**Appendix 1. Description of cancer codes and Scandinavian ancestry used in the study**

**SEER and ICD-10 codes included in the analysis of family history of cancer in first-degree relatives**

|  |  |  |  |
| --- | --- | --- | --- |
| Type of cancer in relatives | SEER | ICD-10 | ICD-O-3 Histology |
| Tumours in the CNS | 31010, 31040 | C70-72 |  |
| Leukaemia | 35011, 35012, 35013, 35021, 35031, 35022, 35023, 35041, and 35043 | C91-95 |  |
| Breast | 26000 | C50 |  |
| Brain | 31010 | C71 |  |
| Osteosarcoma |  |  | 9180 |
| Soft tissue sarcoma -(WHO Classification of Soft Tissue Tumours) |  |  | 8850, 8851, 8852, 8853, 8854, 8855, 8858  8810, 8811, 8814, 8815, 8821, 8825, 9150  8830, 8835, 9251  8711, 8713  8901, 8910, 8912, 8920  9120, 9130, 9133, 9135, 9140  9180, 9220, 9240  8836, 8940,8982, 9373, 9040, 8804, 9581, 9044, 9231, 9364, 9260, 8806, 8963, 8990, 8800 |
| Adrenocortical carcinoma | 32020 |  | 8370 |

SEER: The Surveillance, Epidemiology and End Results

ICD 10: the International Statistical Classification of Diseases and Related Health Problems

ICD-O-3: International Classification of Diseases for Oncology

**Scandinavian ancestry**

In the UPDB we define ancestry based on place of birth of an individual's ancestors prior to arrival in Utah. Basically all Utah founders came from European countries.[[1]](#endnote-1) Based on the scale of average DNA shared between relatives described by Wright in 1922, [[2]](#endnote-2) we constructed a scale from 0 to 1 where each individual got one value according to the ethnic origin of their ancestors by birth country. Thus, a child with both parents born in Scandinavia (Denmark, Norway and Sweden) was given a value of 1 with 0.5 from the father and 0.5 from the mother. A child with only one grandparent from Scandinavia was given a value of 0.25; a child with one great grandparent born in Scandinavia was given a value of 0.125, and so on. In this study we split the population into children with Scandinavian ancestry (value>0) and children without Scandinavian ancestry (value=0). Ethnicity data was not available for UPDB. The study assumed that the UPDB genealogy data represented biological relationships.

**Appendix 2.** **Incidence rates per 100 000 person-years with 95% confidence intervals (CI) of tumours in the central nervous system (CNS) and leukaemia among children aged 0-14 years and born in Norway and Utah in the period 1966 to 1999 and diagnosed in the period 1966-2015.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **All children born in Utah** | | | **All children born in Norway** | | |
| **Type cancer and diagnose age** | **Period** | **95% CI** | | | **95% CI** | | |
|  |  | **Rate** | **Lower bound** | **Upper bound** | **Rate** | **Lower bound** | **Upper bound** |
| CNS 0-14 years | 1965-1969 | 2,1 | 1,1 | 3,0 | 2,5 | 2,1 | 2,9 |
| 1970-1974 | 2,4 | 1,6 | 3,3 | 2,4 | 2,0 | 2,8 |
| 1975-1979 | 3,1 | 2,3 | 3,9 | 2,5 | 2,1 | 2,9 |
| 1980-1984 | 3,4 | 2,6 | 4,2 | 2,3 | 1,9 | 2,7 |
| 1985-1989 | 4,0 | 3,1 | 5,0 | 3,2 | 2,7 | 3,6 |
| 1990-1994 | 3,8 | 2,8 | 4,8 | 4,5 | 3,9 | 5,1 |
| 1995-1999 | 4,8 | 3,8 | 5,9 | 5,3 | 4,6 | 5,9 |
| Leukemia 0-14 years | 1965-1969 | 3,8 | 2,5 | 5,0 | 3,2 | 2,8 | 3,7 |
| 1970-1974 | 4,6 | 3,5 | 5,7 | 3,4 | 2,9 | 3,8 |
| 1975-1979 | 4,5 | 3,6 | 5,5 | 3,1 | 2,6 | 3,5 |
| 1980-1984 | 4,7 | 3,7 | 5,7 | 3,0 | 2,6 | 3,5 |
| 1985-1989 | 4,0 | 3,0 | 5,0 | 3,2 | 2,8 | 3,7 |
| 1990-1994 | 4,3 | 3,3 | 5,4 | 4,0 | 3,5 | 4,5 |
| 1995-1999 | 4,6 | 3,6 | 5,7 | 4,6 | 4,0 | 5,2 |
| CNS 0-4 years | 1965-1969 | 1,9 | 0,2 | 3,5 | 3,1 | 2,3 | 4,0 |
| 1970-1974 | 3,0 | 1,3 | 4,7 | 3,0 | 2,2 | 3,8 |
| 1975-1979 | 3,6 | 2,0 | 5,2 | 2,6 | 1,9 | 3,4 |
| 1980-1984 | 4,8 | 3,0 | 6,7 | 2,2 | 1,5 | 3,0 |
| 1985-1989 | 6,6 | 4,3 | 9,0 | 3,9 | 2,9 | 4,8 |
| 1990-1994 | 3,6 | 1,9 | 5,4 | 5,2 | 4,0 | 6,3 |
| 1995-1999 | 4,7 | 2,8 | 6,7 | 6,8 | 5,5 | 8,2 |
| 2000-2004 | 6,9 | 4,7 | 9,1 | 6,7 | 5,3 | 8,1 |
| 2005-2009 | 7,6 | 5,3 | 9,8 | 7,0 | 5,6 | 8,4 |
| Leukemia 0-4 years | 1965-1969 | 6,8 | 3,7 | 9,9 | 6,0 | 4,9 | 7,2 |
| 1970-1974 | 8,5 | 5,7 | 11,4 | 5,7 | 4,6 | 6,8 |
| 1975-1979 | 6,5 | 4,3 | 8,7 | 5,3 | 4,2 | 6,4 |
| 1980-1984 | 8,9 | 6,4 | 11,4 | 5,7 | 4,6 | 6,9 |
| 1985-1989 | 8,0 | 5,4 | 10,5 | 5,7 | 4,5 | 6,8 |
| 1990-1994 | 6,8 | 4,4 | 9,3 | 7,0 | 5,6 | 8,3 |
| 1995-1999 | 9,5 | 6,8 | 12,2 | 8,7 | 7,2 | 10,3 |
| 2000-2004 | 10,2 | 7,5 | 12,9 | 7,9 | 6,4 | 9,5 |
| 2005-2009 | 10,6 | 7,9 | 13,2 | 8,0 | 6,5 | 9,5 |

**Appendix 3. Incidence rates per 100 000 person-years with 95% confidence intervals (CI) of tumours in the central nervous system (CNS) and leukaemia among children aged 0-14 years born in Utah in the period 1966 to 1999 and diagnosed in the period 1966-2015 across Scandinavian ancestry.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **Children with Scandinavian ancestry** | | | **Children without Scandinavian ancestry** | | |
|  |  |  | **95% CI** | |  | **95% CI** | |
| **Type cancer and diagnose age** | **Period** | **Rate** | **Lower bound** | **Upper bound** | **Rate** | **Lower bound** | **Upper bound** |
| CNS 0-14 years | 1965-1969 | 2,6 | 1,3 | 4,0 | 1,1 | 0,0 | 2,2 |
| 1970-1974 | 2,3 | 1,3 | 3,2 | 2,8 | 1,3 | 4,2 |
| 1975-1979 | 3,3 | 2,3 | 4,4 | 2,5 | 1,2 | 3,7 |
| 1980-1984 | 3,2 | 2,3 | 4,2 | 3,8 | 2,2 | 5,3 |
| 1985-1989 | 3,9 | 2,8 | 5,1 | 4,3 | 2,4 | 6,2 |
| 1990-1994 | 3,8 | 2,6 | 4,9 | 3,7 | 1,9 | 5,6 |
| 1995-1999 | 4,8 | 3,6 | 6,0 | 4,9 | 2,8 | 7,0 |
| Leukaemia 0-14 years | 1965-1969 | 3,3 | 1,8 | 4,8 | 4,5 | 2,3 | 6,7 |
| 1970-1974 | 5,1 | 3,6 | 6,6 | 3,8 | 2,1 | 5,4 |
| 1975-1979 | 4,7 | 3,5 | 5,9 | 4,1 | 2,5 | 5,8 |
| 1980-1984 | 4,8 | 3,6 | 6,0 | 4,5 | 2,7 | 6,2 |
| 1985-1989 | 3,9 | 2,8 | 5,1 | 4,1 | 2,3 | 5,9 |
| 1990-1994 | 4,3 | 3,1 | 5,6 | 4,2 | 2,3 | 6,2 |
| 1995-1999 | 4,9 | 3,6 | 6,1 | 4,0 | 2,1 | 5,9 |

**Appendix 4 Age-adjusted incidence rates of CNS tumours and leukaemia all ages by year and sex**

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**Age-adjusted incidence rates of CNS tumours all ages by year and sex in Utah, Norway and United States**

Incidence data for this figure was obtained from the following sources:

National Cancer Institute, Surveillance, Epidemiology, and End Results Program. The SEER Cancer Statistics Review 1975-2016.[[3]](#endnote-3)

National Cancer Institute, state cancer profiles.[[4]](#endnote-4)

The NORDCAN project. Cancer statistics for the Nordic countries.[[5]](#endnote-5)

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**Age-adjusted incidence rates of leukaemia all ages by year and sex in Utah, Norway and United States**

Incidence data for this figure was obtained from the following sources:

National Cancer Institute, Surveillance, Epidemiology, and End Results Program. The SEER Cancer Statistics Review 1975-2016.1

National Cancer Institute, state cancer profiles.2

The NORDCAN project. Cancer statistics for the Nordic countries.3

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2. Wright S. Coefficients of inbreeding and relationship. The American Naturist, 1922;56:330-338. [↑](#endnote-ref-2)
3. National Cancer Institute, Surveillance, Epidemiology, and End Results Program. The SEER Cancer Statistics Review 1975-2016. https://seer.cancer.gov/statistics/ [↑](#endnote-ref-3)
4. National Cancer Institute, state cancer profiles. https://statecancerprofiles.cancer.gov/historicaltrend/ [↑](#endnote-ref-4)
5. The NORDCAN project. Cancer statistics for the Nordic countries. http://www-dep.iarc.fr/NORDCAN/english/frame.asp [↑](#endnote-ref-5)