (34.9)	210 (14.4)	201 (13.8)	2540 (76.5)
Gastroesophageal	19968	5421	1500 (27.7)	69.0 (60.9, 75.0)	3296	164 (5.0)	508 (15.4)	1246 (37.8)	1378 (41.8)	5220 (96.3)
Ovarian	9502	2858	2858 (100.0)	67.8 (57.7, 75.9)	1602	197 (12.3)	153 (9.6)	780 (48.7)	472 (29.5)	2750 (96.2)
Hepatocellular	4845	714	151 (21.1)	69.4 (61.7, 75.5)	275	79 (28.7)	78 (28.4)	53 (19.3)	65 (23.6)	537 (75.2)
Overall	346954	69898	36635 (52.4)	67.8 (58.1, 75.0)	45322	6194 (13.7)	10635 (23.5)	13463 (29.7)	15015 (33.1)	62040 (88.8)

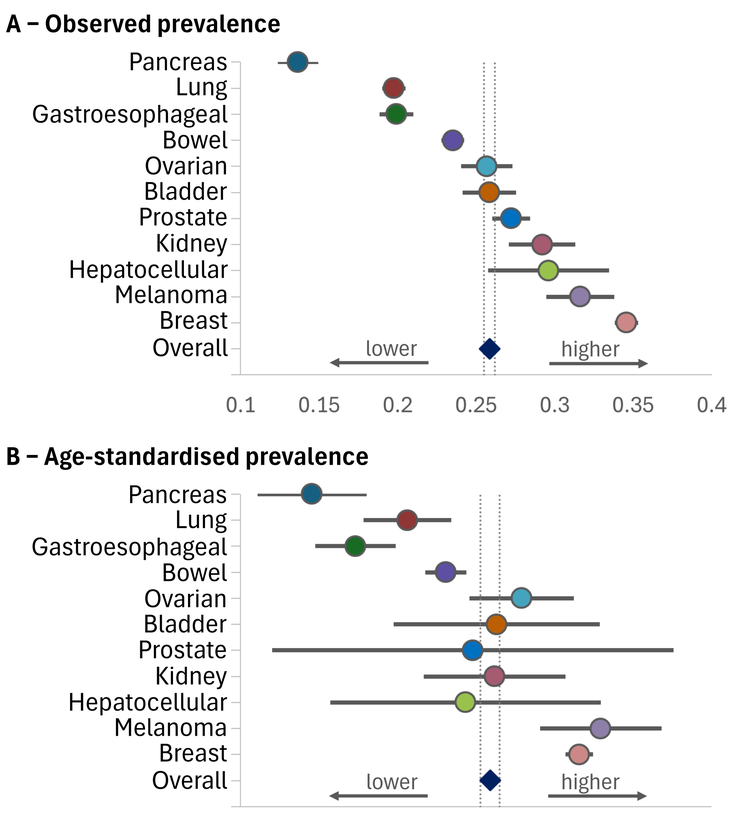
Abbreviations: BMI – body mass index, N – number (denominator), n – number (numerator), SACT – systemic anticancer therapy, Q1 – first quartile, Q3 – third quartile

Table 2. BMI≥30 prevalence rates, by cancer type

	Obese n	Observed % [95% CI]	Age-standardised % [95% CI]
Breast	5403	34.6% [33.8-35.3%]	31.6% [30.7-32.5%]
Prostate	1452	27.2% [26.0-28.4%]	24.8% [12.0-37.6%]
Lung	2122	19.8% [19.0-20.5%]	20.6% [17.8-23.4%]
Bowel	3057	23.5% [22.8-24.2%]	23.1% [21.8-24.4%]
Melanoma	565	31.6% [29.5-33.8%]	33.0% [29.1-36.8%]
Kidney	521	29.2% [27.1-31.3%]	26.2% [21.7-30.7%]
Pancreas	371	13.6% [12.4-14.9%]	14.6% [11.1-18.1%]
Bladder	656	25.8% [24.1-27.5%]	26.3% [19.8-32.9%]
Gastroesophageal	1040	19.9% [18.8-21.0%]	17.3% [14.8-19.9%]
Ovarian	706	25.7% [24.0-27.3%]	27.9% [24.6-31.2%]
Hepatocellular	159	29.6% [25.7-33.5%]	24.4% [15.7-33.0%]
Overall	16052	25.9% [25.5-26.2%]	25.9% [25.3-26.5%]

Abbreviations: BMI – body mass index, n – number (numerator), CI – confidence interval

Figure 1. BMI≥30 prevalence rates, by cancer type

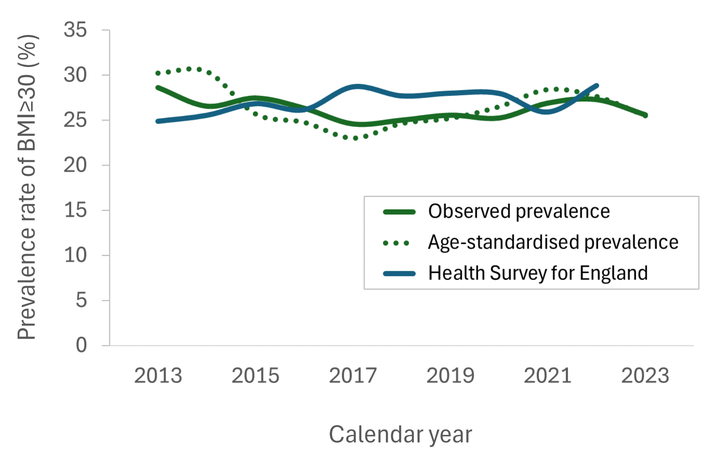


Notes: vertical dashed lines show the lower and upper 95% CI for the overall population estimate
Abbreviations: BMI – body mass index, CI – confidence interval

Observed and age-standardised prevalence

- As shown in **Table 2** and **Figure 1**, the observed and age-standardised rate of BMI≥30 in the overall sample of cancer patients receiving first SACT was 25.9%.
- Prevalence was higher in breast cancer and melanoma and lower in bowel, gastroesophageal, lung and pancreatic cancer with broadly similar patterns found in females and males (data not shown).
- Over the study period 2013-2023, rates of BMI≥30 among SACT patients fluctuated around 26% (**Figure 2**), with some variation expected due to cancer case-mix.

Figure 2. BMI≥30 prevalence rates, 2013-2023



Notes: The latest data available from the Health Survey for England is for the year 2022.
Abbreviations: BMI – body mass index

INTERPRETATION & IMPACT

- In this large data linkage study, we found a BMI≥30 prevalence rate in cancer patients at time of receiving first SACT of approximately 1 in 4 patients. However, there were wide differences across cancer types.
- At point of treatment, we observed a lower BMI for bowel, lung, gastroesophageal, and pancreatic cancers, diseases associated with cachexia and/or poor dietary intake. Breast cancer patients may be more likely to have ascites which may increase BMI. BMI has been shown to correlate with increased Breslow thickness (a prognostic indicator used in melanoma staging)[11] thus it could be that melanoma patients with higher BMI more often receive SACT.
- Limitations of our work include the possibility that BMI at point of cancer treatment may differ from maximal lifetime BMI at the individual and population level. Hence, we cannot make inferences about the role of higher BMI in cancer incidence using these data.
- Our future research will consider lifetime exposure to higher BMI in SACT patients, together with metabolic dysfunction, to understand how these factors relate to treatment utilisation and effectiveness. Our ultimate goal is to develop a prognostic model aimed at predicting and improving outcomes for patients across all levels of BMI, taking into account potential confounders in the exposure-outcome relationship.

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