Office for National Statistics

Statistical bulletin

# Childhood cancer survival in England: children diagnosed from 1990 to 2014 and followed up to 2015

Long-term trends in the number of children (aged 0 to 14) surviving cancer 5 and 10 years after diagnosis.

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# 1 . Main points

For all childhood cancers combined, the general trend of increasing 5-year survival has continued for children (0 to 14 years) diagnosed between 1990 and 2014. For children diagnosed in 1990, age-standardised 5-year survival was 67.3%, whilst 5-year survival is predicted to be 83.9% for children diagnosed in 2015.

A similar increasing trend has been observed for 10-year survival. For children diagnosed in 1990, age-standardised 10-year survival was 63.7% and 10-year survival is predicted to be 82.4% for children diagnosed in 2015.

The increases in 5-year and 10-year survival have been observed in each of the age groups 0 to 4 years, 5 to 9 years and 10 to 14 years.

Interpretation of these survival trends should focus on the overall trends up to 2015, rather than the survival estimates for any particular year. This is because the number of children diagnosed in each year is relatively small and the survival estimates for a single calendar year are less stable.

# 2 . Things you need to know about this release

The Office for National Statistics (ONS) has previously published trends in 5-year survival for children diagnosed with cancer in England. To respond to policy needs for longer-term survival estimates, we have included 10-year survival estimates for the first time.

This bulletin presents estimates of 5-year and 10-year overall survival for all childhood cancers combined, by 5-year age groups and for all ages combined (0 to 14 years), both unstandardised and age-standardised.

Data are presented on survival for all children diagnosed with cancer in England during the period 1990 to 2015.

The analyses were carried out using the cohort approach where 5 or 10 years of follow-up data were available. Period or hybrid approaches were used to provide short-term predictions of survival for children diagnosed more recently.

Confidence intervals are included in the datasets, to give an indication of the precision of the survival estimates. Further information on the methods used to estimate 5-year and 10-year survival can be found in the background notes.

These statistics are designated as Experimental Statistics. Experimental Statistics are those which are in the testing phase, are not yet fully developed and have not been submitted for assessment to the UK Statistics Authority. Experimental Statistics are published in order to involve customers and stakeholders in their development and as a means of building in quality at an early stage. A user consultation will be opened in the future.

# 3 . Collaboration

The cancer registration data in this publication were collected by the National Cancer Registration Service in Public Health England. This publication is produced in partnership with the Cancer Survival Group at the London School of Hygiene & Tropical Medicine.

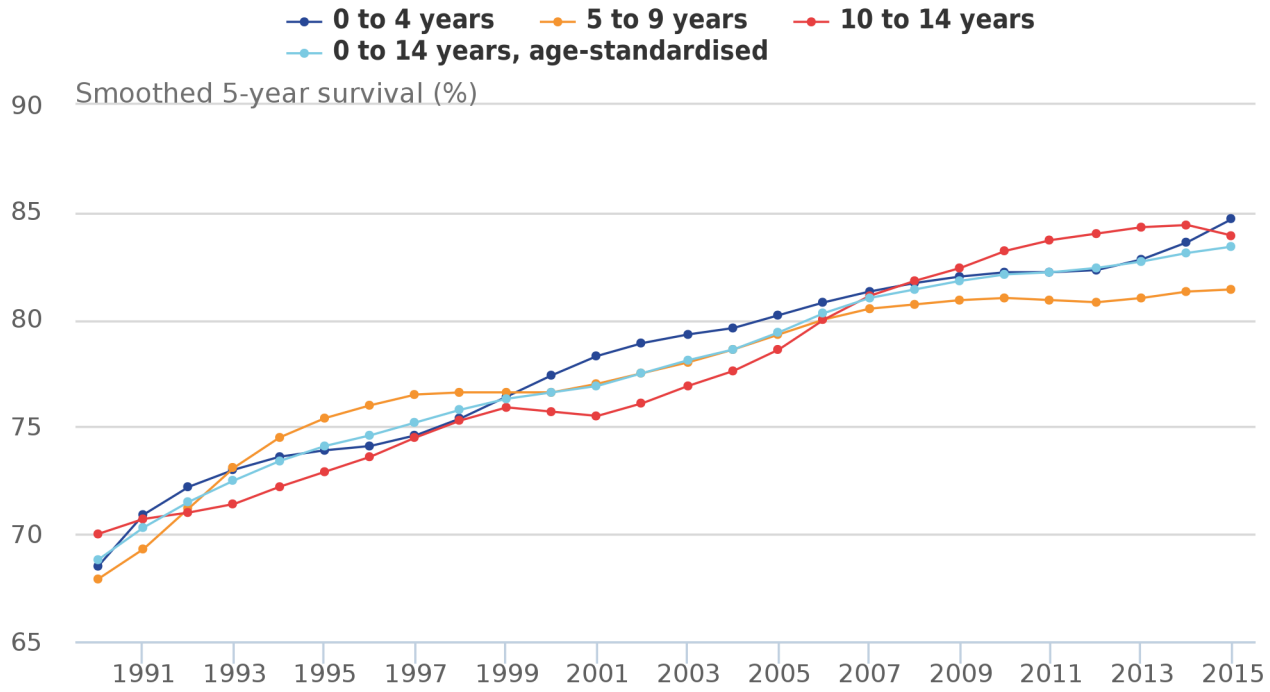
# 4 . Survival trends for childhood cancer

## 5-year survival

For children (aged 0 to 14 years) diagnosed with cancer in 1990, age-standardised 5-year survival was 67.3%, whilst 5-year survival is predicted to be 83.9% for children diagnosed in 2015.

Five-year survival for children with cancer has improved throughout the period 1990 to 2015 (Figure 1). From 1990 to 1995, 5-year survival was below 75%, but it has consistently been above 78% since 2004. The increase in 5-year survival is reflected in improvements in each of the age groups 0 to 4 years, 5 to 9 years and 10 to 14 years.

**Figure 1: Smoothed trends in 5-year survival (%) for children (aged 0 to 14 years) diagnosed with cancer in England between 1990 and 2015**




**Source: Office for National Statistics and London School of Hygiene & Tropical Medicine**

**Notes:**

1. Age-group specific survival estimates are presented for children aged 0 to 4, 5 to 9 and 10 to 14 years. Age-standardised survival estimates are also presented for all children.

2. These data have been smoothed using the “lowess” technique (locally weighted scatter plot smoothing) because of the year-to-year variation in the survival estimates.

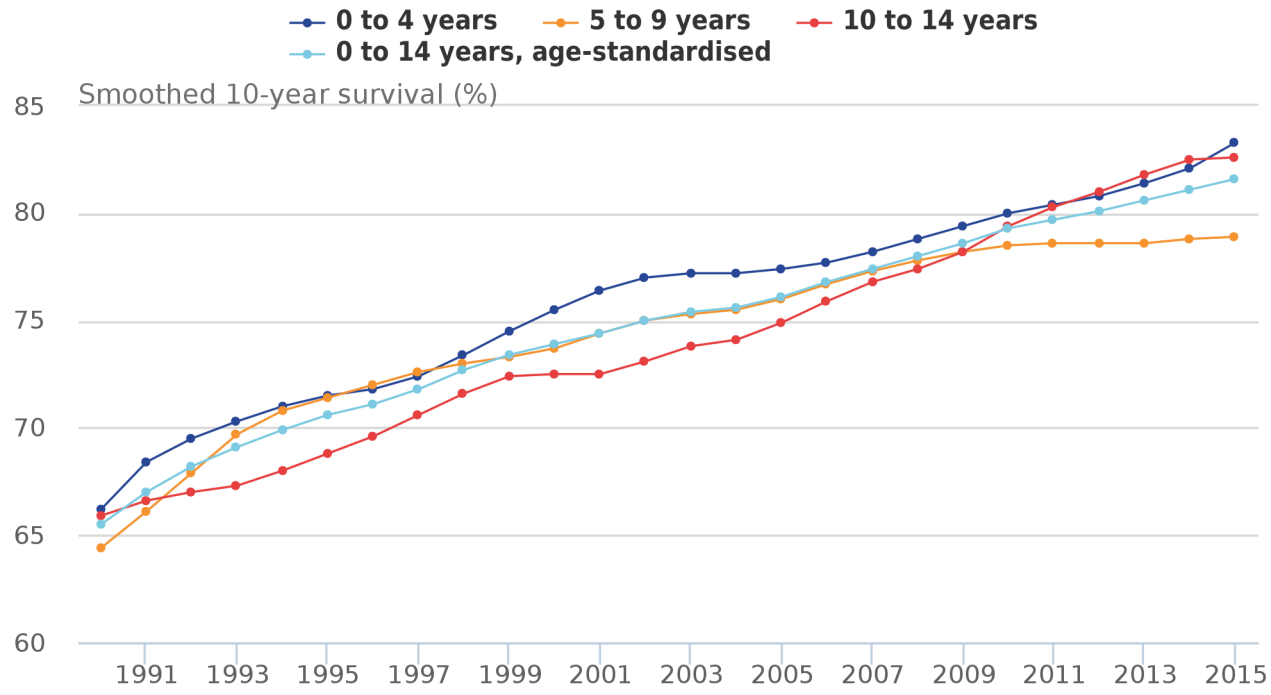
3. The vertical axis of Figure 1 has been fixed between 65% and 90% to display the trends more clearly.

## 10-year survival

For children diagnosed with cancer in 1990, age-standardised 10-year survival was 63.7%, whilst 10-year survival is predicted to be 82.4% for children diagnosed in 2015.

Ten-year survival has improved throughout the period 1990 to 2015 (Figure 2). It was below 75% from 1990 to 1999, but has consistently been above 78% for children diagnosed since 2008. This pattern is also consistent in each of the 3 age groups 0 to 4, 5 to 9 and 10 to 14 years.

**Figure 2: Smoothed trends in 10-year survival (%) for children (aged 0 to 14 years) diagnosed with cancer in England between 1990 and 2015**




**Source: Office for National Statistics, London School of Hygiene & Tropical Medicine**

**Notes:**

1. Age-group specific survival estimates are presented for children aged 0 to 4, 5 to 9, and 10 to 14 years. Age-standardised survival estimates are also presented for all children.

2. These data have been smoothed using the “lowess” technique (locally weighted scatter plot smoothing) because of the year-to-year variation in the survival estimates.

3. The vertical axis of Figure 2 has been fixed between 60% and 85% to display the trends more clearly.

## Overall survival trends

Five-year and 10-year survival for children (0 to 14 years) diagnosed with cancer has continued to improve throughout the period 1990 to 2015. The trends are visible for each age group 0 to 4, 5 to 9 and 10 to 14 years.

The most common cancers in children are the leukaemias and malignant neoplasms of the brain [1]. The increases in survival are likely to be due to improvements in treatment and supportive care. The increases in survival for many of the principal types of childhood cancer have occurred in parallel with clinical trials since the 1990s. Trends in population-based survival for a wide range of childhood cancers in Britain increased significantly during 1978 to 2005[2].

Survival estimates for children diagnosed in 1990 are based on cohort estimates, whilst hybrid estimates [3] are used to predict survival for children diagnosed with cancer in 2015. For further information please see Background note 4.

# 5 . Interpretation of these statistics

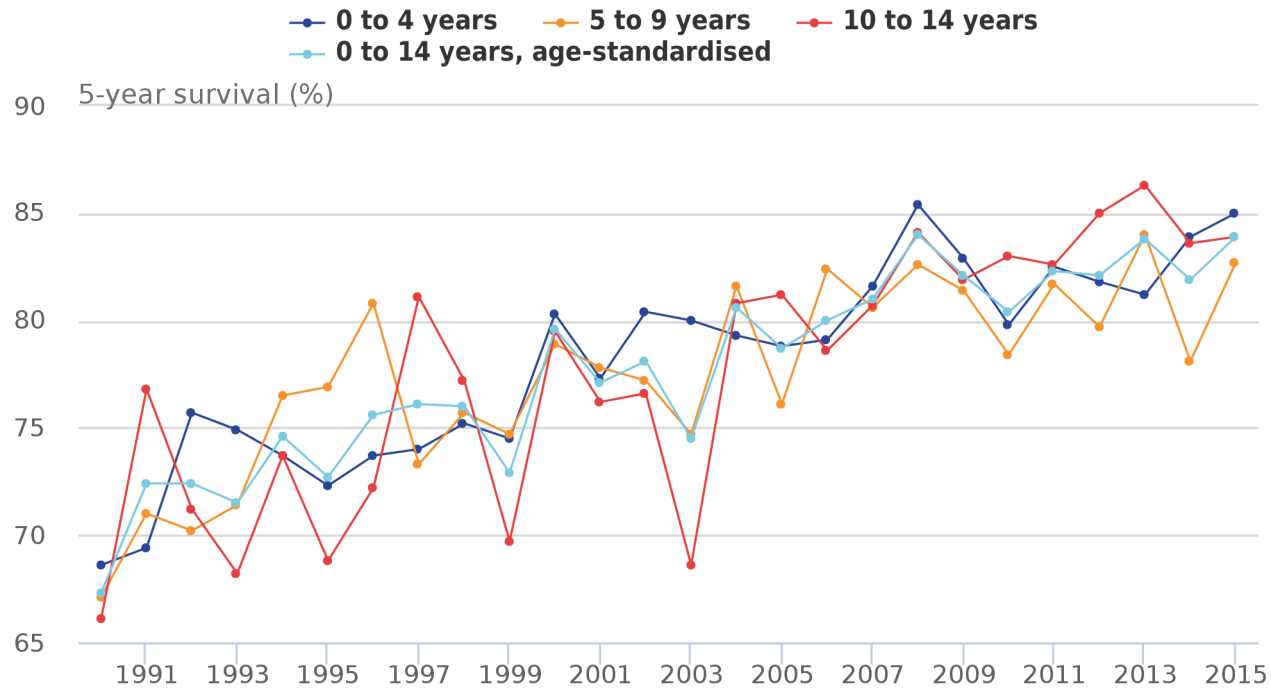
Interpretation of these trends in survival should focus on the overall trends up to 2015, rather than the survival estimates in a particular year. Childhood cancer is relatively uncommon, so year-on-year fluctuations in the survival estimates arise because of the relatively small number of cancer diagnoses and deaths each year.

Figures 1 and 2 provide you with a smoothed trend over the entire period 1990 to 2015. The underlying year-on-year variations in 5-year and 10-year survival have been smoothed by applying the “lowess” technique (Background note 5). The smoothed curves are considered more likely to represent the underlying trend accurately.

The unsmoothed data presented in Figures 3 and 4 provide an understanding of the wide fluctuations in survival that were removed from Figures 1 and 2. For instance, 5-year survival was clearly increasing steadily during the entire period 1990 to 2015 (Figure 3), yet the survival estimate for 2014 is lower than the estimate for 2013. We cannot be certain that there has been a genuine change in the trend in 5-year survival until more recent data become available. Care should be taken when interpreting an apparent decline in survival between 2 successive years, because it is almost certainly due to fluctuation rather than a genuine decline in cancer survival.

**Figure 3: Five-year survival (%) for children (aged 0 to 14 years) diagnosed with cancer in England between 1990 and 2015**

**1990 to 2010: Cohort, 2011 to 2014: Period, 2015: Hybrid**




**Source: Office for National Statistics, London School of Hygiene & Tropical Medicine**

**Notes:**

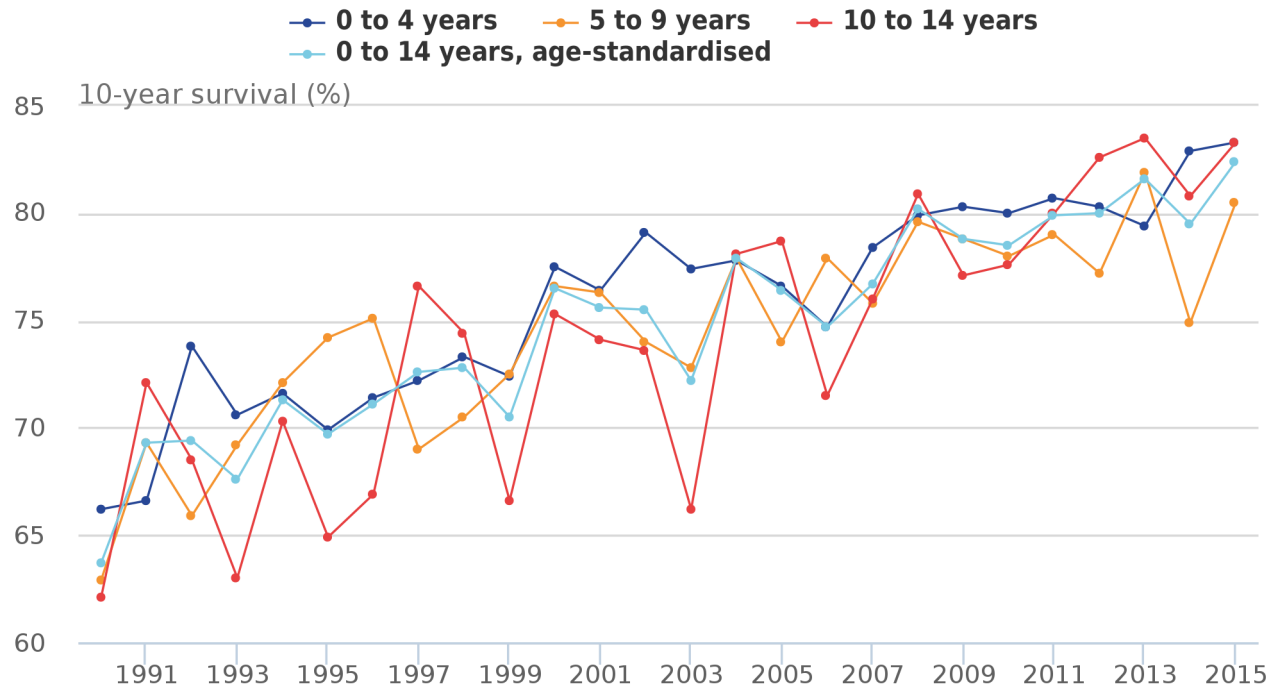
1. Age-specific survival estimates are presented for children aged 0 to 4, 5 to 9 and 10 to 14 years.

2. The vertical axis of Figure 3 has been fixed between 65% and 90% to display the trends more clearly.

3. Interpretation should be focused on overall trends, rather than the survival estimates for any particular year. This is because the number of children diagnosed each year is relatively small and the survival estimates for single calendar years are therefore less stable.

**Figure 4: Ten-year survival (%) for children (aged 0 to 14 years) diagnosed with cancer in England between 1990 and 2015**

**1990 to 2005: Cohort, 2006 to 2014: Period, 2015: Hybrid**




**Source: Office for National Statistics, London School of Hygiene & Tropical Medicine**

**Notes:**

1. Age-specific survival estimates are presented for children aged 0 to 4, 5 to 9 and 10 to 14 years.
2. The vertical axis of Figure 4 has been fixed between 60% and 85% to display the trends more clearly.
3. Interpretation should be focused on overall trends, rather than the survival estimates for any particular year. This is because the number of children diagnosed each year is relatively small and the survival estimates for single calendar years are therefore less stable.

# 6 . Users and uses

This is the fourth bulletin on childhood cancer survival in England. These statistics were prompted by introduction of a cancer survival indicator for children in the NHS Outcomes Framework 2013 to 2014 [4]. The NHS Outcomes Framework was established to monitor overall changes in performance of the NHS and the quality of health outcomes.

Users of cancer survival estimates also include government organisations, policy-makers, cancer charities, academics and researchers, cancer registries, the general public and the media. Population-based cancer survival statistics are used to:

- plan services aimed at cancer prevention and treatment
- provide reliable and accessible information about cancer outcomes to a wide range of groups, including patients and health professionals via health awareness campaigns, cancer information leaflets and web pages
- feed in to national cancer plans, such as: Achieving world-class cancer outcomes: A Strategy for England 2015 to 2020, which outlines 6 strategic priorities to help improve cancer survival in England by 2020 [5]
- inform cancer research

# 7 . References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6. Steliarova-Foucher, E., et al., International Classification of Childhood Cancer, third edition. Cancer, 2005. 103: p. 1457-1467.
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10. Office for National Statistics, Cancer Survival Statistical Bulletins Quality and Methodology Information. 2015, Office for National Statistics: Newport.


# 8 . Authors


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# 9 . Acknowledgement

The Office for National Statistics and the London School of Hygiene & Tropical Medicine wish to acknowledge the work of the National Cancer Registration Service in Public Health England, which provides the raw data for these analyses.

# 10 . Background notes

1. We report the cumulative probability of overall survival up to 10 years after diagnosis using the Kaplan-Meier method. All deaths are included in the analysis, whatever the cause of death written on the death certificate. In adults, by contrast, net survival is used in order to compensate for mortality from other causes, which may be considerable. For children with cancer, overall survival is considered a reliable estimator of cancer survival because, unlike in adults, death within 10 years of diagnosis is almost always due to the cancer.

2. Survival varies with age at diagnosis, and the age profile of patients can change over time. To enable comparison of overall survival in the age range 0 to 14 years over long periods of time, age-standardised estimates are calculated as a weighted sum of the age-specific survival estimates. For children, it is conventional to use equal weights for each of the 5-year age groups (0 to 4, 5 to 9 and 10 to 14 years), which is then equivalent to taking the simple arithmetic mean of the age-specific survival estimates.

3. All children (aged 0 to14 years) resident in England who were diagnosed between 1990 and 2014 with a primary malignant neoplasm of any organ, or a non-malignant neoplasm of the brain and central nervous system (CNS), as defined in the third edition of the International Classification of Childhood Cancer [6], were considered eligible for inclusion in the survival analyses. Cancers of the skin other than melanoma and secondary and unspecified malignant neoplasms were excluded. Children whose tumour was only reported on a death certificate were excluded, because their duration of survival is unknown, however, they only represent 0.5% of all childhood tumours in the period covered. Further details of the eligibility and exclusion criteria have been published[7].

4. The analyses were carried out using the cohort, period and hybrid approaches. For children diagnosed between 1990 and 2010, at least 5 years of follow-up data up to 31 December 2015 are available (vital status: alive, dead or emigrated). Similarly, follow-up data for at least 10 years are available for all children diagnosed between 1990 and 2005. For these estimates the classical cohort approach can be used.

   The period approach is used to produce short-term predictions of cancer survival for children diagnosed more recently by using the follow-up data differently [3]. Period analysis deploys the survival experience of all cancer patients who are alive at some point during the most recent calendar period for which follow-up data are available. In our analysis, this approach was adopted for patients diagnosed from 2011 to 2014 to estimate 5-year survival, and for patients diagnosed from 2006 to 2014 to estimate 10-year survival.

   Finally, the hybrid approach is used for short-term predictions when the follow-up data are more recent than the cancer incidence data. This method was used to estimate survival for children diagnosed in 2015. It is a ‘hybrid’ of the cohort approach (to estimate survival up to 1 year after diagnosis) and the period approach (to predict longer-term survival). It provides more precise estimates, with narrower confidence intervals, because it includes additional subjects who contribute to the conditional probabilities of survival in the period immediately after diagnosis.

   To summarise, 10-year survival estimates from 1990 to 2015 are based on the following approaches; cohort from 1990 to 2005, period from 2006 to 2014 and hybrid for 2015. Five-year survival estimates from 1990 to 2015 have been based on the following methods; cohort from 1990 to 2010, period from 2011 to 2014 and hybrid for 2015.

5. Figures 1 and 2 present smoothed 5-year and 10-year survival estimates to show trends over time. These data have been smoothed using the “lowess” technique (locally weighted scatterplot smoothing) because of the year-to-year variation in the survival estimates. The “lowess” technique is one of many techniques used to smooth time series in which year-on-year fluctuation occurs, to highlight the underlying temporal trends[8].

6. When the data for this report were extracted for analysis on 18 April 2016, cancer registrations in 2014 were believed to be at least 99% complete and each patient's vital status at 31 December 2015 was known for 99% of cancers registered between 1990 and 2014. As in other countries, cancer registration is a dynamic process: a small number of late registrations may arrive up to 5 years after the end of a given calendar period, whereas other registrations may be amended or deleted. The figure of 99% completeness is based on the average number of cases for the 3 previous years (2011 to 2013), including late registrations received after publication of the data for those years.

7. The cancer registration data in this publication were collected by the National Cancer Registration Service in Public Health England. The data for the first bulletin [9] were provided by the Childhood Cancer Research Group, University of Oxford, using data from the National Registry of Childhood Tumours (NRCT). The Childhood Cancer Research Group was disbanded in 2014 and the NRCT dataset was frozen, with the most recent complete year of incidence registrations for 2010. The number of incident cases varies slightly between the 2 data sources and the survival estimates differ slightly between the first and second bulletin. There is no statistically significant difference between equivalent survival estimates in the 2 bulletins.

8. Further information about these cancer survival estimates can be found in the Cancer Survival Quality and Methodology Information paper[10] which provides more details and key qualitative information on the quality of statistics and a summary of the methods used to compile them.

9. Further cancer statistics for the UK can be found through the:

    - Scottish Cancer Registry, managed by the Information Services Division
    - Welsh Cancer Intelligence Surveillance Unit
    - Northern Ireland Cancer Registry