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Case-mix adjusted 30-day mortality post systemic anti-cancer therapy rates for acute lymphoblastic leukaemia and acute myeloid leukaemia

A companion brief to support the interpretation of this data

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Foreword

Acute leukaemias are typically rapidly progressing malignant diseases. In the UK acute lymphoblastic leukaemia (ALL) is the most common childhood malignancy[1]. Acute myeloid leukaemia (AML) is most frequent in the later decades of life[2]. As such the majority of ALL patients receive SACT, mostly with curative intent. Fewer AML patients receive SACT with curative intent, although cure may be realistic in suitable fit patients <75 years old. Approximately one third of SACT treated AML patients receive SACT with non-curative intent[3].

The goal for chemotherapy in all cancer patients is to balance the mortality and morbidity associated with SACT against the prospect of cure or medium/long term clinical benefit. Early mortality can be high in acute leukaemias because of the rapid disease onset, meaning that patients are often very unwell at presentation, for example with infection or bleeding. The risks of SACT are then superimposed, with myelosuppression induced by SACT exposing patients transiently to a greater risk of infection and bleeding. Thus, high quality supportive care is always provided in parallel with SACT, typically as an inpatient in younger patients receiving more intensive SACT. This intensity of SACT in acute leukaemia is distinct from the less intensive SACT required for most other cancers. The combination of a sick patient treated with intensive SACT leads to considerably higher 30-day mortality for acute leukaemias compared with other malignant diseases.

This release of CMAR 30-day mortality data is welcomed but requires some caveats for individual Trusts to consider when reviewing their data. Case mix adjustment is made for relevant parameters that may influence 30-day AML/ALL mortality following SACT, that can be collected by NHS systems. These include age, sex, performance status, and co-morbidities (not necessarily complete as this is computed from HES data only and not universally from GP records). Disease stage at presentation does not apply to AML/ALL. Other determinants of early mortality which cannot currently be comprehensively collected are the biological characteristics of the subtypes of ALL and AML. This disease biology can influence the decision as to the nature of SACT that is recommended, on top of which is then layered other factors such as age, comorbidity and patient choice. The final decision on SACT intensity in turn will influence both 30-day mortality and later survival. In this context Trust-specific 30-day mortality may not reflect intent of treatment for individual patients. To use a hypothetical and extreme example, Trust A could appropriately choose to treat most AML/ALL patients with low intensity SACT (based on the case mix of disease biology) resulting in low 30-day mortality but poor 5-year overall survival. Trust B meanwhile appropriately treats most AML/ALL patients (based on a different case mix of disease biology to Trust A) with high intensity SACT, resulting in above average 30-day mortality but also above average 5-year overall survival.

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[1] Children with Cancer UK. About acute lymphoblastic leukaemia (ALL) in children. https://www.childrenwithcancer.org.uk/childhood-cancer-info/cancer-types/acute-lymphoblastic-leukaemia/#:~:text=Incidence,in%20children%20in%20the%20UK (07 May 2021, date last accessed)

[2] National Cancer Registration and Analysis Service within Public Health England; Office for National Statistics. Cancer registration statistics, England, 2017. https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/datasets/cancerregistrationstatisticscancerregistrationstatisticsengland (07 May 2021, date last accessed)

[3] Public Health England. SACT. 30 day mortality post SACT 2015-16 workbook. http://www.chemodataset.nhs.uk/view?rid=283 (13 May 2021, date last accessed)

Summary

In March 2021, the National Disease Registration Service (NDRS) team, as part of the SACT-NHSE Partnership at Public Health England (PHE), produced case-mix adjusted 30-day mortality post systemic anti-cancer therapy (SACT) rates (CMAR) for acute lymphoblastic leukaemia (ALL) and acute myeloid leukaemia (AML). These CMAR were calculated for NHS trusts and the workbook was circulated to all trusts.

The data is case-mix adjusted to allow for comparisons to be made between trusts and within a trust over time. Trusts were able to request NHS numbers of patients who have died within 30 days of receiving SACT at their trust. We developed this information to support clinical governance at trusts and potentially identify areas where clinical care could be improved. We provided all trusts with the opportunity to comment on their data and their statements are included in this Companion brief, published May 2021.

Context and interpretation

We acknowledge that the clinical pathways for these haematological cancers may be different from the tumour sites we have released previously, and thus this clinical indicator should be interpreted with caution.

Key messages - acute lymphoblastic leukaemia (ALL)

- No trusts were identified as outliers.
- The average case-mix adjusted 30-day mortality rate post SACT (CMAR) was 22.1%.
- 17 trusts had a CMAR of 0%.
- 55 trusts were included in the analyses.
- The number of patients meeting the eligibility criteria for inclusion in the analysis varied, ranged from 1 to 54 patients.
- 36 trusts had fewer than 10 eligible patients, so were not identified as outliers even if they had a high CMAR.
- 17 trusts were excluded from the analyses as they did not meet our 70% completeness threshold for data completeness for the risk-adjustment variables.

Key messages - acute myeloid leukaemia (AML)

- No trusts were identified as outliers.
- The average case-mix adjusted 30-day mortality rate post SACT (CMAR) was 28.0%.
- 11 trusts had a CMAR of 0%.
- 89 trusts were included in the analyses.
- The number of patients meeting the eligibility criteria for inclusion in the analysis varied, ranged from 1 to 96 patients.
- 46 trusts had fewer than 10 eligible patients, so were not identified as outliers even if they had a high CMAR.
- 30 trusts were excluded from the analyses as they did not meet our 70% completeness threshold for data completeness for the risk-adjustment variables.

Background

In 2016, the SACT team at PHE published a paper in the Lancet Oncology providing 30-day mortality post-SACT rates for breast and lung cancer. NHS trusts, NHS England and the clinical community fed back to PHE that this work had been beneficial in terms of setting a national benchmark, identifying variation in clinical practice between trusts and identifying areas where patient care could have been improved. This information helped to inform advancements to clinical practice.

In December 2018, the SACT team released a workbook to trusts providing crude rates for 30-day mortality post-SACT for all cancers combined and breakdowns for acute myeloid leukaemia, breast, colon, children's teenagers and young adults (CTYA), small cell lung cancer, non-small cell lung cancer, upper gastro-intestinal oesophageal.

Feedback generated from this release highlighted the need for 30-day mortality data which was more timely to support clinical audit, as well as case-mix adjusted which would facilitate the comparison of performance between trusts. Unfortunately, these two needs cannot be met in a single data feed. Case-mix adjusted data cannot be produced soon enough after treatment activity to support clinical audit as it requires linkage to the National Cancer Registration Dataset for England to provide supplementary patient information which operates at an approximate 18-month time lag, and additional analytical time to conduct the work. Furthermore, for rarer cancer types, case-mix adjustment may only be possible when several years of data have accrued to provide sufficient cohort size to support analysis. The SACT team have therefore met these two needs through two outputs: the Rapid Data Review (RDR) and the CMAR. The RDR provides a quarterly data feed to all NHS trusts in England providing key information on patients who died within 30 days of receiving SACT at their trust. This aims to inform 'mortality and morbidity' meetings and develop communications between trusts on initiatives undertaken to reduce 30-day mortality. The CMAR produces 30-day mortality post-SACT rates that are adjusted for key variables which means that rates can be compared between trusts and within trusts over time.

In August 2020 and November 2020, the SACT team released workbooks containing case-mix adjusted 30-day post-SACT mortality rates for a range of cancer sites. The data for these workbooks are now available as an interactive web application at https://www.cancerdata.nhs.uk/sact/cmarreport. This presents all cancer sites from these workbooks in one output and enables new functionality; such as displaying trust name, number of patients treated, and case-mix adjusted 30-day mortality rate when hovering over datapoints on the funnel plot. The August 2020 CMAR workbook reviewed patients aged 18+ diagnosed between 2010 and 2017 treated for lung, gastric, pancreatic cancer, and cancer of unknown primary (CUP) in 2017-2018 (depending on the site). The November 2020 CMAR workbook reviewed patients aged 18+ diagnosed between 2010 and 2018 treated for bowel, breast, myeloma and ovarian in 2018-2019 (depending on the site).

Two further workbooks will be released publicly in May 2021. The first reviewed CTYA (Children Teenager and Young Adult) patients aged 0-24 diagnosed between 2010 and 2018 and treated for lymphoblastic leukaemia (ALL) in 2017-2019. The second reviewed patients aged 18+ diagnosed between 2010 and 2018 and treated for prostate cancer in 2018-2019.

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Each workbook was based on data reported by NHS trusts in England through their monthly routine SACT data uploads. In advance of these publications the adult workbooks were sent to the NHS Trusts and the CTYA ALL workbook was sent to Principal Treatment Centres (PTCs) for review, giving them the opportunity to provide a statement to accompany their data. These statements have been included in the companion reports released with the August 2020, and November 2020 and May 2021 CMAR workbooks.

For further information on the SACT data reports please see
http://www.chemodataset.nhs.uk/reports/

Workbook

The workbook is produced as part of the SACT-NHSE partnership and is based on routine data submitted by NHS trusts to the SACT dataset. It includes patients diagnosed with ALL and AML cancer in England between 2010 and 2018 and treated with SACT in all NHS trusts in England between January 2017 and December 2019. The period of treatment activity used varies depending on the cancer type studied (see Table 1) and patients were only included if they received their latest treatment during the treatment period (i.e. patients still receiving treatment in 2020 were excluded). Each patient was allocated to the trust where they received their final treatment, regardless of any prior treatment received at other trusts.

Table 1. ICD-10 code and treatment activity covered

Cancer site	ICD-10 code	Period of treatment activity
Acute Lymphoblastic Leukaemia (ALL)	C91.0	Jan 2017 – Dec 2019
Acute Myeloid Leukaemia (AML)	C92.0, C92.4, C92.5, C92.6, C92.8, C93.0, C94.0, C94.2	Jan 2018 – Dec 2019

The National Cancer Registration and Analysis Service (NCRAS), part of Public Health England (PHE), is the population-based cancer registry for England. It receives data from across the National Health Service (NHS) and produces the National Cancer Registration Dataset for England. The SACT dataset collects systemic anti-cancer therapy activity from all NHS England providers. For the purposes of the analysis, patients were selected from the National Cancer Registration Dataset. This cohort of patients was then linked to the SACT dataset on NHS number in order to retrieve the latest treatment records for these patients. Certain restrictions were applied to the data to ensure the appropriate patients and treatments were selected for each cancer site. These restrictions mean that some trusts may have no data included in the workbook because their patients and patients' treatment activity did not fit the criteria applied. The restrictions applied to the data are outlined below.

Cancer restrictions

- The cohort was restricted to diagnoses between 2010 and 2018.
- Patients whose most recent cancer diagnosis was for the cancer site of interest were selected. If patients had more than one cancer diagnosis on the same day, the cancer site of interest was selected.

It is important to note that in some cases, the cancer diagnosis recorded in the National Cancer Registration Dataset may differ from that recorded by the trust.

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If you would like support in improving the quality of the data feed into the NCRAS then please contact NDRSdatasets@phe.gov.uk

Data completeness restrictions

Trusts with less than 70% completeness for the following key variables: performance status and co-morbidity score, were excluded from the analysis. Please note that these variables were sourced from the SACT dataset, and the National Cancer Registration Dataset. For the CMAR reports, cancer sites were selected for analysis on the basis that less than 20% of trusts would be excluded using the 70% completeness threshold. Initial project design stages showed a higher percentage of trusts (~30%) being excluded for ALL and AML. These were set as 'one-off' releases on this basis. For the current analysis, 23% of trusts were excluded for ALL, and 25% of trusts were excluded for AML.

Data consistency restrictions

- The trust at which final SACT treatment was completed is important for calculating the CMAR. Any patients whose final SACT treatment was recorded at two different trusts on the same day have therefore been removed from the analysis.
- Any patients who had a record of SACT treatment after death were removed from the analysis.

These were not common events in the data.

Age restrictions

- The cohort was restricted to those aged 18+. As this covers an adult cohort, the following children's hospitals have been excluded from analysis:
    - Alder Hey Children's NHS Foundation Trust
    - Birmingham Women's and Children's NHS Foundation Trust
    - Great Ormond Street Hospital for Children NHS Trust
    - Sheffield Children's NHS Foundation Trust

30-day SACT mortality restrictions

We count deaths (for any reason) within 30 days of the date that the last SACT treatment was administered. For oral treatments the 30-day window starts 28 days after the last administration date recorded in SACT, as most oral treatments have a prescription length of 28 days. Please see the CDF methodology document[4] for further details. The current method of setting all oral treatments as lasting 28 days is being reviewed for future SACT outputs.

Treatment restrictions

For the purposes of the analysis, and to ensure treatment data was relevant to the cancer site, the following rules were applied when linking SACT data to the cohort of patients identified from the National Cancer Registration Dataset:

[4] Appendix links for the CDF methodology document: Appendix A (oral treatment duration calculations) and Appendix B (caveats associated with oral treatment duration calculations)

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1. For those patients with only one cancer diagnosed, all treatment records within the relevant time frame were selected.
2. For those patients with more than one cancer diagnosed, treatment records were selected if they fit the following criteria:
    a. Within the relevant timeframe (ALL: January 2017-December 2019; AML: January 2018-December 2019).
    b. The first three characters of the primary diagnosis recorded in SACT for that treatment record matched the first three characters of the cancer site identified in the National Cancer Registration Dataset.
3. For those patients with treatment records that did not fall within categories 1 and 2 outlined above, treatment records were selected if they were within the relevant timeframe and fell within 31 days before and 456 days after the diagnosis of interest. The decision to restrict based on the time between treatment and diagnosis is in accordance with the Linking treatment tables – chemotherapy, tumour resections and radiotherapy' standard operating procedure. The timeframes used ensure that treatment given soon after diagnosis is included for those patients where the diagnosis codes recorded in the National Cancer Registration Dataset are not an exact match to those recorded in SACT. This is particularly relevant for some cancers where coding of the cancer site sometimes differs between data sources.

Treatment regimens

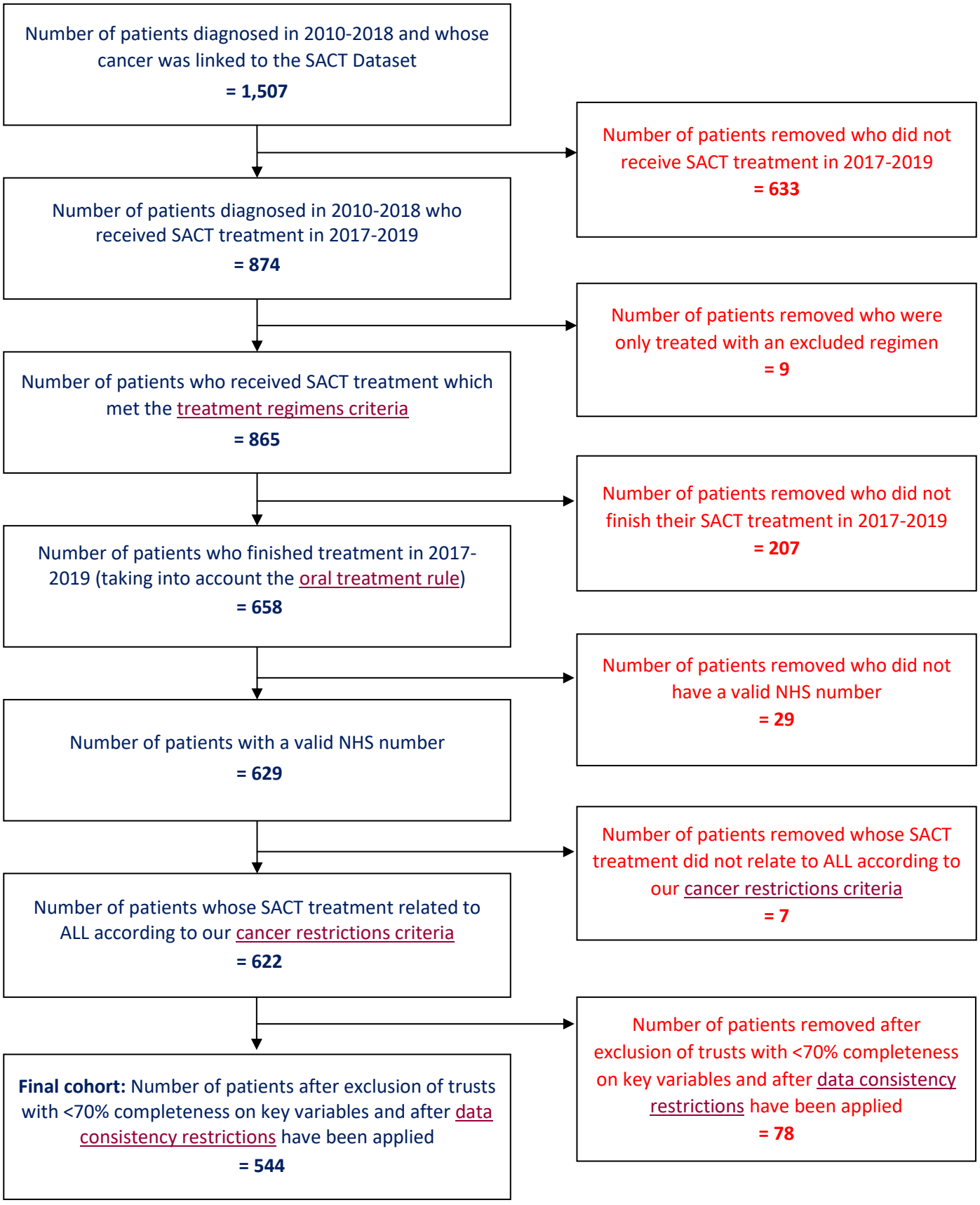
Non-harmful, supportive treatments, hormones and non-chemo drugs excluded from the analysis. The excluded regimens are listed below. These were selected for exclusion in consultation with clinicians and pharmacists, and are reviewed on a site-specific basis for every release.

- Abiraterone
- Anagrelide
- Anastrozole
- Anti-Emetics
- Anti-Histamines
- Apalutamide
- APML
- B12
- Bicalutamide
- Bisphosphonates
- Cyproterone
- Darolutamide
- Degarelix
- Denosumab
- Dexamethasone[5]
- Enzalutamide
- Exemestane
- Finasteride
- Flutamide

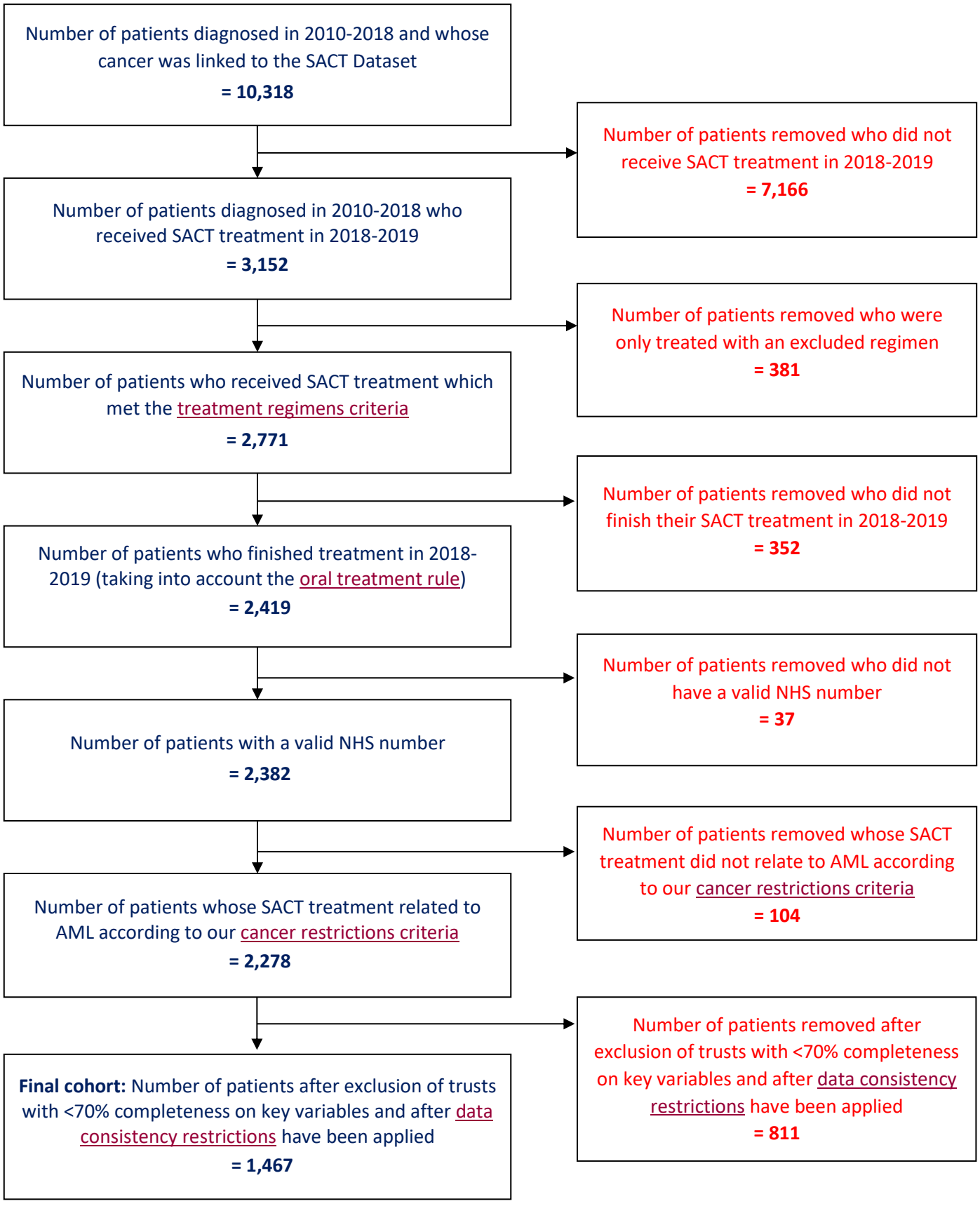
[5] A sensitivity analysis with dexamethasone steroid included in the analysis showed no difference in results.

- Folinic Acid
- Fulvestrant
- GCSF
- Goserelin
- Hepatoblastoma
- Hormone
- Ibandronic Acid
- Lanreotide
- Letrozole
- Leuprorelin
- Medroxyprogesterone
- Megestrol
- Not Chemo
- Octreotide
- Pamidronate
- Pasireotide
- Progesterone
- Retinoblastoma
- Sandostatin
- Signifor
- Somatostatin
- Somatuline
- Steroidabove[5]
- Stilbestrol
- Stilboestrol
- Tamoxifen
- Trial
- Triptorelin
- Vitamin
- Zoledronic Acid

CMAR ALL analysis flowchart



CMAR AML analysis flowchart



Implications of methodological approach

To get detailed information on the cancer diagnosis, patient and cancer characteristics, cancers recorded in the National Cancer Registration Dataset are linked to those in the Systemic Anti-Cancer Therapy (SACT) datasets. This requires analytical decisions to be made. In particular, the recording of primary diagnoses in the SACT dataset are known to not always exactly match the cancer site recorded in the National Cancer Registration Dataset (the gold standard), so linking records on patient identifiers and cancer site would mean many cancers and their associated SACT treatment could be missed.

The treatment restrictions detailed on the treatment restrictions section, are therefore designed to balance the risks of erroneously excluding patients from the cohort because of errors in the recording of primary diagnosis in the SACT dataset (or errors in the mapping of regimens), with the risk of incorrectly including SACT treatment records that do not relate to the cancer site under consideration in the CMAR report.

In cases where the primary diagnoses recorded in the two datasets differ, we use the time between cancer diagnosis and treatment along with the timeframes cited in the 'Linking treatment tables – chemotherapy, tumour restrictions and radiotherapy' standard operating procedure, to infer whether the treatment captured in the SACT dataset is likely to relate to the cancer of interest. For both sites the recommended window is between 31 days before the recorded date of diagnosis and 456 days after, so it is quite a long window.

The COVID-19 pandemic has unfortunately led to an increased lag in the availability of National Cancer Registration Dataset data, which has meant cancer diagnoses made in 2019 are not yet available. Patients who received a second primary cancer diagnosis in 2019 will therefore been captured as having just ALL or AML. We have included treatment information up to the end of 2019 as SACT data is more timely.

We follow the approach used for the Cancer Drugs Fund reports for oral treatments, where we estimate how long the patient is 'on treatment' for, by adding days relating to the typical prescription length to the last administration date recorded in the SACT dataset. 28 days was found to be a reasonable proxy for most treatments. Therefore, we add 28 days to the administration date for all oral treatments. This is then taken into account when retrieving the final treatment date for each patient. This may differ from methodologies used within trusts themselves. We are currently reviewing our methodology to consider which approach is of greatest value to trusts.

We are conservative in our approach to excluding regimens from the analyses, to avoid excluding regimens that have been incorrectly mapped. This can, however, result in SACT treatment for cancer sites other than the site of interest being included.

Interpretation of the data

Case-mix adjusted mortality post-SACT rates are reported in this workbook. Each trust will see and treat a wide variety of patients depending on the population they serve and the services they provide. The case-mix adjusted rates take into account these differences by producing rates that are based on an average group of patients as opposed to the trust's own group of patients. The rates can then be compared between trusts and within a trust over time. This was done using statistical modelling (in this case, a mixed effects logistic regression model). Please see the accompanying FAQ document for further technical information on calculating CMAR. Further to clinical feedback received it has been noted that the clinical pathways for haematological cancers may differ from the tumour sites covered for previous CMAR releases, and thus this clinical indicator should be interpreted with caution.

The following variables were adjusted for in the analysis:

- Age calculated as of the 1st January 2019
- Co-morbidity score[6]
- Deprivation status[7]
- Ethnicity[8]
- Hospital trusts (as a random effect[9])
- Performance status at diagnosis[10]
- Sex

These variables were chosen because they are known to influence 30-day post-SACT mortality and have sufficient completeness. It is important to note that due to the absence of any information on factors such as patient choice and clinical factors such as liver function tests, the case-mix adjustment may not fully correct for the differences in caseload between trusts.

The funnel plot[11] presented in the workbook is a means of visualising 30-day mortality post-SACT rates for the eligible[12] trusts in England.

- The volume of patients is on the horizontal axis. The more patients treated by your trust, the further to the right your trust will be.
- The 30-day mortality post-SACT is on the vertical axis. The higher the mortality post-SACT rate at your trust, the further up the graph it will appear.

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[6] The co-morbidity score relates to the Charlson comorbidity score derived using inpatient Hospital Episode Statistics data from 27 to 3 months prior to cancer diagnosis, with the same methodology as described by Maringe *et al*.

[7] Using the income domain of the Index of Multiple Deprivation. IMD data from 2015 was used for tumours diagnosed between 2010 and 2013 and IMD data from 2019 was used for tumours diagnosed between 2014 and 2018.

[8] Grouped into White, non-White and Unknown categories for analysis as there were insufficient numbers in the other ethnic groups for robust analysis.

[9] In a model, a random effect is usually a grouping factor (e.g. general practice, school, university), in this case the trust, for which we are trying to control and which we expect to be influencing the pattern of 30-day mortality.

[10] Performance status (PS) at start of cycle was used. PS at start of regimen was also included for cases where PS at start of cycle data was missing
This was adjusted for in the regression analysis by categorising as 0, 1, 2+ and Unknown
For further information please see the ECOG Performance Status page

[11] More information on funnel plot uses and interpretation can be found on the PHE Technical Guide and Tower Hamlets Clinical Commissioning Group Guide

[12] See data completeness restrictions section

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- The solid red horizontal line shows the average mortality post-SACT rate of all trusts.
- Your trust is indicated by the yellow diamond, other trusts are represented by the blue diamonds.
- The dotted lines represent the ±2 standard deviations (SDs) (roughly equivalent to 95% confidence intervals); the dashed lines represent the ±3 standard deviations (SDs) (roughly equivalent to 99.8% confidence intervals). They are higher on the left because when a trust treats a smaller number of patients, chance will have a greater impact on the rate, and therefore the confidence intervals will be wider to reflect this.

The confidence intervals presented in the workbook reflect the distribution of trust mortality post-SACT rates around the national average. The workbook highlights the mortality post-SACT rates for ±2 standard deviations (SDs) (roughly equivalent to 95% confidence intervals) and ±3 standard deviations (SDs) (roughly equivalent to 99.8% confidence intervals). Trusts with rates above the upper, +3SD will be identified as outliers.

- Trusts with rates above the upper, +3SD have a significantly higher than average 30-day post-SACT mortality rate.
- Trusts with rates below the lower, −3SD have a significantly lower than average 30-day post-SACT mortality rate.
- Trusts with rates within the confidence limits have an average 30-day post-SACT mortality rate.

It should be noted that outlier status can occur due to data quality issues, problems with linking the SACT data to the National Cancer Registration Dataset and other factors.

Trusts with no data

Some trusts had 'no data' in the workbook. This means that they had no activity data for patients who were treated, and finished treatment in the treatment period (ALL: January 2017-December 2019; AML: January 2018-December 2019), who fit the inclusion criteria. Strict criteria were applied to the data for this work and so there are a few reasons why a trust may have no data in the workbook. Examples of this include:

- Patients were still receiving treatment after the period of interest (e.g. in 2020)
- Patients were treated with regimens that were excluded from the analysis (see list of excluded regimens)
- Patients received their last treatment at a different trust
- We were not able to match the patient's diagnosis in the National Cancer Registration Dataset to that of the trust and the patient's treatment fell outside of the diagnosis-to-treatment time window

The table below presents those trusts with no data in the analysis.

Table 2. Trusts with no data

Trust name	ALL	AML
Airedale NHS Foundation Trust	No data	
Ashford and St Peter's Hospitals NHS Foundation Trust	No data	
Barking, Havering and Redbridge University Hospitals NHS Trust	No data	
Barnsley Hospital NHS Foundation Trust	No data	
Bedfordshire Hospitals NHS Foundation Trust	No data	
Bolton Hospital NHS Foundation Trust	No data	
Chelsea and Westminster Hospital NHS Foundation Trust	No data	
Chesterfield Royal Hospital NHS Foundation Trust	No data	
Croydon Health Services NHS Trust	No data	
Dartford and Gravesham NHS Trust	No data	
Doncaster and Bassetlaw Hospitals NHS Foundation Trust	No data	
East and North Hertfordshire NHS Trust	No data	
East Cheshire NHS Trust	No data	No data
East Kent Hospitals University NHS Foundation Trust	No data	
East Lancashire Hospitals NHS Trust	No data	
East Suffolk and North Essex NHS Foundation Trust	No data	

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Epsom and St Helier University Hospitals NHS Trust	No data	
Gateshead Health NHS Foundation Trust	No data	
George Eliot Hospital NHS Trust	No data	
Harrogate and District NHS Foundation Trust	No data	
Homerton University Hospital NHS Foundation Trust	No data	No data
Isle of Wight NHS Trust	No data	
Kettering General Hospital NHS Foundation Trust	No data	
Lancashire Teaching Hospitals NHS Foundation Trust	No data	
Maidstone and Tunbridge Wells NHS Trust	No data	
Medway NHS Foundation Trust	No data	
Milton Keynes Hospital NHS Foundation Trust	No data	
North Bristol NHS Trust	No data	
North Cumbria Integrated Care NHS Foundation Trust	No data	
North Tees and Hartlepool NHS Foundation Trust	No data	
Northampton General Hospital NHS Trust	No data	
Northern Devon Healthcare NHS Trust	No data	
Northern Lincolnshire and Goole NHS Foundation Trust	No data	
Northumbria Healthcare NHS Foundation Trust	No data	
Portsmouth Hospitals University NHS Trust	No data	
Royal Surrey County Hospital NHS Foundation Trust	No data	
Salford Royal NHS Foundation Trust	No data	
Sherwood Forest Hospitals NHS Foundation Trust	No data	
Southport and Ormskirk Hospital NHS Trust	No data	
Stockport NHS Foundation Trust	No data	No data
Surrey and Sussex Healthcare NHS Trust	No data	
Tameside and Glossop Integrated Care NHS Foundation Trust	No data	No data
The Dudley Group NHS Foundation Trust	No data	

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The Hillingdon Hospital NHS Foundation Trust	No data	
The Princess Alexandra Hospital NHS Trust	No data	
The Rotherham NHS Foundation Trust	No data	
University Hospitals of Morecambe Bay NHS Foundation Trust	No data	
Walsall Healthcare NHS Trust	No data	
Warrington and Halton Hospitals NHS Foundation Trust	No data	
West Hertfordshire Hospitals NHS Trust	No data	
West Suffolk NHS Foundation Trust		No data
Whittington Health NHS Trust	No data	No data
Wrightington, Wigan and Leigh NHS Foundation Trust	No data	
Wye Valley NHS Trust	No data	
Yeovil District Hospital NHS Foundation Trust		No data
York Teaching Hospital NHS Foundation Trust	No data	

Excluded trusts and outlying trusts

There were no trusts identified as outliers in the data.

The table below presents those trusts that were found to be:

- Excluded outliers[13]. When running the original mixed-effects logistic regression model, two trusts with ≤2 patients generated a highly inflated case-mix adjusted rate (>100%). These outliers were excluded from the model and are not presented in the data
- Excluded based on the 70% data completeness threshold[14]

Table 3. Trusts that were outliers for the 30-day post-SACT mortality rates and trusts excluded based on the 70% completeness threshold[15], by cancer site

Trust name	ALL	AML
Airedale NHS Foundation Trust		Excluded Outlier
Barts Health NHS Trust		Excluded
Blackpool Teaching Hospitals NHS Foundation Trust	Excluded	Excluded
Calderdale and Huddersfield NHS Foundation Trust		Excluded
County Durham and Darlington NHS Foundation Trust	Excluded	
Dorset County Hospital NHS Foundation Trust	Excluded Outlier	
Hull University Teaching Hospitals NHS Trust	Excluded	Excluded
Imperial College Healthcare NHS Trust	Excluded	
Isle of Wight NHS Trust		Excluded
Liverpool University Hospitals NHS Foundation Trust	Excluded	Excluded
London North West University Healthcare NHS Trust	Excluded	Excluded
Maidstone and Tunbridge Wells NHS Trust		Excluded
Medway NHS Foundation Trust		Excluded
Norfolk and Norwich University Hospitals NHS Foundation Trust		Excluded
North West Anglia NHS Foundation Trust	Excluded	Excluded

[13] Outlier trusts excluded from analysis are referred to as 'Excluded Outlier' in the table
[14] Trusts with less than 70% completeness for the following key variables: performance status; and co-morbidity score were excluded from the analysis. Please note that these variables were sourced from the SACT dataset, and the National Cancer Registration Dataset
[15] Trusts excluded based on the 70% completeness threshold are referred to as 'Excluded' in the table

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Oxford University Hospitals NHS Trust		Excluded
Pennine Acute Hospitals NHS Trust	Excluded	Excluded
Portsmouth Hospitals University NHS Trust		Excluded
Royal Berkshire NHS Foundation Trust	Excluded	Excluded
Royal United Hospitals Bath NHS Foundation Trust		Excluded
Salisbury NHS Foundation Trust		Excluded
Sandwell and West Birmingham Hospitals NHS Trust	Excluded	Excluded
Shrewsbury and Telford Hospital NHS Trust	Excluded	Excluded
Southport and Ormskirk Hospital NHS Trust		Excluded
St Helens and Knowsley Hospitals NHS Trust	Excluded	Excluded
Surrey and Sussex Healthcare NHS Trust		Excluded
The Clatterbridge Cancer Centre NHS Foundation Trust	Excluded	Excluded
The Dudley Group NHS Foundation Trust		Excluded
The Princess Alexandra Hospital NHS Trust		Excluded
The Queen Elizabeth Hospital, King's Lynn, NHS Foundation Trust		Excluded
The Royal Wolverhampton NHS Trust	Excluded	Excluded
University Hospital Southampton NHS Foundation Trust		Excluded
University Hospitals of North Midlands NHS Trust		Excluded
University Hospitals Plymouth NHS Trust	Excluded	Excluded
Western Sussex Hospitals NHS Foundation Trust	Excluded	
Yeovil District Hospital NHS Foundation Trust	Excluded	

Trust comments

Trusts were invited to comment on their results. No statements were received for inclusion on this acute lymphoblastic leukaemia (ALL) and acute myeloid leukaemia (AML) companion brief release.

Communication of the workbook

The SACT helpdesk at PHE (SACT@phe.gov.uk) compiled a list of named contacts at each NHS trust including the SACT uploader, lead cancer clinician, the regimen mapper, CEO and medical director, unless we were otherwise notified.

The workbook has been sent to these named contacts. There was no patient identifiable data included in the workbook. Trusts are invited to request the NHS numbers of patients in their data who have died within 30 days of receiving SACT. NHS numbers will only be provided via secure means following a request from a trust. This aims to restrict the circulation of this sensitive information to individuals who intend to use it for clinical audit and local governance processes.

We informed the trusts that we would be making the acute lymphoblastic leukaemia (ALL) and acute myeloid leukaemia (AML) workbook covering those aged 18+ publicly available on the SACT website[16] in May 2021 and invited them to provide a statement for inclusion in this companion report.

Trusts were invited to provide a statement for inclusion across all published CMAR reports. Other reports published on the SACT website[16] in May 2021:

- Prostate workbook covering those aged 18+
- Children, teenager and young adults (CTYA) acute lymphoblastic leukaemia (ALL) workbook covering those aged 0-24

Each release will be publicised through a range of channels, including the SACT and the National Disease Registration Service (NDRS) newsletters.

If you have any questions regarding this work, please contact the SACT Helpdesk (SACT@phe.gov.uk).

[16] SACT website: http://www.chemodataset.nhs.uk/